A Taxonomy of Enterprise Architecture Framework for Indonesian SMEs

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Abstract

Indonesian Government commits to increase Information and Communication Technology (ICT) adoption in SMEs by providing computer training ranging from basic up to advance, but the level of adoption in SMEs is still low. Enterprise Architecture (EA) is an approach not only to improve adoption but also to align between business and Information Technology (IT). The paper proposed the taxonomy of the EA framework for Indonesian Small and Medium Enterprises (SMEs). This study employs desk research exploring 4 key concepts of EA framework i.e. stakeholders, principles, views and model.

Keywords: *Small and Medium Enterprises, Enterprise Architecture Framework, Business and IT allignment, Indonesia*

1. Introduction

Indonesian SMEs have a key role as a major provider of employment in rural and a major source for low-income households [25]. Indonesian government and other institutions provide relevant nationwide programs including information providing and Information Technology (IT) training to strengthen SMEs and enhance their competitive advantage [28] [25] [1]. Yet researches proved that Information and Communication Technology (ICT) adoption in Indonesian SMEs generally are still low [19] [2] [9].

IT issues in an organization should be resolved at the enterprise level. It means that IT is a business issues not an IT issues [18]. The idea was born since J.A Zachman conveyed the concept of Enterprise Architecture (EA) in 1987 [32]. EA is a tool/method/an instrument to align business and IT.

The main purpose of this paper is to create taxonomy of EA framework (EAF) for Indonesian SMEs. The taxonomy is created based on the key concepts of EA i.e. stakeholders, principles, elements and models using desk references method.

Some studies regarding EA in various Indonesian institutions have been conducted. However very little work for EA in SMEs was done. The concept of EA was born out of large industries experience so there is understanding only large companies require EA. However a company needs to be agile to face changes on their environment and if EA is seen as a strategy to survive and even increase business value so all sizes of companies including small and medium industries (SMEs) will need it [5].

2. The characteristics and the benefit of EA for Indonesia SMEs

The following are the general constraints of Indonesian SMEs:
-   Manpower
    SMEs in Indonesia commonly self-employment without hired paid workers [25]. They lack knowledge and do not have the necessary skills [26] [7]. The owner handles all tasks from purchasing, production processing up to marketing.
-   Production and Technology
    SMEs in Indonesia adopted simple production process [7] [23] [26]. They more like to adopt the simple technology and the equipment readily available [15]. They have limitations on product innovation capability, access to technology, modern production processes and procurement of a certain quality of raw materials [7] [23] [13] [25].
-   Marketing
    Indonesian SMEs difficult to expand market share especially export [7] [29].
-   Information and ICT
    Some clusters do not know yet the usefulness of Internet, even are fear of learning new

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technologies [2]. Most SMEs that already adopt ICT use the technology just for administration tasks [19]. They are difficult to get relevant information [30] [32] [7].

- Organization
  Their organization and management is simple [19]. Most SMEs especially small enterprises (SE) are self-employed in the non-formal sector of the economy.
- Networking
  Indonesia SMEs commonly has networking with their local government, collectors and local traders [32] [27] [31]. Some have partnership with a non-governments organization (NGO) that support particularly in marketing and production process [10] [31]. Some institutions such as banking and information center also provide facilities for SMEs [31] [25]. However they have difficulties in connecting all the facilities and assistances for business development.
- Financial
  They are difficult to get funds for business development [7] [23] [27] [29].
- Socio-culture
  There are socio-cultural obstacles in the adoption of technologies including ICT.
- Policy
  Some government policies are not pro SMEs, for instant costly bureaucratic procedures.

Nevertheless some Indonesian SMEs have gradually become export-oriented. Initially they sold their products to foreign tourists. Based on the experience, they started to export in small amounts [27]. Meanwhile a bamboo handicraft craftsman group in province of Bali initially had networking with middlemen that proposed their products to a vendor that has network to a trading house. After that the group got order to meet the market in Europe. SMEs in Indonesia survive and even grow by supplying consumption goods for local markets consumed by low-income households [25]. They compete with larger companies by differentiating products that have own market niche [25]. SMEs in several countries in East and Southeast Asia such as South Korea, Taiwan, Hong Kong, and Singapore directly contributed to trade and they adopted export-oriented strategies. It indicates that SMEs can compete effectively in both domestic and international [27][25]. SMEs have to adopt certain strategies to face the changes of business environment and also in order to survive and grow.

The benefits of EA in regards to the challenges faced by Indonesian SMEs are especially as an instrument

to improve IT adoption, IT development and business and IT alignment and to accommodate concerns of and shared understanding among stakeholders regarding existing situation and business development.

3. The concept of EA

A company who wants adopting EAF can choose an existing EAF or create a specific new one. Choosing or creating is just as difficult [4]. Based on the survey, the companies that develop their own framework are the second largest [20]. Following are key concepts in developing an EAF [17]:

Stakeholders
The definition of stakeholders is individual, team and organization with interest in or concern relative to a system [17]. Stakeholder's concerns and communication among them are important on EA development. Some researchers develop EA modeling by first determining the stakeholders involved [4][11] [17] [16]. Current and desired situation, potential impact of the new system and social, cultural, educational and professional background will influence stakeholder's concerns [37].

Principles
Principles are firm foundation for making architecture and planning decision. It is fundamental perspectives and practices believed to be valuable for the organization [30], which is founded in the beliefs and values of the organization and expressed in language that business understands and uses [TOGAF in 17]. Principles also are translated as a target vision that put stakeholders on the same boat [4]. Principles might be called operating models, which involves a commitment to how the company will operate [18].

Elements
They represent a whole system, which contains a related comprehensive set of stakeholder's perspectives. A set of views will enable the architecture to be communicated to and understood by all stakeholders and enable them to verify that the system will address their concerns [30].

Most existing frameworks contain following four basic domains: (1) business architecture (2) information architecture (3) application system architecture (4) technology architecture [30]. According to industry practitioners the most critical and difficult to be implemented is the business architecture [30]. Based on Gartner EA connects

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three stakeholders: business owners, information specialists, and the technology implementers [21]. It means EA consists of business, information and technology. Similarly, the concept of EA by Ross et al consists of the business, data and technology [18].

Some existing framework are completed by (1) Architectural maturity which could be a directions of the enterprise in increasing EAF adoption or indicating the position of enterprises after implementing architecture (2) Architectural Process which provide applying process such as TOGAF and FEA (3) Architectural usage – a framework to measure the effectiveness of the usage of architecture (4) Architectural Result - a framework to measure the benefits realized by the use of the architecture (5) Maintenance module – the function of module is to monitor business and technology changes that might relevant and updating the EA [17].

Model
Model aims to depict the abstraction of reality [17], which is consisted of individual components, their relationship and focus [14]. Model including design rules and modeling procedure, process and technique are an important part of a framework for developing, structuring, defining languages and describing. Modeling techniques commonly used are entity relationship (ER) and UML (class diagram, use case) [14]. Meanwhile most models are graphic, however it does not necessary have to be graphic [17].

4. The key concepts of EAF for SMEs in Indonesia

This paper proposes taxonomy of EAF based on the common characters of Indonesian SMEs. This session focuses on core concepts of EA i.e. stakeholders, principles, views and model of Indonesian SMEs.

Stakeholders and their concerns
Organizations that have interests, activities, operations and any other aspects that aim to develop Indonesian SMEs are categorized as stakeholders. The list of stakeholders that provide program and facilities aiming for SMEs development are following:

- Government institutions both local and national are the most common institutions introducing new technology and providing training [25] and business information [1] [31]. The paper

identifies telecenters[1] under some Ministries coordination such as the Ministry of Communication and Informatics (*Kemkominfo*) and the Ministry of Research and Technology (*Ristek*) as stakeholders who providing IT equipments, business information, Internet access, community empowerment and IT training [1]. Meanwhile Center for Scientific Documentation and Information - Indonesian Institute of Sciences (PDII LIPI)[2] is one of government institutions providing information especially in the field of appropriate technology for rural [1] [31].

- Non-Governmental Organizations (NGOs) commonly provide capital assistance and training [25] [30] and good production processing technique and marketing channels assistance [6].
- Other enterprises (Exporter, Trading House, Distributor) are stakeholders for SMEs providing information and marketing channel as well [8] [25] [6].
- Banks and other financial Institutions are agency to provide capital assistance [25].
- International agencies are also a stakeholder for SMEs providing capital assistance for SMEs through NGOs [6].

However there is no communication among the stakeholders in providing assistance [22]. Even each

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[1] There are kinds of telecenter in Indonesia: (1) Information Technology Kiosk (Warintek) sponsored by The Ministry of Research and Technology (*Ristek*). (2) Partnership for e-Prosperity for the Poor (Pe-PP) sponsored by United Nations Development Program (UNDP) & the National Development Planning Agency (Bappenas) (3) ICT Center sponsored by Directorate of Vocational Secondary Education (*Dikmenjur*), Directorate General of Primary and Secondary Education, Ministry of National Education (4) CTLC (Community Training and Learning Center) sponsored by Microsoft Indonesia and various national NGOs [1].

[2] PDII LIPI is a government institution leading in information services for rural community including SMEs. In 1999 PDII LIPI developed information technology kiosk (Warintek), which is an extension of PDII LIPI to provide information services for rural community. Now Warintek is known as under *Ristek* coordination. Based on the evaluation of World Bank, Warintek was the best telecenter in the aspect of content. PDII LIPI continue to provide information services for rural communities. The institution also conducts research to develop the information packages and appropriate information channel for community in rural.

agency attempted to reach targets and objectives in accordance with the criteria they have set themselves [13]. Ego sectoral especially in local government is still strong in Indonesia [34]. Furthermore the local and national agencies stakeholders generally do top down, so that the program/facility to the public was made not based on local initiatives but the intervention of the experts [1]. Figure 1 below depicts the stakeholders who give assistance for SMEs.
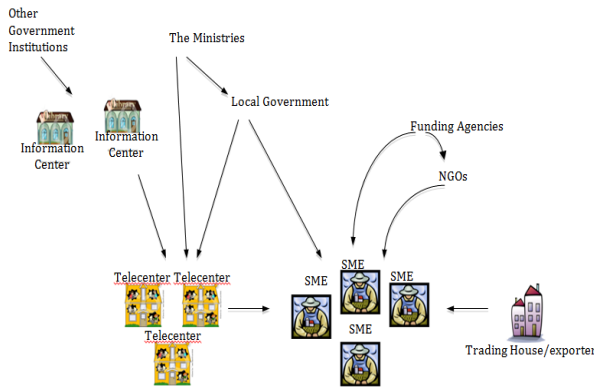

Fig. 1 The stakeholders on Indonesian SMEs

Principles

This paper begins with the problem on IT adoption of Indonesian SMEs. It is to be a firm foundation in creating EAF should focus on strategic organizational process that attempting to establish the linkages between IT and all business process in SMEs.

Commitment and continuous supports from all stakeholders are needed by SMEs. Since there is no communication among the stakeholders that supports will not be optimal because of duplication, does not solve the problem or not needed by SMEs. So the paper proposes EA development for Indonesian SMEs must accommodate and align all available supports/programs from the stakeholders.

Some papers reported there is a variation in level of using ICT in SMEs [19][38]. Meanwhile the duration of experience in the business affect SMEs in adopting the technology [15]. Based on those reports SMEs need the stages of transformation. Therefore the principle of EA for SMEs is an instrument to support system transformation.

Elements

Kind of programs and facilities provided by stakeholders show their concern toward SMEs Indonesia, which indicates as elements needed by SMEs.

- Business elements

Some stakeholders provide business assistance for Indonesian SMEs such as manufacturing technology, product design development, good manufacturing process etc. A majority of the SMEs did claim that their business had improved because of stakeholder's assistance programs [25]. It means the view of business is important for the framework. The concerns of the stakeholders on this element include quality of raw materials improvement and good manufacturing process [10] [3].

- Information elements

Some stakeholders provide information on business for SMEs such as appropriate technology, new technology, market data, finance, good manufacturing product, etc [31] [1] [32] [25]. The benefits of Information elements in the framework for SMEs are the availability of relevant information to solve problems in business such as acquisition, product development, production, marketing, technology and finance.

- IT elements

IT is one of concerns of Indonesian SMEs stakeholders [1] [22]. Hardware, applications and middleware/databases are facilities provided by the stakeholders [1]. IT systems have values on the effectiveness of IT planning and IT roadmaps, planning skills and training [17], finding information, communicating with distributor etc.

Furthermore it would be useful to complete the framework by following features:

- Architecture Process and Architectural Maturity

Relating to the use of the framework, it is important to provide guidance to address how to manage the elements and how to use the whole framework, so that the paper proposed the process methodology in using the architecture.

Some existing frameworks are completed by architectural maturity to measure which stage of the enterprises on before and after implementing architecture. To support the principle of EA as an instrument for system transformation the paper also propose the feature to measure the maturity of EAF adoption (Architectural Maturity).

- Architectural Result and Maintenance module

The programs organized by the government to support SMEs are often marred by the unavailability of effective tools for evaluation and assessment [24] [12]. The framework requires a system to assess the effectiveness. So the paper also proposes the feature

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of architectural result to assess the effectiveness of the framework. Meanwhile maintenance module is important as a good architecture to avoid obsolescence.

Model

The paper does not propose a particular model of architecture for SMEs Indonesia. This is a preliminary study of a series of activities to provide a conceptual model of the EAF for SMEs, the paper has an idea in using simple model such as pictures and graphs.

5. Proposed Model of EAF for SMEs in Indonesia

Based on the description aforesaid the stakeholders have concern on business, IT and information development on Indonesian SMEs. So the paper proposes 3 elements i.e. business elements, IT elements and information elements on the EAF for Indonesian SMEs. Figure 2 shows the proposed model of EAF for SMEs in Indonesia.
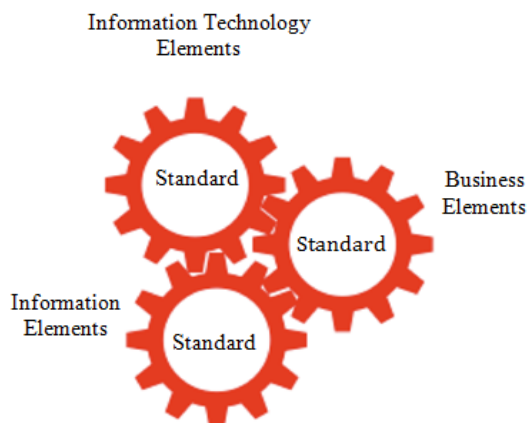

Fig. 2 Proposed model of EAF for SMEs

The interlocking gears indicate the concept of EA unite all elements in one vision to increase business value in SMEs. Three gears show that the stakeholders concern on three elements to encourage business value in SMEs. Each gear has own standard. The aims of standard are to provide a uniform shape. Standards also include rules might be made guidelines and best practices.

The elements of EAF for Indonesian SMEs are identical with the concept of Gartner and Ross, which EA consists of business, information and technology. However the thing important for Indonesian SMEs context is who will develop and manage those

elements. The stakeholders, who assisting the SMEs have different concern. This paper proposes the relevant stakeholders to manage certain elements. Some stakeholders may manage IT elements and information elements, whilst the owners themselves manage the business elements. Standards will make the element that is managed by multiple stakeholders to be uniform. The scenario of the proposed model is following:

- The owner manages their own business elements assisted by the local government and/or the NGOs. Commonly the NGOs get grant from International agencies to assist SMEs. Meanwhile local funding agencies provide direct loans for SMEs. Local governments commonly obtain funding from national government sourced from national income and expenditure budget or allocate their local income and expenditure budget to support SMEs.

- IT elements deal with infrastructure (computer, operating systems, servers, storage etc), databases, Information, and Internet access. Telecenter is an organization that provides IT infrastructure at sub districts. Telecenters are scattered especially in Java Island. Telecenters are one of appropriate stakeholders to manage IT elements to support business elements in SMEs. Besides the ministries, some local governments also coordinate their own telecenters. They establish telecenters in the district who do not have it.

- Information elements describe the structure of logical and physical relevant data assets needed by user. They also deal with data management, Information system and appropriate information packaging. Information centers for instance PDII LIPI are appropriate stakeholder to manage the elements. Commonly each information center specializes on a certain kind of information. The institutions that manage information elements also might provide information to fulfill the needs of other stakeholders. SMEs that have more matured in IT can request information directly to the information center. Figure 3 depicts the relationship between the stakeholders and the elements.

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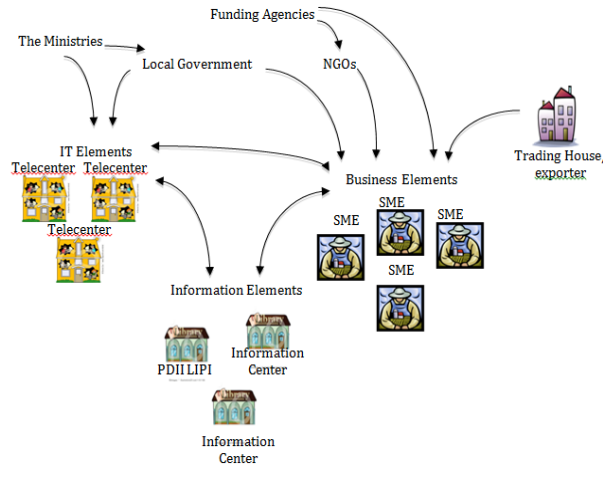ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784
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Fig. 3 The relationship between the stakeholders and the elements

6. The Conclusion

Stakeholders concern and their perspectives are important in creating EAF. The paper identified 5 kinds of stakeholder in Indonesian SME i.e. government, non-government organizations, bigger enterprises, funding agencies and International agencies.

The major principles that guide the application of the framework include the following: (1) Accommodate all stakeholders concern (2) Improve IT adoption and Align to business (3) Support system transformation.

Based on the reference desk the stakeholders concern on program/services to improve business, IT and Information aspects, so that the taxonomy of the framework consists of 3 elements viz. business, IT and Information. The paper also proposes 4 features to shape a good framework. Those features are Process, Maturity, Maintenance and Assessment.

The scenario to run the proposed model is the owner manages business elements assisted by the stakeholders. Meanwhile telecenters are one of appropriate stakeholders to manage IT elements and information centers for instance PDII LIPI are appropriate stakeholder to manage information elements. Standard on each element is useful for making uniform although managed by the different stakeholder. In future standards development is needed so that the EAF can be implemented.

References

[1] Anonym. 2005. Information and Communication Technologies for Rural Development: An Evaluation of Telecenters in Indonesia. The World Bank East Asia and Pacific Region Rural Development and Natural Resources Sector

[2] Anonim. 2006. Homeworkers and ICTs: Indonesia. The Asean Foundation, Final Report, Draft.

[3] Anonim. 2003. DRAFT: Monitoring Perkembangan Usaha Nanga Leboyan di Sungai Leboyan Danau Sentarum. Agustus 2003

[4] Armour, Frank J; Kaisler, Stephen H; Liu, Simon Y. 1999a. Building an Enterprise Architecture Step by Step. Architecture July/August 1999

[5] Avram, Abel 2009. Is Enterprise Architecture Suitable for Small Business? http://www.infoq.com/news/2009/09/EA-for-Small-Businesses. Accessed date [11/3/13]

[6] Caturini, Rizki. 2010. Social Entrepreneur Valentinus Heri: Valentinus Heri, selamatkan hutan sambil berbisnis madu. http://peluangusaha.kontan.co.id/news/valentinus-heri-selamatkan-hutan-sambil-berbisnis-madu-1 Accessed date [10/03/13]

[7] Hamid, Edy Suandi dan Susilo, Y. Sri. 2011. Strategi Pengembangan Usaha Mikro Kecil Dan Menengah Di Provinsi Daerah Istimewa Yogyakarta. Jurnal Ekonomi Pembangunan 12 (1), 45-55

[8] Hamzah, Hamir. 2011. Pemasaran Kerelasian Pelanggan dan Kolaborasi Pemasok dalam Rangka Meningkatkan Sumber Daya Perusahaan serta Implikasinya Terhadap Keunggulan Bersaing dan Kinerja Pemasaran (Suatu Survei Pada UKM Komponen Otomotif Logam Di Pulau Jawa). Dissertasi. UNPAD. http://repository.unpad.ac.id/handle/123456789/2703?show=full Accessed date [12/01/12]

[9] Hidayat, Dudi; Rianto, Yan; Hutabarat, Lambue; Halomoan, UB; Fatony, Achmad; Surya, Tri; Pariyaman, Pariyo; Prasetyas, Vetty Rina; Aguslim. 2003. Studi Adopsi TIK oleh IKM dalai Proyek TATP: Faktor-faktor yang berpengaruh terhadap keberhasilan adopsi TIK oleh IKM. PAPPIPTEK LIPI, Jakarta

[10] Irawan, Thomas. 2007. Lessons learned in getting organic certification. Madhu Duniya 13.

[11] Källgren, Adrian; Ullberg, Johan and Johnson. Pontus. 2009. A Method for Constructing a Company Specific Enterprise Architecture Model Framework.

IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 2, No 2, March 2013
ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784
www.IJCSI.org

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2009 10th ACIS International Conference on Software Engineering, Artificial Intelligences, Networking and Parallel/Distributed Computing.

[12] Karimi, Atefeh dan Noori, Ali. 2011. Software Engineering And Enterprise Architecture: A Comparison Study. International Journal of Academic Research 3 (2)

[13] Kuncoro, Mudrajad. 2000. Usaha Kecil di Indonesia: Profil, Masalah Dan Strategi Pemberdayaan. Studium Generale dengan topik "Strategi Pemberdayaan Usaha Kecil di Indonesia", di STIE Kerja Sama, Yogyakarta, 18 Nopember 2000.

[14] Leist, Susanne and Zellner, Gregor. 2006. Evaluation of Current Architecture Frameworks. SAC. Dijon, France

[15] Mizar, M. Alfian; Mawardi, Muchjidin; Maksum, Mochamad and Rahardjo, Budi. 2008. Tipologi dan Karakteristik Adopsi Teknologi Pada Industri Kecil Pengolah Hasil PertanianProsiding Seminar Nasional Teknik Pertanian. Jurusan Teknik Pertanian. Fakultas Teknologi Pertanian. UGM, Yogyakarta.

[16] Morganwalp, Jillian M. 2002. A system of system focused Enterprise architecture framework. Dissertation. George Mason University, Fairfax.

[17] Land, Martin Op't; Proper, Erik; Waage, Maarten; Clo, Jeroen and Claudia, Steghuis. 2009. Enterprise Architecture: Creating Value by Informed Governance. Springer, Berlin.

[18] Ross, Jeanne W; Weill, Peter and Robertson, David C. 2006. Enterprise Architecture as Strategy: Creating a Foundation for Business Execution. Harvard Business School Press, Harvard

[19] Ryanto, Yan; Aminullah, Erman; Laksani, Chichi Shintia; Prihadyanti, Dian; Triyono, Budi dan Handoko, L.T. 2007. Peta dan Strategi Adopsi Teknologi Informasi di UKM manufaktur. Papiptek. LIPI, Jakarta.

[20] Schekkerman, Jaap. 2005. Trends in Enterprise Architecture 2005: How are organizations progressing?. Institute for Enterprise Architecture developments,. http://www.enterprisearchitecture.info/Images/EA%20Survey/Enterprise%20Architecture%20Survey%202005%20IFEAD%20v10.pdf Accessed Date [11/03/13]

[21] Sessions, Roger. 2007. A Comparison of the Top Four Enterprise-Architecture Methodologies. http://msdn.microsoft.com/enus/library/bb466232.aspx. Accessed date [09/03/11]

[22] Santoso, Widjajanti M; Katubi; Widyawati, Nina; Rochmawati, Waluyo, Djoko. 2011. Pergerakan Telecenter di Indonesia: TIK dalam program pengentasan kemiskinan di Jawa. Jurnal Penelitian dan Pengembangan Komunikasi dan Informatika 2 (2): 115-154.

[23] Sudantoko, Djoko. 2011. Strategi Pemberdayaan Usaha Skala Kecil Batik di Pekalongan. Eksplanasi 6 (1), 29 - 45

[24] Tambunan, Tulus. 2007b. Transfer of Technology to and Technology Diffusion among Non-farm Small and Medium Enterprises in Indonesia. Know Techn Pol 20:243–258

[25] Tambunan, Tulus. 2008. SME development, economic growth, and government intervention in a developing country: The Indonesian story. J Int Entrepr 6:147–167

[26] Tambunan, Tulus. 2006. Development of Small-And Medium-Scale Industry Clusters in Indonesia. http://www.kadin-indonesia.or.id/enm/images/dokumen/KADIN-98-1572-02032007.pdf. Accessed Date [10/01/13].

[27] Tambunan, Tulus. 2009. Export-oriented small and medium industry clusters in Indonesia. Journal of Enterprising Communities: People and Places in the Global Economy 3 (1): 25-58

[28] Untari, Rustina and Sanjaya, Ridwan. 2011. Upgrading SME's Business by ICT. The First International Conference on Interdisciplinary Research and Development, Thailand. http://www.inrit2012.com/inrit2011/Proceedings2011/02_42_10C_Rustina%20Untari_[6].pdf. Accessed Date [10/01/13].

[29] Wiyadi and Shahadan, Faridah. 2009. Kinerja dan Kesiapan Industri Kecil dan Menengah (IKM) Pemrosesan Makanan di Indonesia dan Malaysia Menghadapi Tantangan Globalisasi. Jurnal Ekonomi Manajemen Sumber Daya 10 (2): 165-182

[30] Yoganingrum, Ambar and Sensuse, Dana Indra. 2009. Pengembangan sistem penunjang keputusan untuk prediksi produksi madu hutan di taman nasional danau Sentarum: Kerangka konsep.

Proceeding. Digital Information & Sistem Conference. Bandung: Universitas Kristen Maranatha

[31] Yoganingrum, Ambar; Endang Rr. SRR; Maryati, Ira. 2013. Pelayanan Informasi via Short Message Service (SMS) bagi Masyarakat Pedesaan. Submiting paper.

[32] Yoganingrum, Ambar and Sensuse, Dana Indra. 2010. Pengelolaan Informasi pada Kelompok Petani Madu di Indonesia. Seminar Nasional Sistem Informasi Indonesia. Jurusan Sistem Informasi, Fakultas Teknologi Informasi, Institut Teknologi Sepuluh Nopember, Surabaya

[33] Zachman, J A. 1999. A Framework for Information System Architecture. IBM Systems Journal 38 (2/3): 454

[34] McDonald, Fiona; Yoganingrum, Ambar; Purwaningrum, Farah; Ariani, Dini and Short, Stephanie Doris. 2009. Evidence-based decision making to strengthen local governance: Nutritional health interventions in Bantul and Gunungkidul. The Australia Indonesia Governance Research Partnership program. Crawford School of Economics and Government. ANU College of Asia and the Pacific. The Australian National University, Canberra.

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