

GENERAL FRAMEWORK DESIGN OF INFORMATION MANAGEMENT SYSTEM FOR TENANT INCUBATION

Yusuf Priyandari*, Sinatria Noor Wakhid, Yuniaristanto, Wahyudi Sutopo

Department of Industrial Engineering,
Faculty of Engineering,
Universitas Sebelas Maret
Surakarta, Zip Code 57126, INDONESIA

ABSTRACT

Pusat Inovasi Teknologi Universitas Sebelas Maret (PIT UNS) is a university incubator that organizes technology transfer activity in the Sebelas Maret University, Indonesia. The main goal of PIT UNS is to create technology based start up from UNS research results. However, PIT UNS still face some problems related to incubation process, one of them is tenant selection. There is an internal problem to store incubation's data in a centralized and computerized way. This paper is aimed to discuss a general framework of information management system of incubation's data and document in incubator institution. The study was conducted in PIT UNS and take a best practice from the excellent incubator center, namely the Incubator Technology Center of Assessment and Application of Technology Institution (BIT BPPT). The study starts with a business process analysis stage. Then the data were collected from PIT UNS & BIT BPPT, identification of functional requirements were obtained through analysis of business processes (pre-incubation-post), an architectural design of information management system was proposed to manage the tenant incubation. The results of this study generate nine functional requirements and non-functional requirements that controlled by the four-user group. The system is validated by Focus Group Discussion and pre-implemented by using a case study. Finally, a functional framework information management system tenant incubation (SIM-TS) was proposed.

Keywords: *Architectural design, incubation process, information management system, tenant*

1.0 INTRODUCTION

Law of Republic of Indonesia Number 20 Year 2008 concerning Small and Medium-sized Enterprises (SMEs) mandates the government to improve the business behavior and provide institutional support to businessman [1]. One form of support to increase business behavior is by encouraging SMEs to engage themselves in government's goods and services procurement [2]. Institutional support forms an incubator institution or Business Development Services (BDS) functioning as a business development services and financial consultant between banks and entrepreneurs. BDS is an institution whose function is to provide services such as improvement of business performance, expansion of market access, and improvement of competition ability for new entrepreneurs [3]. Incubator or BDS institutions required by new entrepreneur, because the incubator institution has an incubation process that includes business incubation and technical assistance to help limitations from new entrepreneurs in developing a business and finding new business opportunities [4].

*Corresponding author: priyandari@ft.uns.ac.id

Therefore, new entrepreneurs really need an assistance from incubator institutions for consultation, market access, financing, and several other guidance. The role of the incubator institution has been described in the Presidential Decree of Indonesian Government No. 27 Year 2013, started the process of coaching, mentoring, and development given by the incubator institution to incubation participants or tenants [9]. The incubator will incubate technology innovation, researches product to be matured and prepare it to get into the business world. University incubator gives technology transfer services to academician in the university.

Based on literatures, the incubator has provided some services such as mentoring, network providers, and provider who serves such as work, space resources, competences, finances, and relationships to the tenant's company [6-7]. A business incubator is a program that helps entrepreneurs to start and grow their business by facing various challenges [8]. In addition, the incubator institutions can also provide other Resources, such as network access incubator institutions to legitimacy and knowledge [9]. There are several incubator institutions in Indonesia formed either by the government or private sectors. For instance, there are Technology Incubator Center of Agency Assessment and Application of Technology (BIT BPPT), Technology Business Incubator Association of Indonesia (ADIBI), Entrepreneur Research and Development Center (ERDC), Padjadjaran University Business Incubator, Research and Training Business Economics (P2EB), and Technology Innovation Centre of Sebelas Maret University (PIT UNS). Their objective is to create a new entrepreneur. The incubator institution such as BIT BPPT and PIT UNS focusing their efforts to establish a technology-based startup companies or commonly called as PPBT. According to Ref [11], BIT BPPT and PIT UNS have some distinctions. PIT UNS focuses only on incubating the product of technological innovation from university research to create a University Spin-Off, while BIT BPPT incubating every technological product and also entrepreneurs who meet the requirements, regardless the technology they create or the background of the entrepreneur. Since 2001, the BIT BPPT already has 50 candidates on technology-based startup companies or PPBT, while PIT UNS only has three PPBT candidates or tenant since it was established in 2014 [10-11].

Although BIT BPPT has been running for ten years, it still faces several internal problems. One of the problem is related to the absence of computer applications to store incubation's data in a centralized and computerized way. The computer application which enables the institution to manage incubation's data and documents is urgently needed, because BIT BPPT requires a good transfer of knowledge among its staff in the process of tenant incubation. In addition, BIT-BPPT has become the benchmark of PIT-UNS where in running the incubation process, PIT UNS follows the BIT-BPPT's model. So both of them are commonly facing similar problem. The computer application is made in the hope that it can improve the speed of data and document assessing, and support the institution's decision-making process [12].

Based on internal problems that encountered by BIT BPPT and PIT UNS, it needs a computerized and centralized information management system to manage incubation's data and documentation. The amount of data gathered and information needs is always increasing, the necessary management information system development is gradual. This paper will discuss the general framework of information management system of incubation's data and document management in an incubator institution. The study was conducted at two institutions, BIT-BPPT and PIT UNS. Both institutions are considered as relevant enough to represent the government incubator institution, since BIT BPPT already represents the government-managed incubator institution characteristics, while PIT UNS represents the university-managed incubator institutions. Although the general framework design was conducted by analyzing business processes in both institutions, the general framework is considered to be implemented at each institution incubator in Indonesia.

An effective model of business incubation consists of pre-incubation as a search and selection process of prospective tenants, incubation as the development of business, and post-incubation as network development and monitoring [13], [21-22]. The model is the same as the model of incubation in BIT BPPT and PIT UNS. This paper will discuss a general framework of information management system of incubation’s data and document in incubator institution.

This paper is organized as follows. In section 1.0, the background of the research and problem are described. The methodology is next described in section 2.0 after which the results are presented in section 3.0 and discussion explained in section 4.0. Finally, the conclusion and future research are delivered in section 5.0.

2.0 METHODS

Architecture design stage or general framework of information management system of incubation’s data and document management in an incubator institution presented in Figure 1. Business process analysis stage was conducted at two institutions, BIT-BPPT and PIT-UNS. The business process of both institutions in incubating a business was analyzed in order to get an overview of the incubation process. Although the study was conducted at two institutions in Indonesia, a business process in another incubator institution, even in the world almost same to each other. In addition, an analysis was conducted to find the functional requirements of management information systems needed by both institutions.

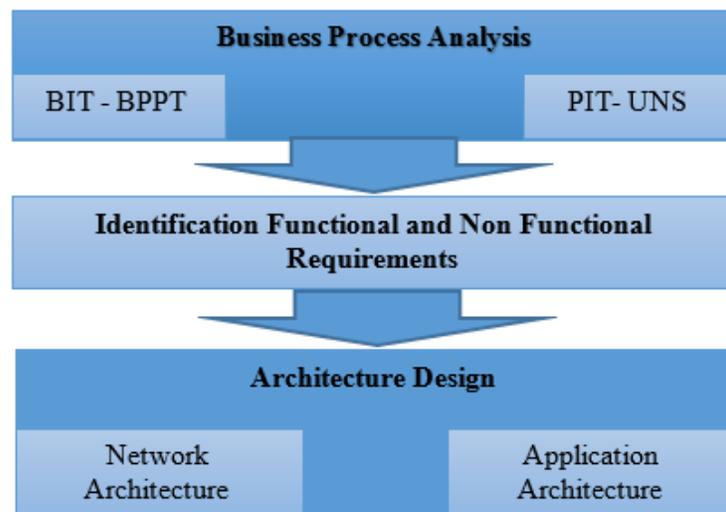


Figure 1: Methodology

Identification of functional requirements was obtained through analysis of business processes. Interviews with stakeholders were also conducted in both institutions. The non-functional requirements were obtained through literature study related to a non-functional needs of information management system. The third stage is the design of the general framework. General framework constructed by designing a functional framework, systems view and the technology view [14]. System view was illustrated by application architecture and technology view will be illustrated by network architecture. This framework was based on the physical design of information systems.

3.0 RESULTS

3.1 Organizational Structure of BIT BPPT and PIT UNS

Figure 2 shows BIT BPPT organizational structure consisting of the Head of Central and Subdivision of Administration, Facilitation and Advocacy Section, and Cooperation and Marketing Section, and other functional Positions. Figure 3 displays the PIT UNS organizational structure consisting of the Director, Secretariat, and there are four (4) divisions, namely Innovative Business Incubation Division (IBI), Division of Human Resources Development (PSDM), Financing Facilitation Division, Network Development Division and Technopreneurship. Each part in the BIT-BPPT and PIT-UNS have a distinct role in the process of incubation [10-11].

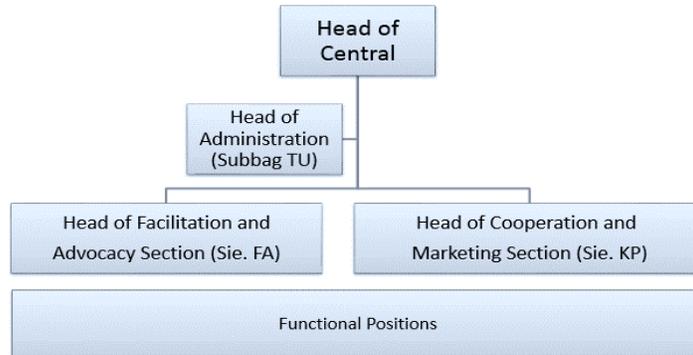


Figure 2: Organizational structure of BIT BPPT

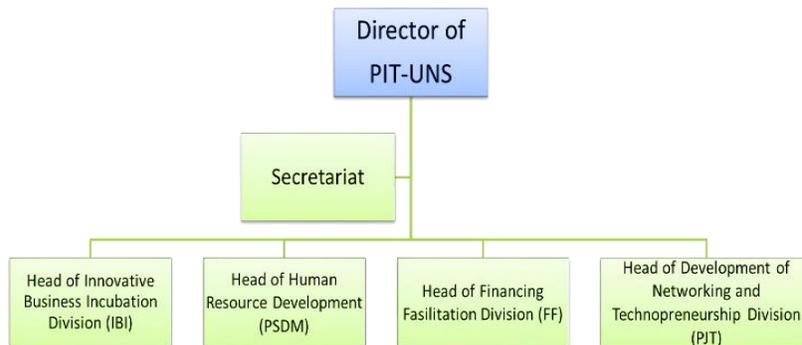


Figure 3: Organizational structure of PIT-UNS

3.2 Business Process Incubation BIT BPPT and PIT UNS

Incubation activities conducted by BIT BPPT and PIT UNS consist of three phases as shown in Figures 4 and 5. The three stages are: (1) pre-incubation, (2) incubation, and (3) post-incubation. The pre-incubation stage has a main activity that talent scouting and partnerships, incubation stage have major activities is the transfer of technology and business, and the stage of post-incubation has major activities namely the accessibility of mass production [10-11].

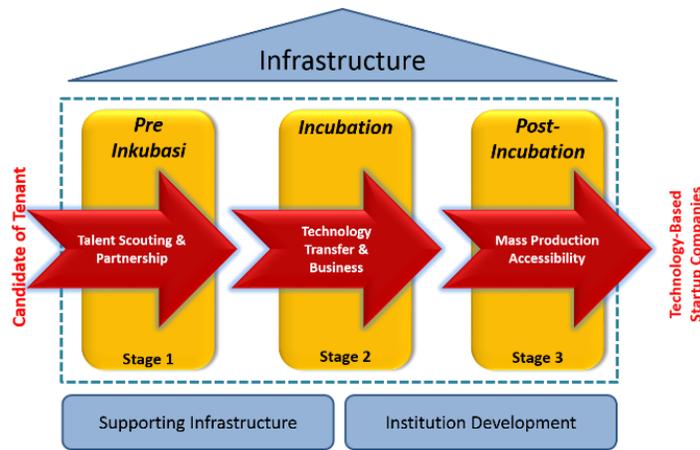


Figure 4: Incubation stage of BIT-BPPT

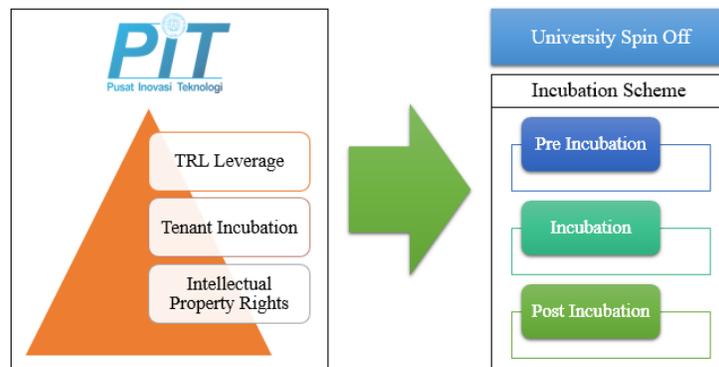


Figure 5: Incubation stage of PIT UNS

Based on the analysis of incubator institution's business processes, can be designed the overall business process of tenant incubation. The results are also able to provide the requirements that should be supported by the general framework of information management system tenant incubation. Business process flow results are shown in Figures 6 to 8. The incubation process begins with a business idea that will be captured through publication activities and road shows, the technopreneur camp, and CRO (Customer Relation Office). The activities will be controlled through the talent scouting system. Then the data from each of these activities will be recorded. These data is data for tenant and product/inventor. Then the data will go through the selection process. In some cases, there are other roads or shortcuts so-called fast track both product technology and tenants who came from Academician, Business, and Government, but between product technology and tenant must both be inter related.

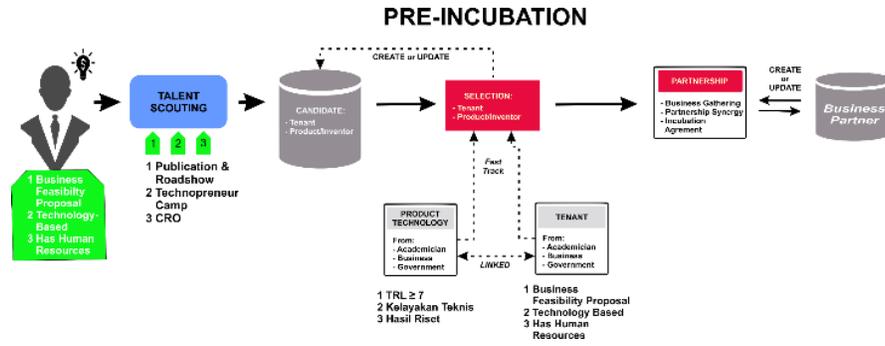


Figure 6: Pre-incubation stage of overall business process

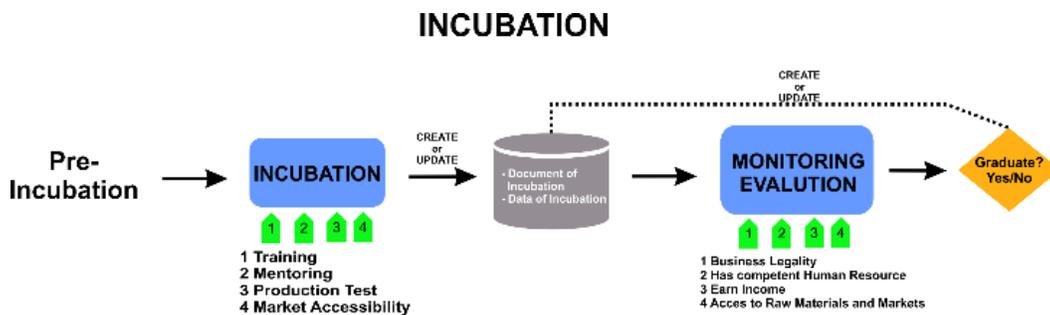


Figure 7: Incubation stage of overall business process

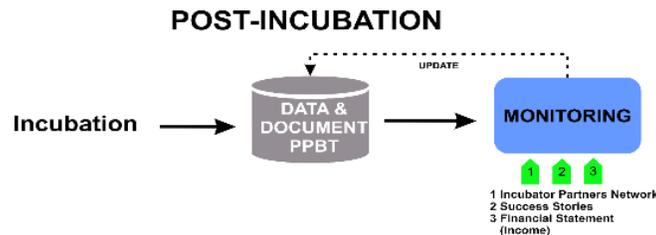


Figure 8: Post-incubation stage of overall business process

The next process is to find a business partner through a partnership consisting of, business meeting, partnerships synergy, and agreements of incubation. Once the activity carried out, there is a system that will store the data in the database. Then the next process is incubation process. Tenants who have passed through partnership activities will go through the incubation process consisting of training, mentoring, production test, and market access. The system will regulate the process of exit and entry of data and documents in the process of incubation. After incubation process, tenants will go through the process of monitoring and evaluation to whether the tenant will be passed or not for the technology-based startup companies (PPBT). Tenant passed if it meets several requirements, namely, to have the legality of the business, have a competent human resources, earn income, and have access to raw materials and markets. If the tenant meets the criteria for graduation incubation, the tenant will be passed into PPBT. After that, the system will store data of tenants who passed.

The tenant who has become PPBT will continue to be monitored to know the progress of the company's that includes an incubator partner network, success stories, and the financial statements (income) and will be stored on a database of information management system tenant incubation.

3.3 Identification of Functional Requirements

Identification of requirement is a process to determine the difference or gap between the supposed or expected conditions to existing conditions. An application of information management system has two different types of functions, namely functional requirements and non-functional requirement in charge of achieving target systems that have been identified at this stage of the analysis of the problem to the outline system requirements to achieve the goal of system development [15]. Before identifying of functional requirement, will be identified subsystems in the process of incubation. The identification results obtained from the results of the analysis of business processes and interview by asking some questions about needs and what kind of information obtained in the process of incubation tenant to the staff at each institution. Two of these subsystems are the Information Management Subsystem of Talent Scouting (SIM-TS) and Information Management Subsystem of Incubation Data (SIM-DI). SIM-TS is a subsystem that manages data about talent scouting. These data include data of Technocamp, Publications and Roadshow, and CRO (Customer Relation Office). SIM-DI is a subsystem that manages the data during the incubation process. These data include data tenants during the selection process, Incubation (Test Production, Mentoring, and Training), Monitoring and Evaluation, Data Partner, and Monitoring of Post-Incubation.

Functional requirements has the purpose of providing a platform to collect, store, and share data in large networks to the user. To obtain this objective, it can be done with three requirements [16]. Requirements consist of data management to collect data from the form, validate the data, and development of the database to store the collected data, the data sharing for dividing the data to the user in a large network, and development of online portal data to publish information and data that can accessed by the user. Based on identification of functional requirement, there are nine functional requirements in information management systems tenant incubation. Functional requirements are the functional requirements of an information management system that is directly related to the business processes of the system. While non-functional requirements is a function of the needs associated with the application to be designed [17]. A list of functional requirements identification is shown in Table 1. Identification of non-functional requirements can be based on an analysis framework of programming and business process analysis [18]. In the non-functional requirements will be used framework PIECES. The PIECES is a tool to characterize the requirements of a system consisting of Performance, Information, Economy, Control, Efficiency, and Services [19]. Results of the identification of non-functional requirements of information management system tenant can be seen in Table 2.

Table 1: Functional requirements list

No	<i>Functional Requirement</i>	Subsystem
1	Data management of tenant	Incubation Data
2	Documents management of tenant	Incubation Data
3	Data management of Partnership	Incubation Data
4	Record activities during incubation process	Incubation Data
5	Provide Data Summary of Incubation Process	Incubation Data
6	Data management of Publication	Talent scouting
7	Data management of CRO	Talent scouting
8	Data management of Account	Talent scouting
9	Data management of Account	Talent scouting

Table 2: Non-functional requirements list

No	Framework	Non Functional Requirement	Notes
1	Performance	Attractive appearance and easy to develop Support pagination Printer friendly script Data filter feature	HTML and javascript Divide the data into multiple pages Controller Report Reduce coding when generates the data
2	Information	Data storage and validation	Create, read., update, and delete (CRUD)
3	Economy	Decrease operational Cost for transfer information and documents	Hard file changes to soft -files
4	Control	User Group	(Super-admin, admin SIM-TS and admin SIM-DI, staff, tenant)
5	Efficiency	Centralized and computerized storage	Data server and document server
6	Services	Can be accessed anywhere and anytime	Web Based, Online (24 hours per day in 7 days)

3.4 General Framework Design

Design of general framework includes use-case diagrams, application architecture, and network architecture. The use-case diagram is a diagram that illustrates the role of each entity in the system. These roles are grouped into four user groups consisting of User Group 1 (Superadmin), User Group 2 (Admin TS and Admin DI), User Group 3 (Staff), and User Group 4 (tenant). The role of each user will be described with functional framework that have been defined in Table 1. Then the roles will be denoted by the symbol Create (C), Read (R), update (U), and Delete (D). Functional framework illustrated in Figures 9 and 10.

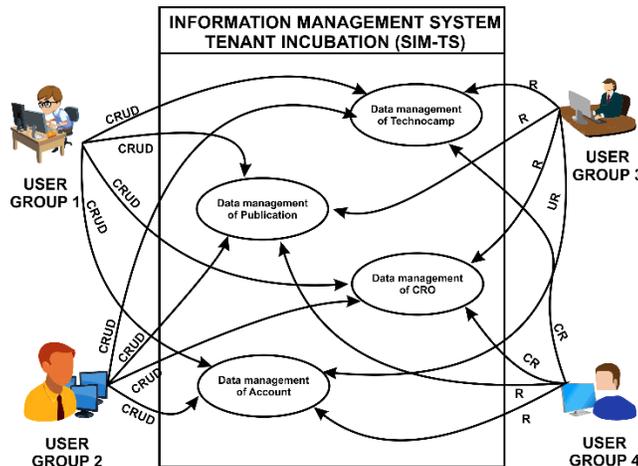


Figure 9: Functional framework information management system tenant incubation (SIM-TS)

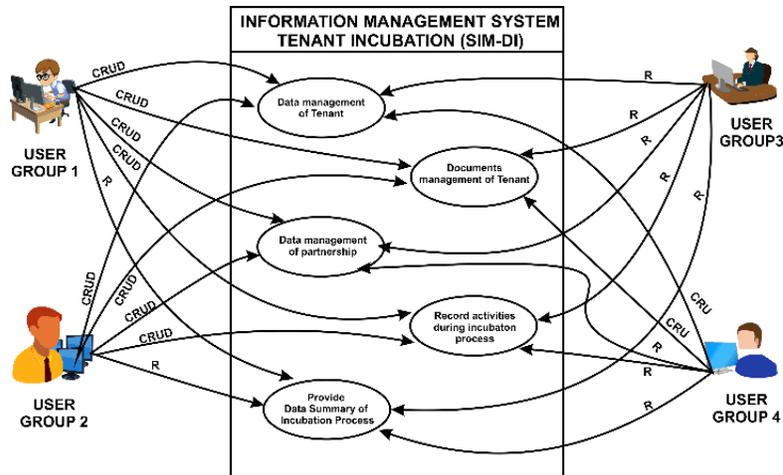


Figure 10: Functional framework information management system tenant incubation (SIM-DI)

The architecture of a system is the description of the tools to be used in carrying out the functions in a system that will be used by the user [20]. Both architectures are illustrated in Figures 11 and 12.

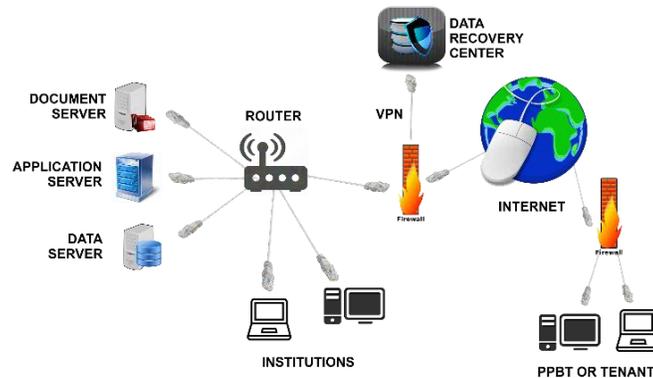


Figure 11: Network architecture of information management system tenant incubation

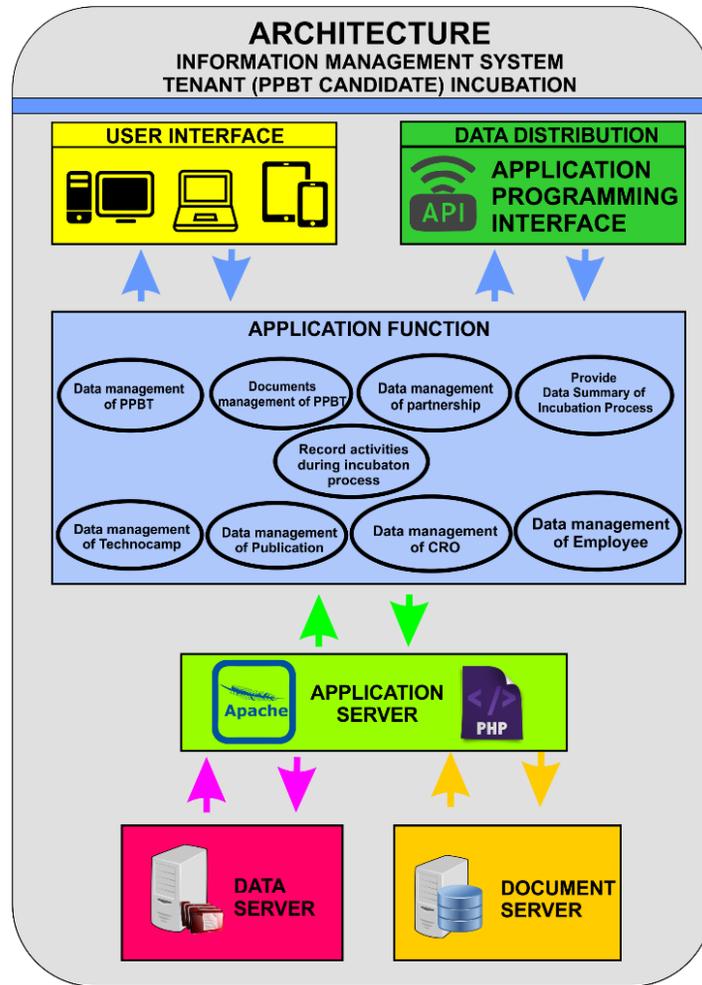


Figure 12: Application architecture of information management system tenant incubation

4.0 DISCUSSION

Figure 11 illustrates the network architecture of Information Management System tenant Incubation. The figure shows how tenants and agencies can access the application server. There are two types of database servers, data server and server document to be ruled by the application server. Data server is a server database that stores data tenant, while the server document is a database server that stores the documents relating to the tenant. Institutions and tenants can access the application server with an internet connection, but the institutions may access the server through a router. The application server will run for 24 hours per day in seven days. If a server fails, the server will be automatically backed up by Data Recovery Center via private network or VPN.

Figure 12 illustrates the application architecture Information Management System tenant Incubation. The figure shows the user can access the application on any gadget, such as PC, notebook, smartphone, and PC tablet. Users will have access privileges to perform the functions according to the user group of the application that is connected to the application server and database server. On the application server, this paper proposes to build the application server with programming languages like PHP. For example, the King of PHP framework is CodeIgniter (CI) Framework. Using PHP to build application server, can support to use MySQL database as the document database servers and data servers.

5.0 CONCLUSION

As a new incubator, PIT UNS need to develop their incubation system. This paper proposed a general framework design of information management system tenant incubation as the basis for the physical design of the application system. The results of this study generate nine (9) functional requirements and non-functional requirements that controlled by the four-user group. The role of the controlling functional requirements described by the functional framework and also produced an application architecture and network architecture of Information Management System Tenant Incubation. In future research, the physical design of information management systems, tenant incubation can be carried out sequentially from each stage of incubation. Then the general framework can be used as a basis of the physical design of information management system tenant incubation.

REFERENCES

1. Republic of Indonesia. 2008. *Law of Republic of Indonesia Number 20 Year 2008 about Small and Medium-sized Enterprises (SMEs)*. Government Secretary. Jakarta.
2. Republic of Indonesia. 2008. *Presidential Decree of Republic of Indonesia Number 54 Year 2010 about Procurement of Government's Goods and Services*. Government Secretary. Jakarta.
3. Priyono, Suci, Rahayu Puji, and Mahargiono, Pontjo Bambang. 2013. Analysis Program Business Development Services (BDS) and Expansion of Network Performance Management Product Market For Small and Medium Enterprises (UKM) In The Region Gerbangkertosusila. *European Scientific Journal*, 9(31), 185-199.
4. Scilitoe, Joanne L. and Chakrabati, Alok K. 2010. The Role of Incubator Interactions in Assisting New Ventures. *Technovation*, 30 (2010), 155–167.
5. Republic of Indonesia. 2008. *Presidential Decree of Republic of Indonesia Number 27 Year 2013 about Procurement of Government's Goods and Services*. Government Secretary. Jakarta.
6. Aaboen, Lise. 2009. Explaining Incubators Using Firm Analogy. *Technovation*, 657-670.
7. Pauwels, Charlotte, Clarysse, Bart, Wright, Mike, and Hove, Jonas Van. 2015. Understanding a New Generation Incubation Model: The Accelerator. *Technovation*.
8. Tengeh, Robertson K. and Choto, Prominent. 2015. The Relevance and Challenges Of Business Incubators That Support Survivalist Entrepreneurs. *Investment Management and Financial Innovations*, 12(2), 150-161.
9. Rothaermel, Frank T. and Thursby, Marie. 2005. University-Incubator Firm Knowledge Flows: Assessing Their Impact on Incubator Firm Performance. *Research Policy*, 34, 305-320.
10. Hamdani. 2013. *Business Process Technology Incubator: First Edition*. BPPT. Tangerang.
11. Kusuma, Citra, Sutopo, Wahyudi, Yuniaristanto, Hadiyono, Suryo, and Nizam, Muhammad. 2014. Incubation Scheme of the University Spin Off to Commercialize the Invention in Sebelas Maret University, *Lecture Notes in Engineering and Computer Science*, 2, 841-844.

12. Pardamean, Bens, Anindito, Djoeng, Anjela, and Tobing, Nana. 2013. Disease Management Information System, *American Journal of Applied Sciences*, 10 (7), 724-733.
13. Hasbullah. 2014. Mentoring Model for Food Sector of SMEs through Business Incubator of University. *Jurnal Ilmu Pertanian Indonesia (JIPI)*, 19(1), 43-49.
14. Lu, Wenhai, Liu, Shuming, Yang, Yi, Ruiquan, Fu, Xiang, Xianquan, Yanmin, Qu, and Huang Haiyan. 2015. Design for the Emergency Command Information System Architecture of Ocean Oil Spill. *Aquatic Procedia 3 of International Oil Spill Response Technical Seminar*, 41- 49.
15. Yahya, Bernardo Nugroho. 2001. Manufacturing Information Systems in Information Management System Framework. *Jurnal Teknik Industri*, 3(2), 80–86.
16. Whitten. 2004. *Design and Analysis Methods*, Ed. 6. Andi: Yogyakarta.
17. Iwanaga, Takuya, Sawah, Sondoss El, and Jakeman, Anthony. 2013. Design and Implementation of a Web-Based Groundwater Data Management System. *Mathematics and Computers in Simulation*, 93, 164–174.
18. Andri, Arifin, and Wilson. 2013. Framework Design of WiPHP Web Application. *Seminar Nasional Sistem Informasi Indonesia*.
19. Jogiyanto. 2004. *Analysis and Design of Information Systems: Structured Approach Theory and Practice of Business Applications*. Andi: Yogyakarta.
20. Lubis, Yeni Khilmi Khairani. 2010. Development of Information Management System in Pondok Pesantren using Object-Oriented Modeling Method. *Thesis Strata-I*, Program Studi Sistem Informasi, Fakultas Sains dan Teknologi, UIN Syarif Hidayatullah, Jakarta.
21. Sutopo, W., Wicaksana, D.E.P., Nizam, M. 2015. Putting a technology innovation culture to realize Indonesian vision 2025: A case study. *Lecture Notes in Engineering and Computer Science*, 2, 848-853.
22. Yuniaristanto, Wicaksana, D.E.P., Sutopo, W., Nizam, M. 2014. Proposed business process technology commercialization: A case study of electric car technology incubation. *Proceedings of 2014 International Conference on Electrical Engineering and Computer Science, ICEECS 2014*, 7045257, 254-259.