INTERNATIONAL JOURNAL OF SOFT COMPUTING

MEDWELL PUBLICATIONS

# Actor-Network Theory and Institutional Theory Approach to Develop e-Portfolio Model

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**Key words:** ANT, institutional theories, competency body, technology, environments

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Page No.: 34-40
Volume: 15, Issue 2, 2020
ISSN: 1816-9503
International Journal of Soft Computing


**Abstract:** This study provides a model, based on Actor- Network Theory (ANT) and institutional theory, for capturing e-Portfolio in competency body, particularly identifying the influence of technology as a conduit for enabling, engaging and empowering stakeholders. This paper aims to explore the role of technology in candicate competency certification. This research used in-depth interview and forum group discussion. The wider e-portfolio systems are complex and dynamic environments with multiple stakeholders, media and supporting systems and the competency body operate under geopolitical and social influences.

## INTRODUCTION

Indonesia as the country with the largest population in the ASEAN region should be ready to face the free flow of labor both at regional (Economic ASEAN Community) and global (China-Asian Free Trade Agreement) levels[1] but the condition of Indonesian workers still showed relatively low competitiveness compared to the ASEAN member countries[1, 2]. To raise the competitiveness, Indonesia's government try to improve quality of human resources in Indonesia[3-5]. The government set up some policies in objective to improving the quality of Indonesian human resources in national development, set up the system, the structure, organization and guidelines for integrating education and job training and work experience in order job competence recognition awards[6-8].

In line with the process of increasing the competence of labor in the process of obtaining certification of professional competence in Indonesia, previously performed Portfolio assessment process conducted by the Board of Certification of Competence Professional Competence[9] assisted by the certification body[9], an assessment methods against someone based on those documents. The document is evidence that the professional has had a competency. To ensure that the portfolio held information is correct, then the assessor may verify the portfolio related to documents filed with the competency test participants using four criteria rules of evidence (Valid, first, latest, sufficient)[8, 9]. However, the assessment portfolio process has a weakness, the portfolio is in paper form, the time for inspection the portfolio required a long time, there is no standard guidence to determine which one evidence must be submitted, it cannot be used to test a unit in an integrated, cannot render the evidence is not written, the reference list or index of the portfolio proposed to be set in advance, the evidence indicated must be current and valid and the election and an explanation of the evidence submitted by the participants competency tests may have an impact the expected results.

Based on the issues, e-Portfolios can be the one way to solve it where e-Portfolio as a professional profile in digital form can capture and compare the information on the level of skills and professional competence, potential for development and career prospects. Besides e-Portfolio also have broad implications for public tool used by the government where they can be used

Table 1: Evaluation of previous e-Portfolio model with updates framework/model

| Framework/Model | Researchers | Methodology | Covered | Not covered |
|---|---|---|---|---|
| Balancing 2 faces e-portfolio model | Barrett | Desk research<br>Case study on K-12 basic education in America | The idea for a major e-portfolio system as a workspace and learning process. e-Portfolio as a view, focus on products | Lack of empirical research to test the framework (Methodology) |
| Meta-model of e-Portfolio usage in different environments | Balaban *et al*.[10] | Desk research<br>Case study in higher education | Developing a comprehensive model representing the use of e-Portfolio in the individual's, academic and industrial institutions as a system in the development of lifelong learning | Lack of explanation about the role of stakeholder stakeholders and technology |
| Framework for project managers competencies and role of e-Portfolio to meet these competencies | Omidvar etc., | Desk research<br>Questionnaire/survey on five different industries | There are three main components to improve competence<br>Project manager, i.e., "Job-competence", "Person-competence" and "Contextual-competencies" | Lack of success factors affecting e-Portfolio implementation |
| e-Portfolio system's model with artificial intelligence traits | Gorbunovs | Desk research<br>Case study in higher education | e-Portfolio approach to minimize time the learning process search process is complemented by AI feature consists of several actors involved to ensure their interaction | Lack of explanation about the role of each stakeholder and technology |
| uFolio framework for a learning platform and assessment system | Ku | Desk research | uFolio frame design with three major components: MyFolio, MyClass and MyLog- and uAware, to build a multi-function e-Portfolio | Lack of empirical research to test the framework (Methodology) |
| Malaysia skills certificate e-Portfolio framework | Bekri etc., | Desk research<br>Case study in Malaysia's vocational school | Detailed frameworks and models of e-Portfolio development are needed to meet the needs of individuals and educational institutions | Lack of explanation about the role of each stakeholder and technology |
| Modeling TRAILER project methodology for the recognition, tagging and acknowledge of informal learning activities | García-Penalvo etc., | Desk research | This methodology defined by taking into account learners and institutional opinions and proposed technology framework to implement it | Lack of empirical research to test the framework (Methodology) |
| ePortfolio system design based on ontological model of self-regulated learning | Nguyen and Ikeda[11] | Desk research<br>Case study in higher education | Ontology and semantic web use can evaluate competencies and performance, share resources and seek help | Lack of success factors affecting e-Portfolio implementation |

to describe the services provided by the government which is a service that is more transparent and more accountable pursuant to Presidential Instruction No. 3 of 2003, O'Brien[4, 12] stated e-Portfolio is a form of e-Government implementation in the development of an entrepreneurial society independently.

Therefore, the development of e-Portfolio requires the suitable model to meet the needs of professional competence certification system. This study was conducted to produce a proposed model of e-Portfolio of Professional Competence Certification in Indonesia based on. This is done to upgrade the competency assessment system existing workforce, to enable the country to produce a skilled workforce that has more quality, very broad, innovative and competitive (Table 1).

## Literature review

**Actor-network theory:** There are many studies that combine social in the technological research and we know it as a socio-technical approach. One of the alternative approach that widely used in information system, especially in qualitative research is ANT (Actor-network theory). Previous studies that use ANT in the information system development are e-Participation framework[1], e-Health key issues[2] and e-Government[3].

It has been >30 years, since, ANT was introduced by Michael Collin, Bruno Latour and John Law in the 1980s[4, 5]. Even though Latour was recalled the use of the terms actors, network, theory and hypen[6], ANT is still used and developed as an approach in many research until now. It can be seen from the existing of International Journal of ANT and Technological Innovations, since, 2009.

ANT is used to recognize the connections between actors, including human and non-human in the social dynamics situation[7, 8]. Those actors are named as actants which have the same position[5]. It can support to strengthen the analysis of the complex interactions between actors in the information system projects. ANT is considered as a suitable approach to understand the

Table 2: Research into ANT applications in various subjects

| Researchers | Title | Application method |
|---|---|---|
| Heeks and Stanforth | Understanding e-Government project trajectories from an actor-network perspective | Discussed local and global networks framework, network and project trajectory as well as investigated network and power |
| Cho etc., | Contextual dynamics during health information systems implementation: an event-based actor-network approach | Identified significant dynamics related to implementation content Used events to focus, structure and present the ANT analysis |
| Perillo | Constructing participation practice: ANT account | Discussed translation, sociology associations and network building |
| Bin Salamat and Hassan | An Actor Network Theory (ANT) approach to Malaysian e-participation framework | Identified group of user, the actor and roles, the causes, building the actor network, Obligatory Passage Point (OPP), obstacles and enrolment |
| Faik etc., | Modernisation through ICTs: towards a network ontology of technological change | Discussed ontological and methodological principles of ANT |
| Kumar and Rangaswamy | The mobile media actor- network in urban India | Described actors, actor- networks, the four moments of translation: problematization, interessement, enrollment and mobilization |
| Sayes | Actor-Network Theory and methodology: Just what does it mean to say that nonhumans have agency? | Understanding nonhumans exercise agency |

Table 3: Apply ANT in IS domain study

| Title | Researchers |
|---|---|
| Using ANT to uncover the full potential of an Intelligent Operational Planning and Support Tool (IOPST) for acute healthcare contexts | Muhammad etc., |
| Future research on cloud computing adoption by small and medium-sized enterprises: A critical analysis of relevant theories | Saedi and Iahad |
| An integrated theoretical framework for cloud computing adoption by small and medium- sized enterprises | Saedi and Iahad |
| Actor-network-theory in medical e communication-the role of websites in creating and maintaining healthcare corporate online identity | Bielenia-Grajewska |

socio-technical interactions compared to SCOT (Social Construction of Technology), STIN (Socio-Technical Interaction Network) and sociomateriality[9].

There are three key stages of ANT, i.e., inscription, translation and framing[2]. The main process of ANT analysis is to consider the translation in the making interactions between actors by aligning the interests of different actors with the focal actor[13]. The four phases of the translation process, including problematization, interessement, enrollment and mobilisation[14].

Table 2 shows past research that implement ANT in various subjects. ANT mostly used to understand the actors and their inter-relation, e.g., understanding the trajectory of e-Government projects by these understanding can lead to know why projects progress succeed while others failed and ANT also can be used to analyze many level such as individual to organisational, national to international. Other research such as Perillo, use ANT in education research as an analytical study to understand the characteristic of participation practice at school related to the curriculum changes which concluded that ANT is concern with any type of actor how large or abstract that actor could be which still provide for a critical analysis. e-Portfolio could also use ANT as a framework to understand e-Participation for public policy formulation which helps to touch every single aspect of element that could be related to the project considering all actors even the elements that are outside the project. ANT can give a deeper explanation about relationship between changes and development as in Faik research, that modernisation means a particular level of change that need to be considered by the research and practitioners, which ANT can help to understand the process of modernisation. Actor of ANT could be a human such as customer and supplier or non-human entities such as technology (mobile phone) that use ANT to understand the emerging mobile culture related to pirate media network and it practices. Non-human in ANT provides a proper rendition of complexity, ANT provides tool for a better understanding towards displacement, translation, practices, process and much more, no matter what the actors may look like. These research summary could be seen in Table 2. Furthermore, ANT has also implemented in IS domain study, as presented in Table 3, based on Table 3, ANT is dominated used on healthcare and enterprise. ANT can used to enable in depth and rich analysis[2], to categorize the influencing factor into social, technical or human and non-human actors and understanding the interaction to classified the actor into human and non-human factors and then is used to find the relationship between the actors and to shape the online identity healthcare suppliers by studying the role of the living and nonliving entities.

Beside ANT there are many other theories. Based on our literature review, we compare ANT with those theories, such as: Social Shaping of Technology (SST), institutional theory, structuration theory, stakeholder theory and grounded theory. We summarize those theories based on their description, advantage and disadvantage which is presented in Table 4 by comparing ANT and other relevant theories gives a comprehensive view why ANT is suitable for this research.

Table 4: Comparison of ANT and other relevant theories

| Theories | Brief descriptions | Advantages | Disadvantages |
|---|---|---|---|
| The Social Shaping of Technology (SST) | This theory was developed by researcher. It explains that the design and implementation of technology are patterned by a range of factors such as organizational, political, economic and cultural factors as well as technical considerations | Avoids "technological determinism"<br>Considers various factors such as Organisational, political, economic and cultural<br>Considers technological change<br>Avoids generalization<br>Cross-disciplinary | Does not mention change factors<br>Does not examine power relations<br>Does not emphasize non-human factors<br>Does not emphasize local-global networks |
| Institutional theory | According to researcher, the concepts of institution and institutionalization have been defined in various ways with substantial diversity among approaches such as by Selznick, Berger and Luckman, Zucker, Meyer and Rowan, Hughes, Hertzler, Friedland and Alford | Emphasize the importance of history, a holistic and contextual approach<br>Consider complexity of institution<br>Examine social conditions<br>Capture processes in the institution | Does not state about change factors<br>Does not examine about power relation<br>Does not examine about power relation<br>Does not emphasize non-human factors<br>Does not emphasize local-global networks |
| Structuration theory | This theory was developed by sociologist Anthony Giddens. It proposes that agents and structures are not two independently and conflicting elements but act as a mutually interacting duality | Avoiding deterministic approach<br>According to researcher, this theory has potential application in IS research in terms of operational studies, use as a meta theory and use of individual concepts<br>According to researcher this theory is flexible and allows for combinations with other theories | We do not recognize power relations between local and global structures, change and complex factors, non-human factors<br>According to researcher, there are three criticisms, including the conflation of structure and human agent; the complexity and spread of the theory leading to contradictions and a lack of assumptions and methodological guidelines |
| Stakeholder theory | It was originally developed by R. Edward Freeman in the book strategic management. This is a view of capitalism that stresses the interconnected relationships between a business, its customers, suppliers, employees, investors, communities and others who have a stake in the organization | Covers all relevant stakeholders<br>It has attention to bigger perspective of values, not only money profit | We do not recognize power relations between local and global structures, change and complex factors, non-human factors |
| Grounded theory | Grounded theory was developed by sociologists glaser and strauss. It is a general inductive methodology involving the systematic generation of a theory from systematic research and a set of rigorous research procedures leading to the emergence of conceptual categories | Useful for developing theory from data<br>Powerful for collecting and analysing data | According to researcher that grounded theory has dilemmatic in term of "no preconceived ideas" and when researcher should finish analysis<br>Too rigid on the method and techniques |
| Actor-Network Theory (ANT) | It is a concept developed by Callon, Latour and Law in the 1980s. It explains networks which consist of heterogeneous or socio-technical elements called actants such as human or technological artefacts, organizations, institutions and others | Avoids a deterministic approach<br>It is an established theory in the sociology of science and technology and has been implemented in various subjects<br>It seems suitable for describing the contexts of both case studies<br>It is usable in interpretative and qualitative research<br>It covers power relations, change and complex factors, including non-human factors | Many controversies exist about this theory, particularly about non-human actors<br>Some researchers addressed the limitations of ANT such as Whittle and Spicer who argued that ANT is actually an ontologically realist, epistemologically positivist, and politically conservative account of organizing. ANT also failed to contribute to the development of critical approaches to organization |

The reason why we used ANT in this research is because it has implemented in many various research and also IS domain which is suitable with this research. Other reason as presented in Table 4, that ANT has an advantage to interpretative and qualitative research and understand the relations and interaction of the actors.

**Institutional theory:** Institutional theory is the view of the complexity of the organization. Bjork applies the theory of institutions for the management of security IS/IT in an organization according to institutional theory can help us understand and explain why the organization often creates and maintains formal security structures without trying to implement it thoroughly.

The institutional theory has three pillars: while the institutional actor's shaped symbolic systems, social structure, routine and artifacts (objects). The following explanation of the three pillars.

**Regulatory:** Relates to the formal and informal pressure to follow the government in this aspect of the rules or the law.

**Normative:** Related to the competence of actors organizations: information processing capabilities.

**Mimesis:** A form of behavior in which the organization seeks to emulate other organizations in certain situations, so as to minimize the risk of similarities between the organization with other organizations.

In this research, the institutional theory is used as a reference to classify factors of e-Portfolio for competence assessment certificate.

**e-Government:** Nowadays, e-Government has been used broadly to reform the governance of the government. The main factors of implementing e-Government are because of the movement from management orientation to service orientation and the effective and efficient of using information technology[15].

There are many approaches to define and develop e- Government applications. In this paper, we implement ANT to develop model of e-Government application. The reason to use ANT in e-Government research based on several advantages such as the stability, well-established and provide technology deterministic[5].

**Certification of competence:** The key elements of professionalism are defined by Walrad in three elements, i.e., public obligation, personal integrity, responsibility, accountability and competence[16]. One of the elements, competence, is used as the well-accepted standards to find the professions with the good understanding of their activities[16]. To find those competence professions, an organization use the certification of competence through an assessment test. Certification helps to evaluate an individual's skills, knowledge and abilities to know the current level of expertise[17]. Competence is not only assessed by a certification test but also it can be evaluated by the related documents, called portfolio.

**e-Portfolio:** One of e-Goverment implementation is e-Portfolio. e-Portfolio is a workforce assessment data collection to present the individual's competence in spesific field using electronic or technology devices[12]. It can be used as a solution to process the certification of individual's competence by capturing and comparing the information on e-Portfolio system[18]. It supports the government services more accountable and transparent. According to David Jose, there are five key features to reach of e-Portfolio objectives, including electronic storage, personalization, showcasing, reflection and feedback and assessment[10]. The previous research of the e-Portfolio model has been developed by several scholars using many methods such as ontology model[11], integral theory using AQAL[19] and meta-model[10].

## MATERIALS AND METHODS

**Step-by-step research method:** First, we gather information and identified the problem, strategic issue and concept identification that is relevant with this research. Then, a literature review about the definition, element and factors and e-portfolio model that is similar and can be use in this research (Table 5).

Table 5: Step-by-step research method

| Activity | Output | Validation |
|---|---|---|
| Exploratory Study | | |
| Gathering information | Problem identification, Strategic issue and Concept identification | |
| Literature Review | Definition | Y |
| | Elements and Factors | Y |
| | e-portfolio model | Y |
| Selection of a theoretical tool | Used ANT and Institutional Theory | |
| Updated initial e-portfolio model | E-portfolio model for competency profession | Y |
| In-depth interview process | | |
| Designed interview question | List of interview questions (definitions and model) | Y |
| Pilot interview (mostly competency body) | 4 people interviewed | Y |
| Approaching participation candidates (14 people), recruitment of participants and in- depth interview conversation in the institution below: | Most interviews are maximum 60 min; just a few interviews are >60 min because there were interesting answers from the interviewees | Y |
| Ministry of ICT | 1 people agreed to be interviewed | Y |
| Ministry of Labour | 1 people agreed to be interviewed | Y |
| Competency body of ICT and banking | 6 people agreed to be interviewed | Y |
| Community of Practice | 5 people agreed to be interviewed | Y |
| Coding process | | |
| Transcribing process | Interview transcript | Y |
| Coding process using NVIVO 11 based on the transcript and audio recording of the interview | List of codes on NVIVO 11 | Y |

Table 5: Continue

| Activity | Output | Validation |
|---|---|---|
| Classified into themes groups | | |
| Survey and questionnaire | | |
| Designed questionnaire question | List of Questionnaire (Factors CSF, Institutional Theory and BNSP) | Y |
| Pilot questionnaire | 3 people | Y |
| Check questionnaire reliability using Kappa Fleiss | 18 people | |
| Check questionnaire validity using fuzzy delphi method | 18 people | Y |
| List of factors has >75% expert agreement | | |
| Describe and classify the results | Description and classification | Y |
| Analysed similarities, differences and common themes | Similarities, differences and common themes | Y |
| Develop model of e-portfolio for competency certification | Model of e-participation within schools | Y |
| Verification of the results and frameworks using forum group discussion with 14 experts | Interview results and frameworks have been verified | Y |
| Interpretation, critical analysis and reflection | A model of e-portfolio for certification competency | Y |

Table 6: List of interviewees for pilot interviews

| Interviewee | No. of interviewees |
|---|---|
| Competency body in ICT domain | 3 |
| Competency body in banking domain | 1 |

Table 7: List of for in-depth interviews

| Organization | Interviewee | No. of interviewees |
|---|---|---|
| Badan Nasional Sertifikasi Profesi | Ketua Komisi Perencanaan dan Harmonisasi Kelembagaan (Chairman of the commission on planning and institutional harmonization) | 2 |
| Kementrian Komunikasi dan Informatika | Peneliti (researcher) | 1 |
| Kementrian Keetenaga kerjaan | Kepala Pusat Penelitian dan Pengembangan Profesi (Head of center for research and professional development) | 1 |
| Competency body in banking domain | Manager | 1 |
| Competency body in ICT domain | Assessor Kompetensi (Assessor of competence) | 3 |
| | Manager | |
| Profession association | Chairman general secretary advisor board | 5 |
| Industry association | Chairman general secretary | 3 |

## RESULTS AND DISCUSSION

In result of the literature review, we select ANT and institutional theory as a theoretical tool. Afterwards, we compare e-Portfolio frameworks that has already exist, resulting an initial framework that, we used for the study case.

We conduct an in-depth interview process, consist of: designing interview process, pilot interview and approaching interview candidates, recruitment of participant and in-depth interview conversation.

Afterwards, 16 people were interviewed for pilot interviews and in-depth interview, as presented in Table 6 and 7. Interviewee of the pilot interview consists of 4 people that are from 2 organization which are: Competency body in ICT domain and Competency body in banking domain 7 organization were included to be an interviewee, which are: Badan Nasional Sertifikasi Profesi (BNSP), Kementerian Komunikasi dan Informatika (KOMINFO), Kementrian Ketenaga Kerjaan (KEMENAKER), competency body in ICT domain and competency body in banking domain, profession association and industry association.

There are 16 people that were selected to do the interviewes and their position was: Chairman of the commission on planning and institutional harmonization, Researcher, head of center for research and professional development, manager, assessor of competence, chairman, general secretary and advisor board.

After the in-depth interview process, the next step was coding process. coding process is transcribing the interview and the coding process is conduct using Nvivo11 and then it is classified into themes group. To check the reliability of the questionnaires, we use Kappa Fleiss and fuzzy delphi method to check the validity. We described and classify the result and then analyze the similarities and difference and common themes. afterwards, we developed a e-Portfolio model for competency certification and verify the result and model in forum group discussion with 14 expert attending. Final, we interpret, critical analysis and reflection of the research with a output a model of e-Portfolio for certification competency.

## CONCLUSION

The aim of this study is to develop a model of e-Portfolio for Indonesian Professional Competency Certification which needs six elements. There are six elements: certification of professional competence, factor e-Portfolio, the model of ICCP e-Portfolio, actor network theory, DANA and recommender system. While the

e-Portfolio model for Indonesian Professional Competency Certification can provide recommendations for the prospective workers who want to take a certification, training or certification of what can be put forward again for the development of self-competence, for which according to the self-competence. And for the NBPC can help provide the data and complete profile recommendations from each of the workforces that have been certified, the new certification filed and will file a re-certification, so as to facilitate mapping of Indonesian labor certification requirement. For the industry can help mapping the competency of the workforce in Indonesia and mapping standards of competency, so, it can make another skills standards to be competitive at the regional scale (ASEAN). And for assessors of competency in PCA can be helped by making assess the portfolio standard.

The model was developed in five stages: problem identification, literature review, design, analysis and interpretation, development and evaluation models.

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