Geographical Information System adoption by the Sports Authorities in Sri Lanka as an Administrative Tool; An exploratory study to develop a service model

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Abstract

The construction of sports information is a unity of individual behaviour and collective behaviour aims to fully respect the right authority of different sports organizations, which is to take measures to implement market mechanism, and to mobilize the initiative of different sports enterprises conducting the construction of sports information. Geo-Information System (GIS) has been used as an administrative tool or platform to access potential stakeholders in Sports. The purpose of this paper was to determine the factors influencing sports authorities' decision to adopt GIS as an administrative platform in Sri Lanka. The technological, organizational and environmental (TOE) framework was used as the conceptual parameter which is a widely-accepted model for studying IT adoption in organisations. The data collected, through an online questionnaire-based survey that was completed by 32 respondents. Exploratory statistical tests were used to analyse the data and the proposed hypotheses. The results showed that the environmental context had a significant impact on the adoption of GIS. Organization and Environment contexts had moderate positive relationships with GIS adoption. The organizational context had a significant moderate relationship with the GIS adoption but it didn't have any significant impact on the adoption of GIS. Superiors support, employees' innovativeness, and IT experience did not impact on the adoption of GIS. This would imply that any support and guideline from superiors of the organizations for employees would be very crucial for an adoption decision. Furthermore an in-depth interview would be recommended to provide further insight as for qualitative or mixed method studies.

Keywords: GIS (Geo-Information System), Technology, Organization, Environment, Technology Adoption, TOE and Sports Authorities

Introduction

The modern technology and its tools namely GIS is one of the remote sensing techniques is widely used for administrative purposes. Especially it helps in planning and management of utilities and resources, multipurpose cadastre, e-government, e-commerce and for decision making with respect to the management of many other resource management systems (Wijesekera &

Peiris, 2008). GIS is a system of hardware, software and procedures to facilitate the management, manipulation, analysis, modelling, representation and display of Geo-referenced data to solve complex problems regarding planning and management of resources (NCGIA, 1990). GIS technology can systematically manage all kinds of geographic data and attribute data, provide a variety of query, display, analysis, statistics, and graphic output function (Cheng & Guo, 1999). The introduction of GIS, along with the combination of sports information together with the geographical environment, enables the exact description of all kinds of regional sports information (Cheng & Guo, 1999). The world of sport is naturally very dynamic and the use of information technology is one of the developments that have made a significant impact on many modern day sporting disciplines and organisations (Nhamo & Magonde, 2014). The development level of Sports Informationization can reflect the overall sports strength of a country (Cheng & Guo, 1999). Thus, compared with major Western developed countries the Sri Lankan sports informationization still has a significant gap in terms of scale, and development level. In 1966 "Sports" was identified as a subject under the Ministry of Peoplised Services and the year 1967 Hon. V.A. Sugathadasa was appointed as the first Minister of Sport (MOS Corporate plan, 2019). Subsequently by Gazette (extraordinary) No. 20/1650 dated 30th April 2010 this Ministry came into being as the Ministry of Sports (MOS Corporate plan, 2019). The Ministry of Sports is a democratic institution established under legislative powers vested in the constitution of the Democratic Socialist Republic of Sri Lanka to implement policies, plans and programs in respect of Sports, encouragement and development of sports, improvement of Sports Education, development of sport and recreation infrastructure (MOS Corporate plan,2019). The Sports Law Act No 25 of 1973 provides an outline of the structure of sport promotion organizations; National Olympic Committee, Fifty two (62) National Sports Federations and Associations.

As per the performance review document submitted by the Ministry of Sports to the Parliament in 2018 has been clearly mentioned that considering the development of sports as a whole in an independent manner, the stability or the unstoppable progress in sports is not at all satisfactory and observed many reasons as the ministry of sports and the department of sports do not have a comprehensive integrated active and practical system ,the players do not get the opportunity to involve with their relevant sport on a regular basis due to internal crisis and conflicts within the sports federations and irregular distribution, weakness in handing and maintenance of the infrastructure facilities associated with Sports which are provided on an Island wide basis (MOS annual performance report, 2018). Thus the sports authorities in Sri Lanka have realized the requirement of information system platform like GIS.

Previous studies have examined the factors that have had an influence on the adoption of GIS. However, there have been few studies that have explored the use of GIS as an information platform. Another objective of this study was to investigate the factors influencing of the TOE framework for level of adoption as an administrative platform by the sports authorities in Sri Lanka. Therefore, GIS has been used as an administrative tool or platform for them to access potential stakeholders in Sports. This research aimed to determine the factors evaluating the TOE of GIS adoption by the Sports Authorities in Sri Lanka; An exploratory study to develop a service model.

Literature Review

Geographical Information System & Sports Administration

A geographic information system (GIS) is a framework for gathering, managing, and analysing data, it's rooted in the science of geography, GIS integrates many types of data to analyse the spatial location and organizes

layers of information into visualizations using maps and 3D scenes(www.esri.com,2020). Thus, this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations to help users make smarter decisions.

Over the past few years, the game and the business of sports has changed exponentially (Narain, 2017). Thus, it is not about winning or losing anymore but about the statistical and geographical analysis and the planning of future game strategies accordingly. According to Narain (2017) Geographic Information Systems (GIS) is being effectively used to identify characteristics, patterns, movements of players and it is actively being used in the business of sports which involves choosing stadium locations to managing security at sporting events (Geospatialworld.net, 2017). GIS is not limited to one sport, its being actively used in soccer, rugby, swimming and other sports for accurate athlete performance analysis (Narain, 2017).

The construction of sports information is a unity of individual behaviour and collective behaviour, it aims to fully respect the right authority of different sports organizations, which is to take measures to implement market mechanism, and to mobilize the initiative of different sports enterprises conducting the construction of sports information (Cheng & Guo, 1999). At the present time, the application of GIS in sports information is very limited, and the relevant research findings are not many in this Sri Lankan context. Hence, this research has an important validity to investigate the GIS adoption by the Sports Authorities in Sri Lanka.

The Technology-Organization-Environment (TOE) Framework

TOE is a widely-accepted model for studying IT adoption in organisations (Rahbi, 2017). It was first developed by Tornatzky, Fleischer and

Chakrabarti (1990) as a theoretical framework to predict the adoption of various forms of IT innovation (Thurasamy et al., 2009). Subsequently, it has been extended and developed by further studies such as Oliveira and Martins (2010); Srivastava and Teo (2010); Yee-Loong Chong and Ooi (2008); Pan and Jang (2008); Kuan and Chau (2001); Chau and Tam (1997) (Rahbi, 2017). Thus, as a valuable analytical framework (Oliveira and Martins, 2008), TOE has broad applicability and possesses exploratory power that is useful in order to study a wide range of technologies (Baker, 2012). It has been viewed as an ideal theoretical framework for predicting and explaining the adoption of any given technology (Ndekwa and Katunzi, 2016; Yeboah- Boateng and Essandoh, 2014; Ramdani, Chevers and Williams, 2013). Since its beginning in 1990, TOE has been used in different contexts, in developed and developing countries (Rahbi, 2017), to study the adoption and implementation of various technologies as it has been used to study adoption of cloud computing (Gangwar et al., 2015; Alshamaila, Papagiannidis and Li, 2013), e-commerce (Rowe, Truex and Huynh, 2012; Ghobakhloo, Arias-Aranda and Benitez-Amado, 2011; Al-Qirim, 2007), e-business (Wen and Chen, 2010), and enterprise applications systems (Ramdani, Chevers and Williams, 2013). The TOE framework has emerged as a well-established and a robust framework to analyse different internal (technological and organisational) and external (environmental) factors that influence the adoption of different types of ICT in different contextual setting (Abeysinghe and Alsobhi, 2013).

Technology context of the TOE

This context describes existing technologies in the organisation as well as the pool of technologies available in the market (Roger, 2010).Many researchers have argued the importance of a set of technological features on the adoption process(Rahbi, 2017). Rogers (2010) identified five attributes of

technology that may have an influence on the decision to adopt or reject a given technology in organisations: relative advantage; complexity; compatibility; trialability; and observability (Rahbi, 2017). These attributes, which represent the core pillars of Roger (1995) Diffusion of Innovation theory, have been widely examined in the IT adoption literature (Ramdani and Kawalek, 2007), and are the core factors in the technology context of TOE.

Organisation context of the TOE

Organisation characteristics, the second set of determinants in the TOE framework and it has been impacted the adoption of new technologies. The four organisational factors that have been widely examined are: enterprise size; top management support; CEOs' innovativeness; and prior IS experience (Rahbi, 2017).

Environment context of the TOE

The environment context represents the third set of factors in the TOE framework that has been identified to impact the adoption of Information systems. The IT adoption literature suggests that looking in to the environment helps to understand ICT uptake within the types of businesses (Kapurubandara and Lawson, 2006). In fact, it is believed that the arena in which an enterprise operates represents a primary stimulus for the adoption of innovations as organisations respond to changes in the external environment (Alshamaila, Papagiannidis and Li, 2013; Damanpour and Schneider, 2006; Kapurubandara and Lawson, 2006). Several environment factors have been identified as affecting an organisation's decision to adopt new technologies, including; competitive pressure; industry type; Government direction or market scope;

external IS support; and customer pressure (Alshamaila, Papagiannidis and Li, 2013; Damanpour and Schneider, 2006; Kapurubandara and Lawson, 2006).

Conceptual Framework and Hypothesis development
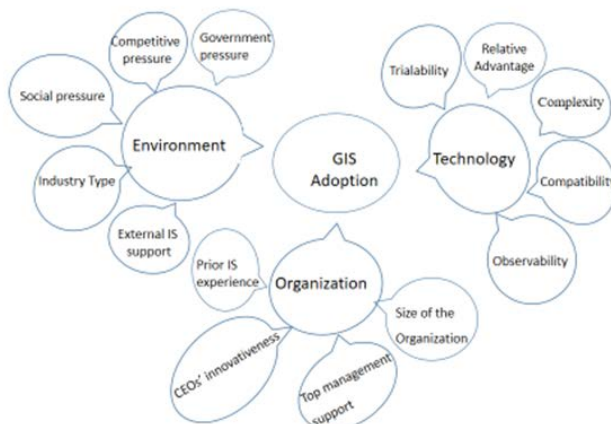
Figure 1. The conceptual framework and measurement model

Hypotheses of the Study

This section provides a description of each TOE context and the hypotheses defining the relationships between model constructs. The model relationships between independent and dependent latent variables are designated as positive or negative

Technological Context

The technological context represents attributes of the information system that may impact adoption and includes the availability of those requisite technologies both inside and outside the firm (Tornatzky et al., 1990; Zhu et al., 2010). Perceived or expected benefits describe the advantages a firm

anticipates procuring through the adoption of a new IS innovation over the current systems or processes in use (Chwelos et al., 2001).

H1: There is a relationship between Technological context and Adoption of GIS

H2: The technological context has significantly impact on the adoption of GIS

Organizational Context

The organizational context reflects characteristics of the firms such as size structure, organizational readiness, and climate (Chau and Tam, 1997; Zhu et al., 2010). It can also include managerial structure, the degree of centralization, resources and communication processes which serve to impact or influence an organization's adoption of an innovation (Oliveira et al., 2014). Within this context, Researcher examines a construct that reflects the organization's attitude towards the adoption of a new innovation.

H3: There is a relationship between Organizational context and Adoption of GIS

H4: The Organizational context has significantly impact on the adoption of GIS

Environmental Context

The environmental context reflects the external environment in which the firm operates and includes competitive, market, and regulatory forces. It can also include the availability of organizations external to the firm with specific expertise to assist in IS adoption (Zhu et al., 2010).

The main purpose of the study is to examine the relationship and impact of technological, organizational and environmental factors on organizational adoption of GIS for sports authorities?

H5: There is a relationship between Environmental context and Adoption of GIS

H6: The Environmental context has significantly impact on the adoption of GIS

Methodology of the research

'Paradigm' is used to mean the philosophy of a particular piece of research, and is viewed by Johnson and Onwuegbuzie (2004) as being the research culture, representing a set of beliefs, values and assumptions about the nature and conduct of research. The positivistic approach has been applied for this quantitative research and it is going through the deductive process.

Items for measuring the TOE model was adapted and modified from the previous studies of Ahmad et al., (2018). All items were going be measured using a five-point Likert-type scale (ranging from 1 = strongly disagree to 5 = strongly agree). The population for this study was the administrative staff who attached to the sport's governing bodies in Sri Lanka. Based on the purposive sampling method, an online questionnaire sent to the respondents using Google forms as the data collection tool. The intendant sample size was 32 respondents were representing the above population and unit of analysis was the administrative officer under the different sports authorities in Sri Lanka. The IBM SPSS 26 package was employed for data analysis, Bivariate Correlation and Linear Regression exploratory statistical test were used to analyse the data and the proposed hypotheses.

Findings of the Study

Samples profile

Both male and female respondents were equally representing and the highest category of age was above 50 years as 40.6% followed by 30-40 years and 40-50 years as 34.4% and 25%. The middle management was the highest management category level of the sample which had 40.6% respectively

followed by Top management and Junior Management as 31.3% and 28.1%. The highest respondents were representing the Institutions under the Ministry of Sports (43.8%) and Sports federation (43.8%) equally followed by the Ministry of Sports (12.5%). Also the major category of respondents have Post-graduate qualifications (43.8%) followed by the Degree, Other Qualification and Diploma holders were representing as 21.9%, 18.8% and 15.6%.

Measurement model

Reliability analysis was done to measure internal consistencies of the total scores for each scale through Cronbach's Alpha Coefficients. The calculation of reliability measurements is presented in table 1. As per the findings, all the reliabilities for scales are found in between excellent and good level based on the following continuum according to George and Mallery (2003), Cronbach Alpha > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, > .5 – Poor, and < .5 – Unacceptable).

Tab. 1 – Reliability analysis for the Scale. Source: Survey data 2020

Scales	No.of Items	Cronbach's Alpha	Mean	SD
Technology	15	0.894	3.8042	0.57969
Organization	09	0.772	3.6563	0.58819
Environment	10	0.877	3.6563	0.73920
GIS Adoption	04	0.842	4.255	0.54993

According to the descriptive statistics given in the table 01, the technology scale has a moderate level (M=3.80, SD=0.579). In addition to

descriptive statistics, the researchers assessed other scales under the independents variables, Organizational and Environment were having at a moderate level as (M=3.65, SD=0.588) and (M= 3.65, SD = 0.73). GIS adoption scale has positive level of mean value on the descriptive statistics as (M=4.25, SD= 0.5499).

Tab. 2 - Correlation Matrix. Source: Survey data 2020

	Tech	Org	Env	ADOP
Tech	1			
Org	.396*	1		
Env	.434*	.620**	1	
ADOP	.212	.368*	.603**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The researcher has conducted the Correlation analysis to explore the positive or negative relationship between the independent and dependent variables based on the Hypotheses one, three and five. Further findings have revealed that in the first hypothesis test as no relationship between the technological context and GIS adoption, third hypotheses concluded that a moderate positive relationship between the organizational context (0.368) and GIS adoption and also it is statistically significant at 0.05 level. Finally in the fifth hypothesis, the environment context showed a strong positive relationship (0.603) with the GIS adoption, and also it has a statistical significant at 0.01 level.

Tab. 03 - Regression models on Technology, Organization, Environment contexts and GIS adoption: Source: Survey data 2020

Explanatory Variables	$^\beta$ Value – GIS Adoption
Constant	2.752 (4.310)
Technology	-.061 (-.358)
Organization	.003 (.016)
Environment	.627 (3.159)
R Square	.367
Adjusted R Square	.299
F-Statistics	5.404
Sig.	.005
Number of Observations	32

The above statistical interpretations have revealed that technological context negatively relate to the GIS adoption of TOE model. As β values and t-statistics imply, judging from the strength of the influence of each independent variable on the GIS adoption by the sports authority in Sri Lanka. The R-Square value has been revealed that TOE variables were representing 36.7% of the model and it was not statistically significant on model fit. Also further findings revealed that two aspects (Technology and Organization) of TOE model were not significant explanatory variables on GIS adoption and it had less P-vales than the 0.05 Alpha value. Therefore it was evident that the present technological and organizational influences were not impacted for GIS adoption by the sports authorities in Sri Lanka. As per the above findings, Ordinary least square regression model has been developed as follows.

$\hat{Y}e = 2.752 + 0.467$ Environment

Discussion of Results

This study attempted to investigate the factors influencing Sports authorities' decision to adopt GIS (Geo-information system) in Sri Lanka. The findings from the study revealed that the organizational and environment contexts have significant positive moderate and strong relationship with the adoption of Geo-information system. Moreover, only the environmental context had a significant direct positive impact on sports authorities' adoption of GIS information system. The findings were consistent with the results from previous studies that had examined the adoption of other types of ICT systems (Ahmad et al., 2018; Gutierrez et al., 2015). This could be interpreted that Sports authorities in Sri Lanka have been pressurized from the environment for adopting IS systems as administrative platforms for their operations.

The relative advantage, complexity, compatibility, trialability, and observability have all been found not to be significant technological factors in determining the adoption of GIS by Sports authorities. This could be interpreted as sports authorities not believe that adopting GIS would enhance the administrative performance of their operations. Another would have been impacted on this result as the techno-literacy of the employees under sports institutions and the technological complexity & compatibility. This finding was consistent with previous research (Ahmad et al., 2018).

The one only factor directly influencing sports authorities' adoption of GIS as an administrative platform was the environmental context. The advance of Internet technology and information systems have dramatically changed organizational operations and employee behaviour. According to Narain (2017) Geographic Information Systems (GIS) is being effectively used to identify characteristics, patterns, movements of players and it is actively being used in

the business of sports which involves choosing stadium locations to managing security at sporting events (Geospatialworld.net, 2017). Competitive pressure is also an important factor to drive sports authorities to adopt Geo-information system. As such, competition, local and international sports event organizers and social pressure have been found to be significant factors in determining the adoption of Sports Geo-information system.

The organizational context had a significant moderate relationship with the GIS adoption but it did not have any significant impact on the adoption of GIS by sports authorities. Superiors support, employees' innovativeness, and IT experience could not be impacted on the adoption of GIS at the sports institutions respectively. This finding conformed with previous studies (Gutierrez et al., 2015). According to Karunaratne &Wanninayake (2018) confirmed this type of behavioural impact on the research of consumer ethnocentrism and purchase intention for powdered milk brands available in Sri Lanka

This would imply that any support and guidelines from superiors of the organizations for employees would be very crucial for an adoption decision. Strategic level of the sports organizations need to play an important role to support their employees by providing subjects or practicum training on how to exploit the benefit of GIS for doing smoother sports administration.

Conclusion & Recommendations

This study offered a new insight into the factors affecting the adoption of Geo-information system as a sports administrative platform by Sports authorities in Sri Lanka. The proposed TOE model in this study provided a more comprehensive framework to understand the adoption of GIS in the Sports administrative context. However, there were a few limitations. Firstly,

data collection was limited to few institutions under the Ministry of Sports Sri Lanka. Therefore, the findings should be carefully generalized for all sports authorities in country. Secondly, samples size also not enough to generalize the outcome of this research for making crucial managerial decisions on GIS adoption for sports administrative purposes in Sri Lanka. Therefore, future research could contribute to ascertain the generalizability of the findings by testing the proposed research model in other independent sports institutes (62 sports federations) or fields of study. Lastly, while a quantitative survey strategy was chosen for this research, future research studies could also use other sophisticated statistical analysis methods; such as structural equation modelling, multiple regression and so on for an analysis. Furthermore an in-depth interview would be recommended to provide further insight as for qualitative or mixed method studies.

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