Exploring the need and the sustainability of an open source platform for dengue prevention in Sri Lanka

Naduni Wickramaarachchi, Niroshan Sanjaya, Rangajeewa Ratnayake, P.K.S Mahanama

Abstract

The rise of Information Communication Technology (ICT) has offered the world a new and efficient mechanism for increase active citizen engagement which enables gather a vast variety of data in a concise period. Citizen science approach involves engaging with the citizens to crowdsource data acquisition processes, data analysis, interpretation, and study dissemination in a simplified manner. Growth in open source technology has widened the space for engaging a vast number of citizens limitless of geographical and hierarchical boundaries via crowdsourcing real-time data Even though there is a boom in using ICTs in connecting and sharing knowledge and information among different stakeholders still, there is a considerable gap in using the citizen science approach in combating the public health issues in countries. As a country with a high internet usage rate Sri Lanka, still shows underutilization of such technologies in public welfare and health sector. Dengue is a serious health threat in Sri Lanka which shows the need for active surveillance in combating and prevention. The main objective of the paper is to seek the potential possibility of using the Internet of Things (IoT) in preventing dengue outbreak in Sri Lanka. Also, it aims to identify the opportunities of using a mobile application and even tries to address the usability issues that could arise when introducing and retaining a mobile application. By doing that, this paper will contribute to filling the gap in research that addresses the functionality and the usability issues that arise in developing an open source mobile application.

Keywords: Dengue Prevention, Information Communication Technology, Open Source technology, Public Health

Introduction

With the failures of the neoliberal model in managing public wellbeing efficiently and fairly, now the citizens are stepping out and becoming the producers of knowledge shaping the rational decision-making process in parallel with the traditional bureaucratic decision-making mechanism (Wildschut, 2017). The rise of Information Communication Technology (ICT) has offered the world a new and efficient mechanism for increase active citizen engagement compared to the traditional participatory methods. Much of this work is facilitated by the open source programming where software engineers work collaboratively and share their software developments freely on the internet. Growth in open source technology has widened the space for engaging a vast number of citizens limitless of geographical and hierarchical boundaries via crowdsourcing real-time data (Hunt, O'Grady, et al., 2015). Open source platforms instigate and strengthen the participatory democracy by increasing interactive dialogues between planning authorities and a large number of people upon crucial issues facing by the cities (Reyna & Simoes, 2016). This transition has created a new chapter in societies where knowledge and information shared among peer groups, researchers, scientists and governments for finding solutions for their issues in a vast array of fields such as traffic management, pollution, environmental planning and public health (Hunt, O'Grady, et al., 2015).

In recent years' dengue fever has been identified as a severe health concern by the World Health Organization (WHO) because of the alarming increase of the dengue-infected cases around the world

and also because of the significant economic and social damage it causes on the endemic countries. Dengue is a mosquito-borne infection widely spread over many tropical and subtropical regions where over half of the world population living in these countries (World Health Organization, 2018). Dengue fever is transmitted by female mosquitoes mainly from the species *Aedes aegypti* and, to a lesser extent, *Ae. albopictus (Gubler & Clark, 1995)*. Dengue can cause the full spectrum of disease from an infection to a mild self-limiting disease, the dengue fever (DF) and severe illness that may be fatal, the dengue which can lead to haemorrhagic fever/dengue shock syndrome (DHF/DSS) (World Health Organization, 2018). The actual numbers of dengue cases are underreported or misreported. A recent study indicates the estimated number of dengue cases as 390 million per year around the world and the reported cases have been increased from 2.2 million in 2010 to 3.2 in 2015 (World Health Organization, 2017a). Sri Lanka is facing dengue epidemic since 1960 s (National Dengue Control Unit, 2014) and the year 2017 showed a dramatic increase of reported dengue cases including 215 deaths (World Health Organization, 2017b). Heavy rain falls, and the failure to clean the potential breeding places increase the number of affected people especially in urban and semi-urban areas. The need for active surveillance and efficient communication is emphasized in many times as the traditional methods are inadequate and ineffective in controlling fast spreading dengue outbreak (Achee et al., 2015).

With the proliferation of mobile technologies and users, new opportunities have emerged in using such technology in promoting public health around the globe (Kreps & Neuhauser, 2010; Rashid & Elder, 2009). Also, there are various ready-to-use open source software tools to facilitate the collection, management and sharing of field data using mobile devices with a centralized data management system (Bandara & Raghavan, 2018). However, there seems an underutilisation of technology for promoting public participation in the public health sector in the world as well as in Sri Lanka (Qiang, Yamamichi, Hausman, Miller, & Altman, 2012a). Even though few mobile applications have been introduced to increase active citizen engagement in the field of dengue prevention, mal-functionality of these applications remain as a question. The primary objective of the paper is to seek the potential possibility of using the Internet of Things (IoT) in preventing dengue outbreak in Sri Lanka. Also, it aims to identify the opportunities of using a mobile application and even tries to address the usability issues that could arise when introducing and retaining a mobile application. By doing that, this paper will contribute to filling the gap in research that addresses the functionality and the usability issues that arise in developing a mobile application (Mirkovic, Bryhni, & Rulans, 2011).

The paper is organised as follows: first, the article will provide a review on open source technology as a tool for citizen science approach and its importance in the public health sector. Next, the paper will go into an analysis of open source interventions in Sri Lanka in the dengue prevention sector. The literature review will discuss the theoretical background as well as the sustainability and the user-friendly aspects of mobile applications as guidance for future development. The potential opportunities and the particular requirements of a dengue prevention application will be analysed using empirical findings of a survey carried out in the Dehiwala Mt-Lavinia Municipal Council area. Finally, based on the findings, the paper presents some recommendations for the future development of a dengue prevention mobile application.

Open source technology as a tool for citizens science approach in the field of public health sector

In general, local governments have realised the need for engaging more with the public as a way moving forward fastly in combating local issues and finding sustainable solutions. In this attempt citizen science approach is useful where the general public are engaging in scientific research activities and generating

knowledge with their intellectual capacity or broad experience with the tools and resources available for them (Qiang, Yamamichi, Hausman, Miller, & Altman, 2012b). Citizen science approach is strengthened with the network of individuals (citizens) and scientist and also engage with governance with the power of information technologies especially with the development of open source techniques.

Citizen science approach involves engaging with the citizens to 'crowdsource' data acquisition processes, data analysis, interpretation, and study dissemination with a simplified manner. Moreover, citizens on moving from data collection to action. The tremendous advantage of using crowdsourcing is the ability to gather rich, intense data in a short period with a minimum cost (Liu & Sandfort, 2011). Further, the citizen science approach brings local knowledge to the table, it empowers the citizens and legitimizes the ownership of the projects to the general public (Warren, 1991). Local governments will enable to understand the local networks through the citizen science approach which provides a guide to finding local leaders and volunteers when implementing the projects.

Citizen scientists are advancing from open source technology and trying to find solutions for public issues by using open source tools in the varied field ranging bird or insect mapping to finding solutions for environmental and health problems (Braschler, 2009; Reyna & Simoes, 2016). With the proliferation of ICT, now the citizen scientists are more active in the fields of traffic management, accident reporting and waste management.

Even though there is a boom in using ICTs in connecting and sharing knowledge and information among different stakeholders still, there is a considerable gap in using the citizen science approach in combating the public health issues in countries (Qiang et al., 2012a). Community engagement in public health area is essential regarding introducing more sustainable community-oriented health policy interventions (Broeder, Deviles, Oers, Schuit, & Wagemakers, 2016). Mainly, when the diseases are spread and expand under climate change, the prevention can be hard without active surveillance. Citizen science in public health can also notify local agencies about the status of spreading diseases, residents' perceptions and views and provide access to prevent and manipulate causes and risks. Moreover, this may enable government agencies to address resident concerns, and 'empower' them to strike a balance between such concerns and issues.

With the proliferation of mobile technologies and users, Sri Lanka shows a high prospect in utilizing such techniques and capabilities to improve public life (Department of census and statistics, 2017). Sri Lanka is in an epidemiological transition where tuberculosis, dengue, Japanese encephalitis, diarrhoea and acute respiratory infections are still in existence (Jayasinghe, 2011). Sri Lanka is facing an unpredicted outbreak of dengue fever over the past years. During the year 2017 a total of 186,101 suspected dengue cases were reported, and as of 24 May 2018, a total of 19,459 suspected dengue cases were reported to the Epidemiology Unit of the Ministry of Health (MoH) of Sri Lanka with over 320 deaths in 2017 and 20 deaths in 2018 until May. Dengue is spread all over the country, and over 40 per cent of dengue cases were reported from the Western province (International Federation of Red Cross and Red Crescent, 2018).

Surveillance of mosquito breeding places is a critical component of how health authorities manage and reduce the risk of mosquito-borne disease. The mosquitoes that drive outbreaks of dengue can breed in very little quantity of water spots and not as easily measured and found by traditional surveillance approaches. Effective control needs a wider engagement with the public in real time. The active surveillance requires lots of human resources and time which weaken the monitoring and prevention

system. Open source tool provides solutions for this issues and generates rich real-time data across the whole area (Lewis, Boudreau, Patterson, Bradet-Legris, & Lioyd, 2018). Enhancement of GPS-enabled devices, Crowd Sourcing and Volunteered Geographic Information has facilitated deploying Geo-ICT based Citizen Science platform with a particular emphasis on public health. Still, prudent and effective use of geospatial technologies requires fostering of a highly skilled workforce for developing, maintaining Geo-ICT solutions for public health. Citizen Science in public health can develop practical knowledge, in the pursuit of worthwhile causes related to diseases and spreads (Tiwari & Jain, 2013). Applying the citizen science-based approach in tracing mosquito breeding places spatially provides up to date information which is vital for the authorities to take action against spreading. Much stronger engagement with the public will not only give the data to the authorities but also make a pressure to act against the breeding and spreading.

Sri Lanka, however, struggles with outdated manual paper-based dengue management system. Community education and direct engagement on dengue prevention have been executed in this traditional system. Sri Lanka is one of the countries with the most affordable rates of mobile services in the world, with penetration rates higher than most developing countries (Rauniyar, Samuel, & Jayatissa, 2011). However, there seems an underutilization of technology to combat dengue in Sri Lanka (Lwin, Jayasundar, Sheldenkar, Wijayamuni, & Wimalaratne, 2017). With the recent outbreak of dengue, few mobile applications were developed in the country, with the interest and involvement of different stakeholders.

Information Technological interventions for prevention of dengue in Sri Lanka

Time to time, few technological interventions have been introduced to increase the effectiveness of the dengue management system in Sri Lanka. These systems were launched at different levels with different stakeholders and communities. *Veta-Fight Dengue* is a mobile application that developed to empower citizens to take part in dengue prevention actions by themselves. The social media comments on Veta-Fight, however, indicates the mal-functionality of the application. The reviews on the comments for Veta -Fight Dengue App indicate the community desire in taking actions against their complaints by a relevant authorised person rather than waiting for the community to take measures (Veta-Fight Dengue, 2017). The central principle of *Veta-Fight Dengue* APP where asking the community to take part in cleaning their environment by the community seems disadvantaged on the application because it restricts the community participation to act against neighbours without any authorised power. Moreover, also with the Asian context, active voluntarism is not popular as a cultural norm. According to Dickmann (1985), people would instead do nothing thinking someone else does it. (Dickmann cited, Gould, 1993:183).

Similarly, the Death to Dengue (D2D) mobile application has been introduced aiming to empower neighbourhood communities to be surveillance on their safety including dengue prevention. This App includes different features such as sending alerts, sending checklists for the general public and building neighbourhood groups (Death to Dengue, 2018). Similar to the Veta- Fight App this APP also doesn't have a connection with the relevant authorities. As it's a community-based APP, the users cannot communicate with the officers or neither make a complaint to take necessary actions. It controls and limits the steps that can be taken to prevent dengue as the general public cannot take actions on others premises. Mo-Buzz is another intervention in the field of dengue prevention and is not in use at the moment.

In contrast, most of the available dengue prevention apps provide functions and features for collecting data related to dengue and disseminate among the general public or government agencies. Based on the officials such as Public Health Inspector (PHI) and municipal doctors opinion dissemination of existing breeding locations or potential areas are not adequate to make decisions.

Theoretical Background

The design element and the public participation of an open source platform can be viewed and interpreted through the economic and sociological approaches. Liu and Sandfort (2011) argue the usefulness of using both approaches in predicting the public participation and identifying the needs of the community. Economists view the community participants as rational thinkers of benefits. People would consider the long-term benefits based on trust, rule designs and expectations before participating in a common activity. According to the rational economic theory, people do not participate in collective action unless they receive any benefits. This can be a tangible or intangible benefit. However, some scholars viewed at the informal relations and the way that they create some incentives (Tirole & Lerner, 2002). Lerner and Tirole (2002) suggest signalling incentives motivate contributors to participate. For example, people would gain a reputation within their community by engaging in a common activity by participating in an open source for the common benefit (Moon & Sproull, 2000). This motivates the non-contributors to take action in common tasks.

Sociological perspectives provide a theoretical framework on the characteristics of a mobile application to attract community participation. Sociologists consider the structure of the group such as the density, community size and also the existing relationships. Gould (1993) has pointed out two push factors for peoples' collective action. First, people engage in joint efforts to match with the contribution of others because of the norms of fairness. Secondly, people would take part in common activities, if they know their input is valued and not wasted (Gould, 1993). Further, he says that people would invest in action if it seems that others will also join in to produce a positive result. On the other hand, non-contributors will face to a pressure when the collective community action is visible.

Combination of both economic and sociological perspectives provides sufficient guidelines for designing a sustainable user-friendly online platform. The future development of the mobile platform for dengue prevention will incorporate both economic and sociological aspirations of people as a framework for the sustainability of the product. Further to the broader theoretical coverage, we looked at the other potential elements for introducing a sustainable and user-friendly mobile application.

Sustainable and user-friendly aspects of developing a mobile application

The critical part of the mobile application development is to evaluate and monitor every part of the development to ensure the sustainability and the usability of the end product. With the past experience of mobile application developments, scholars have identified some ‘good concepts’ and ‘practices’ for user-friendly and sustainable design elements of an application.

User experience is crucial for the sustainability and the retention of the application, the user experience is not just about making the experienced user-friendly, but it needs to convince users that it is usable, useful and desirable. According to Mike Gualttieri (2012) location, locomotion, immediacy, intimacy and device are the five dimensions that help to retain the user with the mobile application. When using a mobile application, the most attractive element is the simplicity and the convenience. The application

should allow the user to use it at anywhere without limiting to a place. Also, the application should be compatible with the capabilities of the mobile device they have.

Over the years with his experience, Dieter Rams (2018) the chief designer of the company of Bauran, identified ten good characteristics for a long-lasting mobile application development. According to his analyses, a good design should be an innovative, useful, aesthetic, understandable, unobtrusive, honest long lasting thorough down to the last detail, environmental- friendly and with little design.

Gamification is a powerful tool that can be used in motivating people to use the application. Gamification is a strategy that applies game mechanisms to non-game activities to change the user's behaviour of an application. It improves users' engagement by allowing the user to gain scores for their actions on the application which will direct them to obtain tangible or nontangible incentives (Law, Kasirun, & Gan, 2011). As outlined in the research papers these intensives can promote active and long-lasting participation compared to the non-gaming mobile applications.

User-friendly mobile applications should be self-explaining in its use via the clear structure of the surface-screen (Arndt, Dziubaczyk, & Mokosh, 2014). As a result of the clear structure, the user doesn't need to spend additional time learning the functionalities of the APP. Clear structure and clear symbols lead to the self-explanation. Good design is innovative, makes a product useful, is aesthetic and makes the product understandable.

When considering about citizen science platform, it consists with various other components than a mobile application. Accordingly, on the application development perspective, development of citizen science platform is a crucial task. For health officials, geospatial scientists or citizens to truly address the current issues, information gaps and technological barriers should be minimized. Deploying and utilization of such systems should be able to carry out by non-programmers, minimally trained users and organizations (Bandara, Raghavan, Fenoy & Yoshida, 2016). Therefore the apps and the systems should provide an opportunity for unprecedented users to interact with such systems. Also, available apps and systems have developed by commercial companies or different organizations. Therefore, further improvements or upgrades need to be done by the same owner. In order to sustain the project, the system must be developed and implemented as FOSS synergy ().

When it comes to the mobile applications where the public can report their issues it should be linked with the relevant authority to sustain the application; otherwise, people will lose their trust with the application (Fix my street, 2018). At the same time, the application should develop the trust by ensuring their voices have been heard.

Mobile applications should be compatible with the user's requirements. To utilize the user's desires and also to assess the end product sustainability in Sri Lankan context, we conducted a need and a sustainability assessment with the general public in the Dehiwala Mt. Lavinia Municipal Council area.

Study Location

Dehiwala Mount Lavinia Municipal Council (DMMC) has been identified as the research location for this project due to two reasons. 1) the reported increasing number of dengue cases. 2) extended interest and the support from the administration of the council and the health medical officer to conduct a pilot project in DMMC.

DMCC is the second largest municipal council in Sri Lanka with a land extent of 2,109 hectares (Urban Development Authority, 2008). It lies south to the Colombo Municipal Council separated from a small canal. Due to the proximity to the capital city Colombo, DMMC shows a rapid increase of the population with a 0.95 of growth rate. As the census (2011) data shows 245,974 number of community resides in the DMMC. The Dehiwal Mount Laniva township area was recognised as a district council in 1929 with a population of 25,341. With the rapid expansion of the population, it was converted to an urban council in 1931. And then to a municipality in 1959 with over 100,000 population (UN-Habitat, 2003).

The land in the city of DMMC is predominantly in mix residential use. The mixed-pattern of land use between the residential, commercial and industrial makes a very congested and unpleasant environment along the main roads of the municipal area. Mainly 90 per cent of the land is developed while the other 10 per cent of land consists of marshy ground and water bodies (7%) and agricultural use (3%). The total undeveloped land amounts to 209 hectares where 138.7 of hectares are covered by marsh and water body. Some wards experience flooding during the rainy seasons. Poor drainage and garbage disposal systems have led to the prevalence of mosquito (vector) born diseases in the DMMC area very hard.

Land Use Pattern

Use	Extent Hectares	% of Total	% of Developed
Residential (mixed)	1343.0	63.75	70.76
Commercial	68.0	3.23	3.58
Industrial	124.3	5.90	6.55
Transport incl. Airport	235.8	11.19	12.42
Recreation, parks incl. of zoological gardens Institutional	28.8 98.2	1.37 4.66	1.52 2.46
Water Bodies	24.7	1.17	-
Marsh land	114.0	5.41	-
Agriculture and Vacant land	70.0	3.32	-
Total	2106.8	100	-
Total Developed	1898.1	90.1	-
Total Undeveloped	208.7	9.9	-

Source: Urban Development Authority 1985 CMR structure Plan 1998

With the high density of population, Dehiwala- Mount Lavinia Municipal Council reported a high number of Dengue breeding places in 2018 (Mirror Citizen, 29, 06, 2018). According to a recent

inspection carried out by the council with the support of the National Dengue Prevention Unit of the Ministry of Health, 113 possible Dengue mosquito breeding grounds out of the inspected 971 premises have been identified. (Mirror Citizen, Friday, 29th June 2018)

Need assessment and the socio-cultural and technical feasibility assessment

With the fast changing world, the emphasis on the sustainability aspects of a mobile application is vital as otherwise the usage and the lifetime will not last as expected. However, determining the parameters for optimal usability, and functionality is more complex and hard to predict from only the software developers perspective, instead should mix with the users perceptions too. To maximise the sustainability, we conducted a need and a sustainability assessment with the general public before formatting the blueprint of the mobile application.

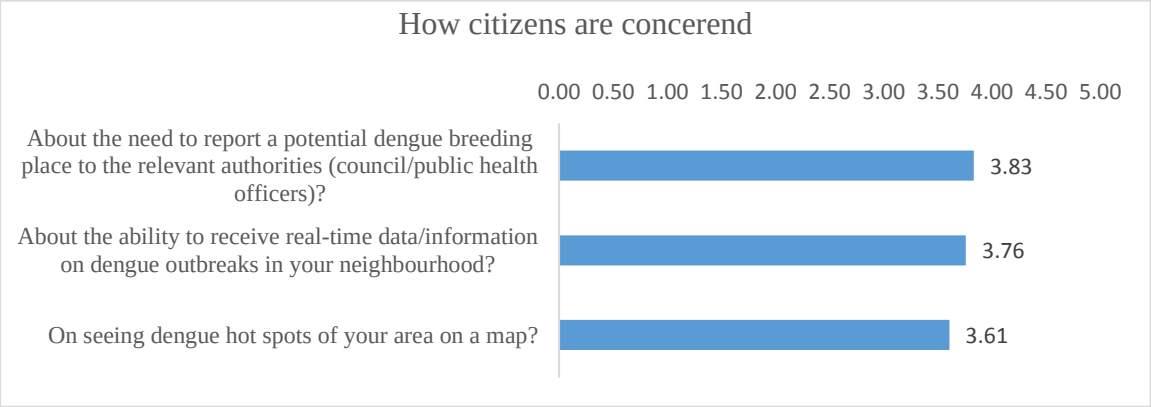
A questionnaire survey was conducted with the primary objective of 1) understanding the current system of dengue prevention method 2) assessing the technological, socio-cultural feasibility, and 3) determining the users' requirements. The survey was conducted with 300 people in Dehiwala Mount Lavinia Municipal council area. The random sampling method was used and the number of respondents from each ward was determined according to the population size of each ward.

The demographic profile of respondents

Socio-economic variables	Categories	Survey %
Age	15-35 years	38.8
	36-56 years	49.2
	57-77 years	11.7
	>77	0.3
Monthly household income	<Rs. 50,000	6.0
	Rs. 50,000- 100,000	21.3
	Rs. 100,000-150,000	48.3
	Rs. 150,000-200,000	22.0
	Rs.>200,000	2.3
Education	No schooling	1.4
	Primary school	24.0
	High school	42.2
	Vocational Training	14.9
	University	17.6
	Post Graduate	0.0
Gender	Male	57.7
	Female	42.3
Marital Status	Married	84.3
	Unmarried	15.7

The survey gathered evidence on the concern levels of the participants on reporting and receiving real-time information on dengue outbreak (figure 1). Participants were asked to rank their level of concern on a Likert scale starting 1 as not at all concerned to 5 Extremely concerned.

Figure: 1 Participant's concern level in reporting and receiving information on dengue

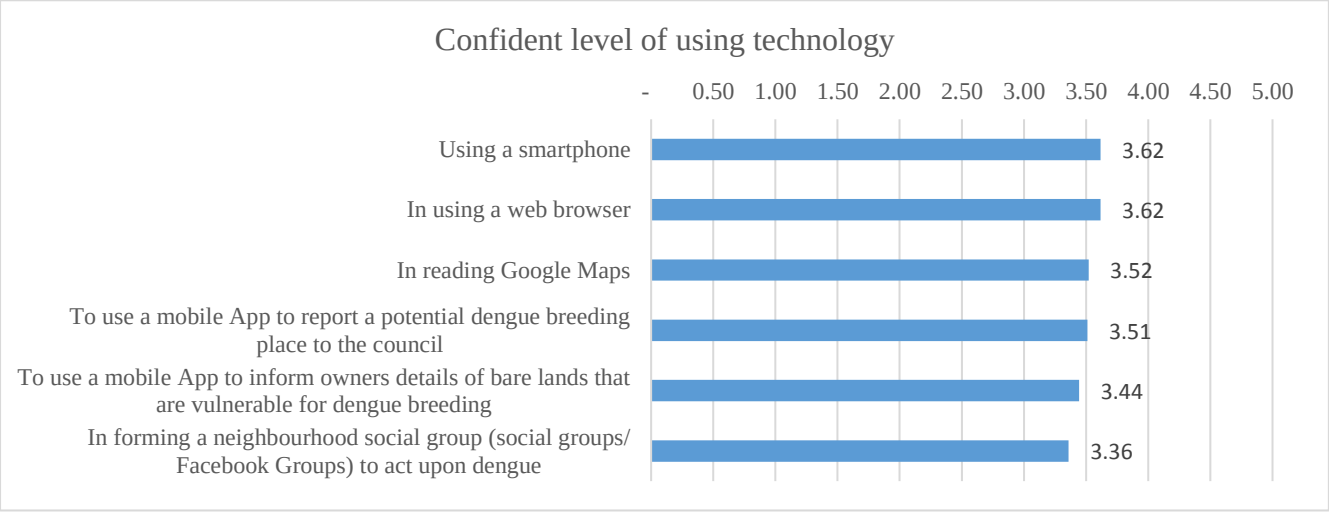


Source: Survey, 2018

Young people showed a great interest in seeing dengue hot spots on a map. As the prevention of dengue needs active citizen engagement, the survey tried to gather information on the current status of the way of communication between the relevant authority and the community. 96 per cent of the participants mentioned that they had communicated with the council on dengue-related matters in their neighbourhood with the council. Around 85 per cent of the participants has communicated with the council once in a month. When it comes to the community aspirations, participants thought that more people would actively engage with the dengue prevention activities, if they receive incentives. Scaling on a Likert chart where 1 was mentioned as not at well, and 5 was extremely well, participants rated 3.86 for the above-mentioned question.

For the sustainability of the product, we need to predict the confidence level of using the technology of the users (figure 2). Findings show a high potential of introducing a mobile application as the younger age group showed a significant confidence level in using technology compared to other groups. As the younger generation grew by years, the sustainability of the product will continue (figure 3).

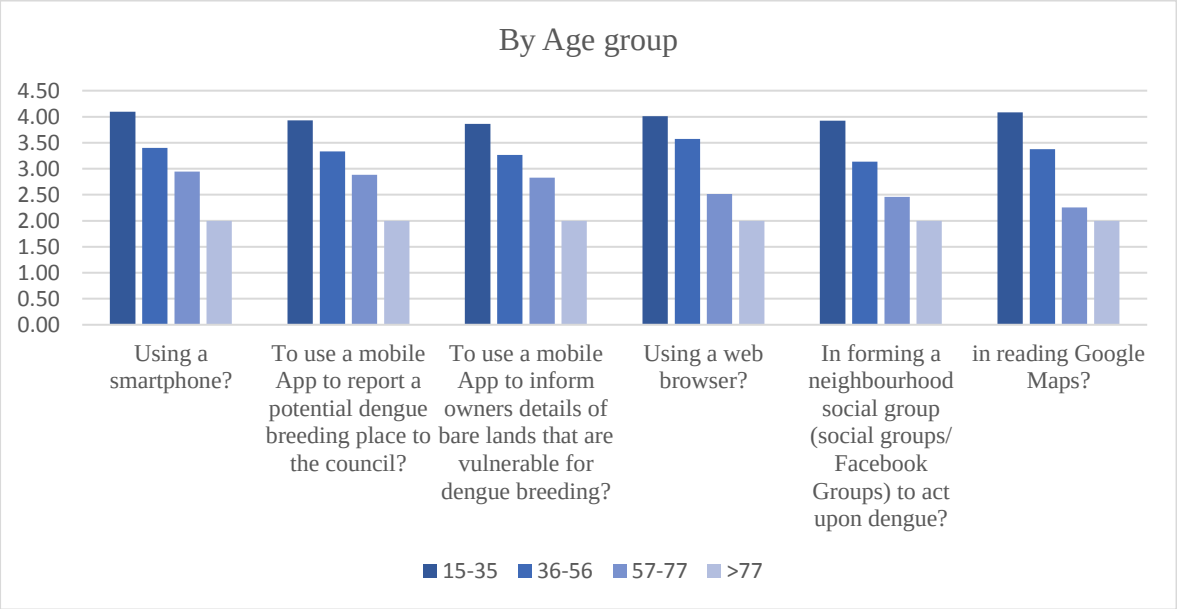
Figure 2: Participants confident level of using technology



Source: Survey, 2018

The younger group indicated the highest level of confidence level for every component of the technology.

Figure 3: Level of confidence level in using technology by age

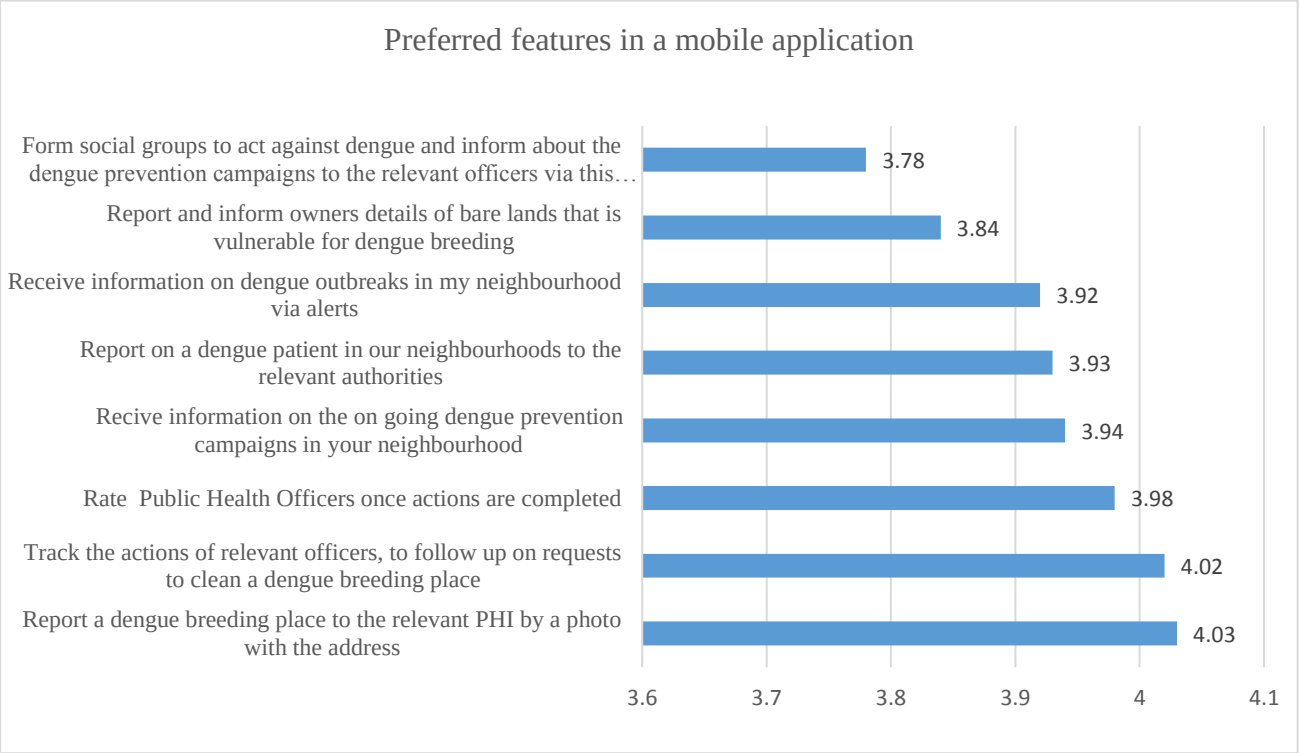


Source: Survey, 2018

Participants educational level showed a significant correlation with the confidence level of using technology. Higher the education level showed a higher level of confidence in using a mobile application. Apart from the age and the educational level, gender and marital status also showed a correlation pattern. Males and unmarried participants indicated a higher level of confidence level in using technology related to the dengue prevention application.

The usability survey aimed to identify the desired features of the future product (figure 4). Results indicated the participants desire in reporting and receiving back the feedback on the actions taken upon their requests. The findings support the economist view on online participation which highlights peoples work as rational thinking of costs and benefits. People would not take action on common activities unless their efforts have been valued (Liu and Sandfort , 2001).

Figure 4: Preferred features in a dengue prevention mobile application



Source: Survey, 2018

People showed less interest in forming social groups for dengue prevention. This directly points out the need for linking the general public and the relevant authorities to establish an efficient and sustainable dengue prevention system. And it clearly shows that the existing community has the capability to handle a mobile app to input data. Also, they have literacy to track the issue and understand the situation of dengue issue in their neighbourhoods. Moreover, existing systems which have limited capabilities such as data collection and determination are not able to fulfil their requirements. In terms of promoting the use and evolution such citizen science platform, thus ensuring an optimal uptake of the results, the system could allow users to analyse data and provide capabilities to make decisions out of the data they collected as the main strategy.

Discussion

The survey findings provide a guideline for the future development of a dengue prevention mobile application for Sri Lanka. As a promising factor, more than half of the participants showed their highest level of concern on reporting a dengue breeding place to the relevant authority and also confirmed their current active engagement in dengue prevention activities by indicating that they have communicated with the council very often in the recent past. The ground level enthusiasm is a positive feature and also an indication of a need for a better communication system for dengue prevention activities.

The findings support the economist approach to open source participation (Tirole & Lerner, 2002). People tend to take action on common activities if they receive tangible or intangible intensives. Gamification (Arndt, Dziubaczyk, & Mokosh, 2014) is a tool that can be incorporated with the

development of the mobile application as a way of providing intensives. As a way of moving forward, we had some initial discussions with the council on introducing a scoring system for the general public on their actions. This will include providing free parking tickets, providing priority for council's services, and providing badges or certificates. This creates a push factor for the non-contributors to come forward as the social norms urge them to do so (Gloud, 1993).

The confident level of using ICT was high among the participants. Among the other age groups, the young group showed a higher level of confidence level in using every aspect of the ICT. As a developing country, this is a promising sign for introducing such technologies in the public welfare sector. As the younger generation grows with the years, this can be viewed as a great potential for the sustainability of an open source product. However, as a tool for social justice, the ICT literacy level among the elderly group should be upgraded by conducting workshops freely. A self-explaining clear, structured mobile application will facilitate any age group in the society (Arndt, Dziubaczyk, & Mokosh, 2014).

Educational level and the confidence level of using a mobile application showed a significant correlation. The findings indicated the low level of confident level in using a mobile application among the people who have a low level of education. The recent experience with using mobile application among the taxi drivers in Sri Lanka, however, shows a contrast opinion for the findings. Even though the Sri Lankan taxi drivers' education level is considered as low, there is a boon in using smart technology in that industry. If the mobile application is user-friendly and simple there is a high possibility of popularizing it. Economically, if the App provides easy solutions for community problems, people will easily download it.

The findings reveal the community desire in receiving follow up messages on their requests from the relevant authority. Previous practical experience around the world, also suggests the necessity of linking the community with the relevant authority to make the application trustworthy. Sustainability of an open source technology is dependent on the value that user receive upon their action. If they are satisfied with the action that has been taken upon their request they tend to use it again. The previous dengue prevention application which was introduced in Sri Lanka were lacking the linkage between the relevant authority and urged the community to form social groups and act upon their problems. As a remedy for this matter, we have identified the Dehiwala Mount Lavinia municipal council as the implementing partner of the dengue prevention project.

The findings of the need and the sustainability assessment of the dengue prevention mobile application indicate the high level of feasibility in introducing an App. The success and the sustainability of the product will rely on the better incorporation of the community desires and the user-friendly design elements with the development. To ensure the user-friendly and convenient structure of the application, there need several rounds of prototype testing on the ground with the participants. The development process should go several rounds with the incorporation of the feedbacks receive through the prototype testing.

Acknowledgement

This paper is based upon the work supported by the Citra social innovation lab, Sri Lanka. We acknowledge the Citra social innovation lab for providing funding for the research. We thank Gamunu Premarathna, Data Specialist, Citra lab for analyzing data. A special thanks goes to the Chief Medical Officer, Ratmalana and the Public Health Inspectors (PHI) of Ratmalana Medical Office of Health (MOH). Lastly, we thank the research team from the Department of Town and Country Planning, University of Moratuwa for conducting the field research in Dehiwala Mount Lavinia municipal council area.

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