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Information system supporting research on rubber in Thailand

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ABSTRACT

This research aimed to develop an information system supporting research on rubber (ISSR) in Thailand. This system was designed as a web application with responsive web design. The rubber database was developed with MySQL, used Apache server as a web server and programed with PHP-script. HighChart, Google Chart API and Java technology were used to represent an online information with graphical format. The system was tested with the actual data on rubber research in Southern Thailand. The system has been available online at URL http://www.s-cm.site/issr. There are three type of users: administrator, researcher (member) and generic user. The researcher performed data entry about research with log-in to the system using username and password provided by the automatic system via online registration form. The administrator can manage the research information. The researchers can manage their research information, use searching tool and leave comments on other member's research. The generic users can access the system without username and password to view the research and general information on rubber. Moreover, the system generates a report on rubber research with online graphical format. In conclusion, this information system enhances investigation on rubber research in Thailand and its strategy planning for rubber plantation in the future.

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1. INTRODUCTION

In recent years, information technology (IT) rapidly evolves to help our world and daily lives and it has been continuously developed. The information technology field is a promising field of research. Recently big systems have consisted of several servers and terabytes of information [1]. To assist administrator's appraisals, information system (IS) displays precise data [2]. Information technology and information system have been widely applied in science research such as health science [3], biology [4], agriculture [5] since there is not a sharp criterion capable of dividing science from technology [6].

As an original point of supply, the rubber tree provides two recyclable raw resources: natural rubber and wood. Consequently, as an industrial resource, the outcomes are advantageous for both the economy and environment [7]. Natural rubber enterprises have been underpinning the socio-economic security for Thailand for a century [8]. Vital rubber material is required for preparing many industrial and consumer products, some significant examples are rubber tires, gloves, condoms, rubber bands, flexible tubing, elastics, and hoses [9, 10].

The subtropical areas covering approximately 10 hectares, produces ten million tons per year of global production. The primary location for rubber tree crop setting and farming with more than 90% of

global production takes place in Thailand, Indonesia, and Malaysia-South East Asia [7]. For 2010, Thailand rubber plantations covered over 5 million acres, thus recognized as the global and primary rubber producer with an output of approximately 2.5 million tons yearly [8]. China, the world's major buyer for natural rubber, purchased 4, 820 thousand tons in 2015. The following year, 2016, increased by 1.26 percent. To meet its requirements and supply difference, China imported natural rubber reaching 3,803.2 tones in 2015 or more significantly 78.9 percent of total consumption for 2015 [11, 12].

Trending in 2015 to 2019 total global rubber utilization increased approximately 1.8%. Projected increases in 2017 (2.9%) and 2018 (3.3%) [13]. For the next decade, considering the growth of the global automotive and medical technologies, the rubber utilization estimate may reach 2.7% per annum [10]. This year, the global economy tends to grow more positively as compared to 2019. Natural rubber outlook 2020 is forecast to slow down in line with global economic growth as the economic factors above coupled with the natural rubber output and demand for natural factors [14].

Each year, the government of Thailand must prepare the budget for research in several fields for Thai strategy approaches including rubber technology research. In this study, we focused on the information system supporting research on rubber in Thailand, case study on Natural Rubber Innovation Research Institute, Prince of Songkla University. The system enhances decision making and strategy planning by Natural Rubber Innovation Research Institute for preparation of budget planning and rubber plantation in the future.

2. RESEARCH METHOD

2.1. System architecture

This system was designed as a web application with a responsive web design. The rubber database was developed with MySQL for the database management system. The Apache server was used as a web server to contact client/server sides and programmed with PHP-script as shown in Figure 1. The Apache web server respond to the client request in either of the following two ways including sending the file to the client associated with the requested URL (front-end) and generating response by invoking a PHP-script and communicating with rubber database (back-end) as shown in Figure 1.

In the system, PHP script was used to work with HTML, CSS and Java script for contacting the Apache server and MySQL database. The data was retrieved from the MySQL database by PHP-scripts in dynamic webpages with graphic images. Moreover, HighChart, Google Chart API and Java Technology were used to represent an online real-time rubber information with graphical format.

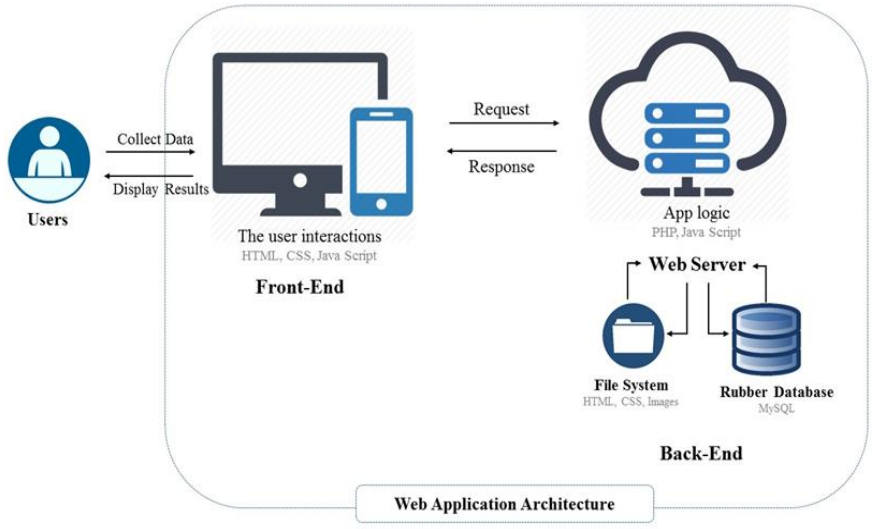


Figure 1. System architecture of ISSR

2.2. Data collection

We obtained the data on rubber research from Natural Rubber Innovation Research Institute, Prince of Songkla University, Thailand from 2015-2019. The rubber research data including researcher, research title, type of research, funding, budget, and publication.

3. RESULTS AND DISCUSSIONS

The system was designed for three type of users: administrator, researcher (member) and generic user. The researcher performed data entry on research with log-in to the system using username and password provided by the automatic system via online registration form. The administrator can manage the research information. The researchers can manage their research information, use searching tool and leave comments on other member's research. The generic users can access the system without username and password to view the research and general information on rubber as shown in Figure 2. Moreover, the system generates a report on rubber research with online graphical format. Since 2017, the system has been available online at URL http://www.s-cm.site/issr.

The system provided the searching tool for the researcher and generic users. They can use the searching tool using the keyword, author or publication year. The results from this tool will appear in the abstract and full document for free access or link to access the full paper as shown in Figure 3.

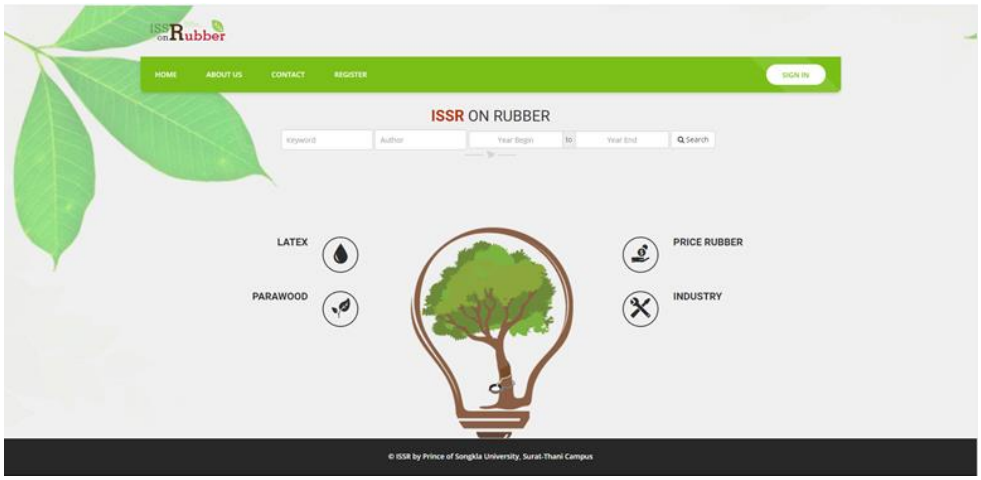


Figure 2. The homepage of ISSR

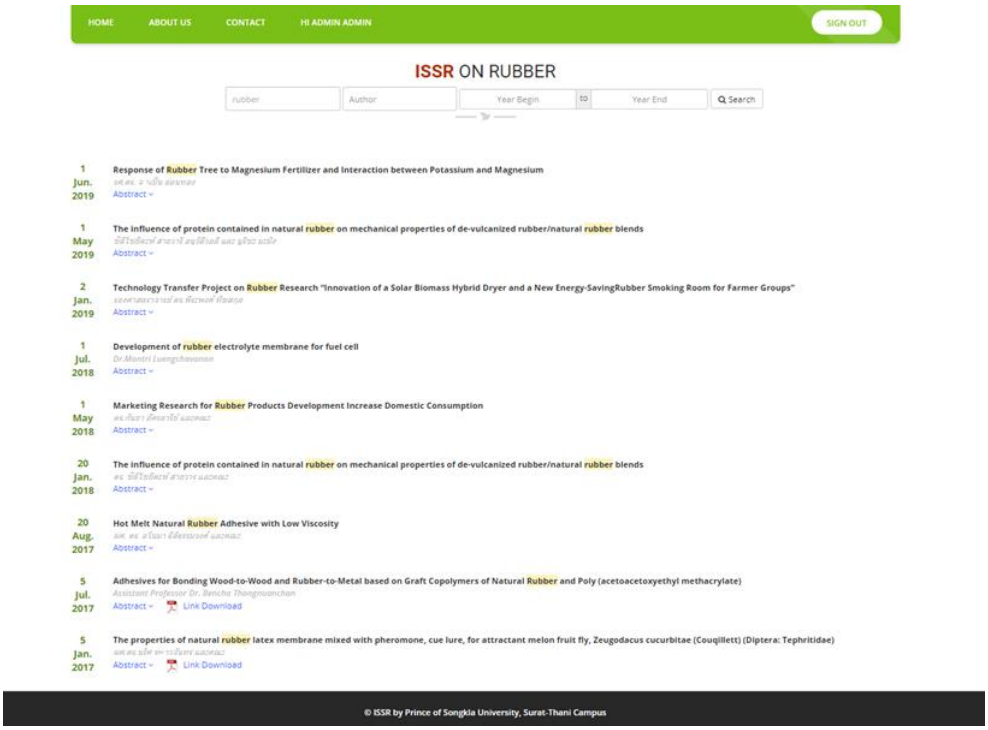
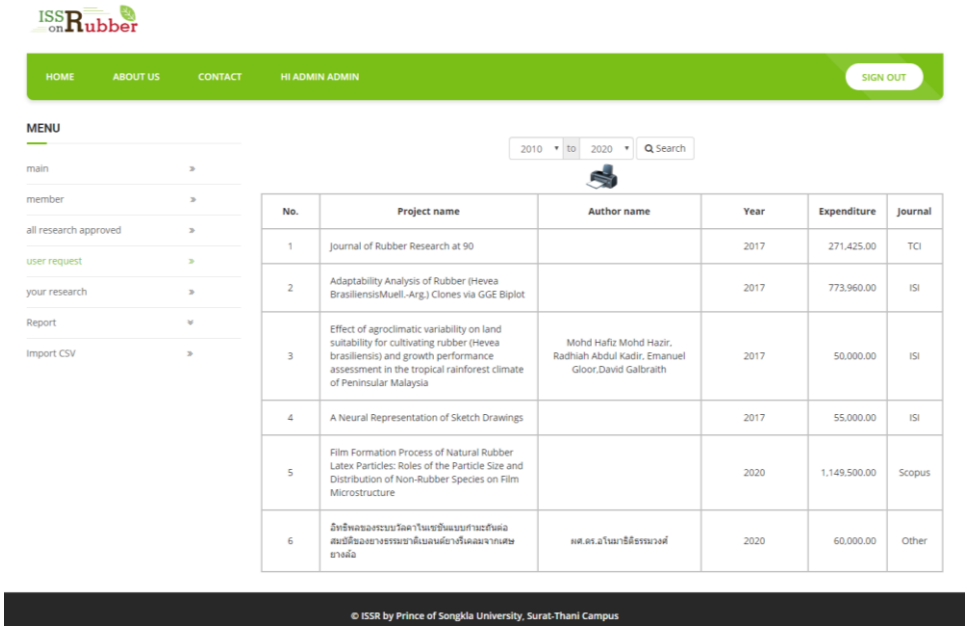


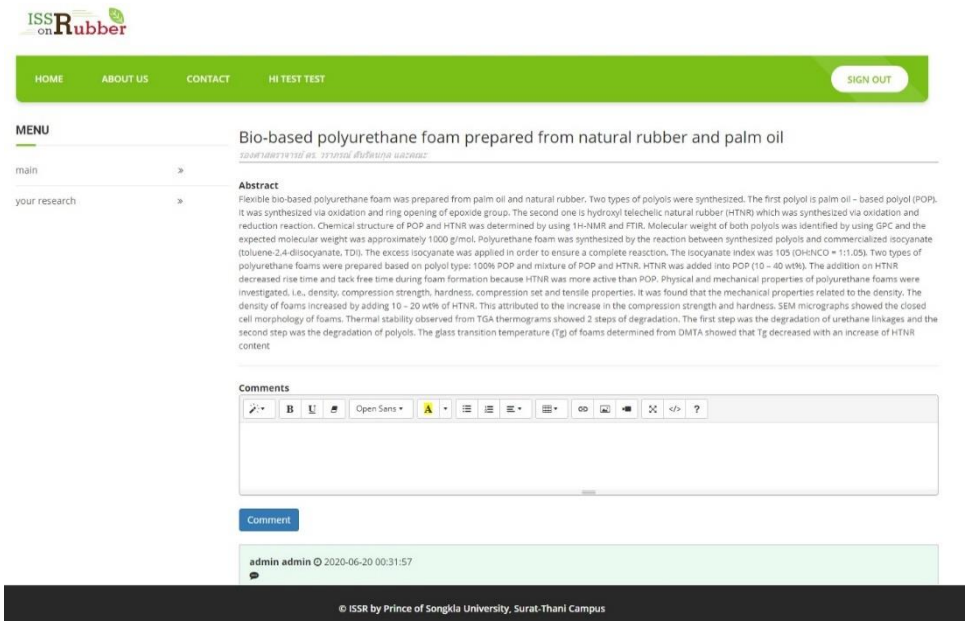
Figure 3. The example of results using searching tool

The logged-in users were able to access the rubber research data collected at Natural Rubber Innovation Research Institute, Prince of Songkla University, Thailand. The system provided the data entry and data management tools for the administrator and the researchers. The researchers can manage their research information, use the searching tool as shown in Figure 4(a) and leave comments on another member's research as shown in Figure 4(b).

Additionally, the system generates a report on rubber research with online graphical format. The system shows the budget for each type of research in the form of an executive summary report presented in a graphical format including bar chart and pie chart in each time period. In addition, the system allowed users to select the time period of interest for display and can export the report in CSV file format or export for printing. Users could compare the budget in each type of research and time period using graphical format as shown in Figures 5(a) and 5(b).



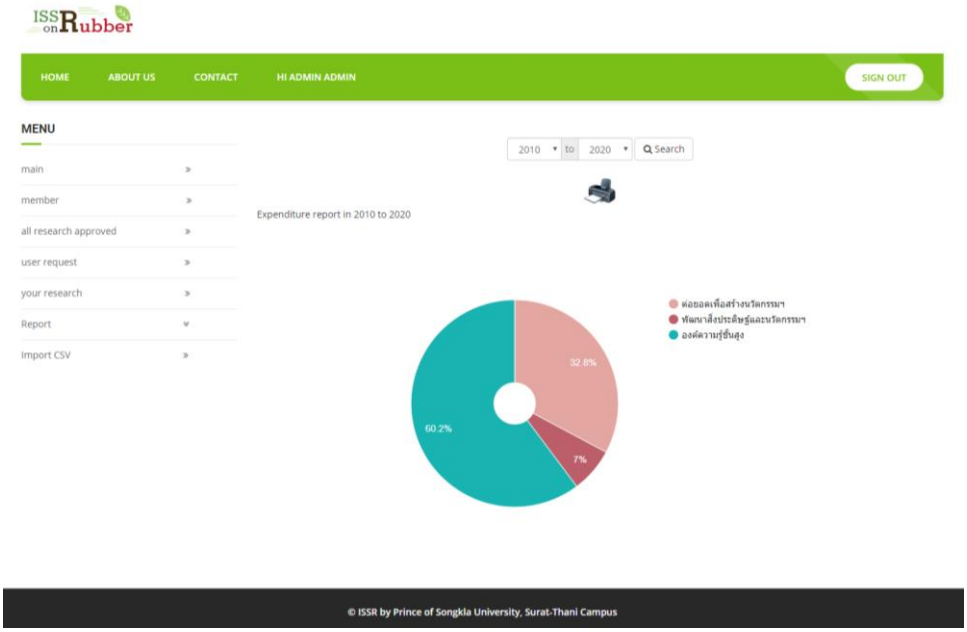
(a)



(b)

Figure 4. The researcher's tool, (a) Data management, (b) Researchers' comment

(a)



(b)

Figure 5. The budget report in (a) Bar chart, (b) Pie chart

This study endeavored to understand how the information system (IS) and information technology (IT) is utilized to support the rubber research in Thailand. There are few studies on using IS and IT on rubber research. Previous studies [15, 16] used geographic information system (GIS) technique for monitoring rubber tree plantation. The previous study [16] used the hierarchical classification to realize a precise map of rubber tree growth age distribution employing SPOT-5 satellite imagery. To map the distribution of rubber tree growth, GIS technology, specifically time-series MODIS 250 m NDVI products and sub-national statistical data was utilized for mainland Southeast Asia [15]. The studies suggested that rubber growth information is important in decision making process for rubber resource exploitation because the spatial distribution of each category and their coverage are precisely known [16]. Essential for understanding the dynamics of the ecological processes of the rubber tree growth, critical and up-to-date monitoring, and mapping provide documentation and insights [15]. To differentiate among mature and young rubber trees, other crops, and vegetation, the time-series MODIS 250 m NDVI was effective [15].

IT including database technology have been widely used in various fields including agricultural science [17], science education [18], ecology [19] and health science [20-22]. In a previous study [17] methods used in palm oil natural evaluation, illustrated fuzzy logic and various image processing. Detached and fallen fruit, provided a study challenge for harvesting work. The farmers are at risk of climbing the tall thorn trees, a local custom to determine the appropriate harvest time for oil palm fruits [17]. In science education, the web database technology has been used for described the mosquito larvae distribution in Thailand [18]. The student, teacher and researcher can use the mosquito larvae distribution for performing their school research in the community. Additionally, ecology research employed IT for interactional analysis among bird diversification, spatial distribution, and land classification at Kenyir countryside of Terengganu, Malaysia, employing an artificial neural network (ANN) for self-organizing map (SOM) inquiry [19]. In health science, web database technology have been used for data management such as the spatial and temporal variations in tuberculosis (TB) incidence in South Asia (India, Bangladesh, Pakistan, Maldives, Nepal, and Sri-Lanka) [20], an online advanced analytical service for dengue hemorrhagic fever (DHF) transmission in Thailand [21], and an alert system for dengue epidemic was designed as a web application for Kanchanadit Hospital in Thailand [22].

In addition, IT has been applied for dangerous situations and telecommunication provider [23]. A previous study [24] recommended a system that identifies dangerous conditions in a reagent cabinet and automatically activates the safety apparatus. Applications can monitor and control the reagent cabinet status in real time through remote monitoring and control. The analytical method used to find best telecommunication provider by visualizing their performance in Malaysia using data mining technique from customer's feedback via Twitter Inc [23].

Another previous study [25] indicated that IT can be applied for rubber plant disease diagnostics and recommend efficacious problem resolution. Enabling and providing solutions was adapted to the development of system in diagnosing rubber plant diseases consisting of white root fungus, upas mushroom disease, antraknosa disease, skin necrosis, and cancer lines, respectively (Rigidoporus micropus, corticium salmonicolor, colletorichum gloeosporoides, fusarium sp., and phytoptora palmivore, respectively) [17]. Although, in previous years, Thailand demonstrated constant growth in the production and consumption of natural rubber with an increase rate of 5.81 and 5.39 respectively [13]. As a result of Thailand's robust and well-established manufacturing base, the growth in the rubber market accommodates a wide array of products [13]. Thus, using IS and IT to apply in rubber research for data management is another effort to help Thai farmer for better understanding or decision making on rubber plantation.

4. CONCLUSION

In this paper, we presented an information system supporting research on rubber (ISSR) in Thailand. The system was established at Natural Rubber Innovation Research Institute, Prince of Songkla University, Thailand. The system empowers the rubber staff to explore the knowledge on rubber research by accessing the system via the internet. In addition, the system will assist the staff in Natural Rubber Innovation Research Institute for understanding the past, present and trend of budget for each type rubber research and help the organization for planning on research budget. Moreover, rubber stakeholders can access the rubber information assisting their performance their work in the community, factory or organization. Finally, for increased understanding, when using the graphical format to illustrate data on rubber research, the system provides and assist stakeholders with an appraisal mechanism for government, rubber plantation administrators or famers, and growers in Thailand.

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