World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:1, 2015

Factors That Affect the Effectiveness of Enterprise Architecture Implementation Methodology

Babak Darvish Rouhani, Mohd Naz'ri Mahrin, Fatemeh Nikpay, Pourya Nikfard, Maryam Khanian Najafabadi

***Abstract*—**Enterprise Architecture (EA) is a strategy that is employed by enterprises in order to align their business and Information Technology (IT). EA is managed, developed, and maintained through Enterprise Architecture Implementation Methodology (EAIM). Effectiveness of EA implementation is the degree in which EA helps to achieve the collective goals of the organization. This paper analyzes the results of a survey that aims to explore the factors that affect the effectiveness of EAIM and specifically the relationship between factors and effectiveness of the output and functionality of EA project. The exploratory factor analysis highlights a specific set of five factors: alignment, adaptiveness, support, binding, and innovation. The regression analysis shows that there is a statistically significant and positive relationship between each of the five factors and the effectiveness of EAIM. Consistent with theory and practice, the most prominent factor for developing an effective EAIM is innovation. The findings contribute to the measuring the effectiveness of EA implementation project by providing an indication of the measurement implementation approaches which is used by the Enterprise Architects, and developing an effective EAIM.

***Keywords*—**Enterprise Architecture, Enterprise Architecture Implementation Methodology, EA, Effectiveness, Factors, Implementation Methodology.

I. Introduction

ENTERPRISE Architecture (EA) is employed by enterprise for providing integrated environment in order to support the alignment of enterprise's business and Information Technology (IT) [1], [2]. In EA, the framework represents the structure to model enterprise's business and IT entities. There are different models for various perspectives in EA Framework (EAF), each with different scope and activities [3]. The outputs of EAF are EA's artefacts that consist of models, diagrams, documents and reports [4], [5]. Since EA artefacts are not sufficient for enterprises by they own, enterprises are looking to find a method to address theirs challenges on competiveness by implementing those artefacts [6]. In addition, enterprises implement the EA in order to find appropriate answers for their business's demands [7], [8].

EA Implementation Methodology (EAIM) can describe the structured approach in order to solve some or all of the problems related to EA implementation [9], [10]. EAIM covers all aspects of the EA lifecycle - the planning for enterprise understanding projects, the analysis of business requirements, the design of systems, the evolution of systems, and the ongoing enhancements of all of the above [6]. The methodology is both complete and concise, serving as a coherent guide for practitioner professionals. It allows paths and pieces of content to be selected and extracted for application on specific projects [11].

The Methodology is the generic reference procedure that represents the (1) structure and condition of existing systems (2) the practices and descriptions that lead to manage the step by step guidelines from current architecture to desired one (3) the practices and description that lead to maintain and keep the enterprise update in order to cope with upcoming changes (4) the practices and description that lead to supervise and govern the systems and artefacts [12]-[14].

In EA implementation the effectiveness refers to outputs of implementation that completely meet the defined goals of EA project [15]. One of the main challenges of Enterprise Architects is to determine the effectiveness of EA implementation. Since the effectiveness directly affects the consent of EA stakeholders, Enterprise Architects are looking for the way that helps them in order to increase the effectiveness of EAIM [6], [16]. This paper aims to identify the factors that affect the effectiveness of EAIM.

In this study the word practice refers to set of activities and processes in order to define, develop, and maintain the architecture, and the word factor refers to the item or quality attribute that effect on effectiveness of architecture implementation. The aim of this research is to represent the factors that affect the effectiveness of EAIM.

The reminder of this paper are divided as following parts: research background is described in Section II, the research methodology is represented in Section III, the result of this research is described in Section IV, and discussion and conclusion of this study is expressed in Sections V and VI respectively.

II. Related Work

The effectiveness is determined by degree in which the outputs of EA implementation help the enterprise attain its intended goals [17]. If the intended goals of the enterprise regarding EA coincide with the individual goals of stakeholders, then EA effectiveness determines. Moreover, EA function effectiveness is: "The degree in which organizational objectives are attained through the outputs of the EA function". Besides, effectiveness of EA may be objectively

Babak Darvish Rouhani is with the Advanced Informatic School, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia (corresponding author; phone: +60176200392; e-mail: drbabak2@live.utm.my).

Mohd Naz'ri Mahrin, Pourya Nikfard, and Maryam Khanian Najafabadi are with the Advanced Informatic School, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia (e-mail: mdnazrim@utm.my, npourya2@ live.utm.my, knmaryam2@live.utm.my).

Fatemeh Nikpay is with the Department of computer science and information technology, University of Malaya, Kuala Lumpur, Malaysia (e-mail: fa.nikpay@siswa.um.edu.my).

measured by using the organizational performance data related to the implementation of EA decision making [18].

Current EA assessment approaches mostly focus on financial and efficiency of EA functions [29]. However, in order to understand the degree in which functions of EA implementation achieve the objectives that pursued with EA, the effectiveness of EA implementation play major role in contrast of efficiency or cost. In EA implementation, the main concerns are in the achievement of EA functions. Obtaining the intended results by using the EA implementation practices are the key concern on the effectiveness of EA implementation. Reference [18] mentioned numbers of qualitative objectives in order to measure the effectiveness of EA in terms of objectives. Reference [17] considered two dimensions agility and alignment as the EA implementation measurement model.

Reference [18] summarized several author's perspectives on how to measure the effectiveness of EA (in terms of objectives or metrics). Based on the three measurement dimensions and corresponding benefits of [30], [18] formulated 12 qualitative objectives, with 58 corresponding indicators, to be attained by any EA framework and architecture development process. 11 of 12 objectives (47 of 58 indicators) appeared to be positively influenced by the EA framework (EAF) and development process.

Reference [17] considered two dimensions agility and alignment as the effectiveness of EA implementation measurement model. According to [17] in order to measure the effectiveness of EA implementation two dimensions including: agility with six indicators (external monitoring, speed, flexibility, quality and customization, and initiation of change) and alignment with six indicators (internal monitoring, communication and understanding, governance, partnership, readiness of change, and conformance and integration) should be considered. However, this measures the effectiveness of EA implementation in order to obtain the stakeholders satisfaction and does not support all quality attributes of the effectiveness of EA implementation. Factors that mentioned by [18] are emphasized on the EAF, and [17] focused more on implementation, however, our research focuses on identifying the factors that have positive effect on the effectiveness of EAIM, which related to development, management, and maintenance processes.

III. Research Design

We conducted a Systematic Literature Review (SLR) in accordance with Kitchenham's (2007) guidelines and procedures in order to identify the factors that affect the effectiveness of EAIM [19]. 46 primary studies have selected and five key factors identified. Table I describes the identified factors.

In this research the survey has been selected as research method in order to achieve intended research objective. In this regards, the questionnaire is employed as tool.

TABLE I
Definition of Selected Factors

Factors	Definition	Sources
Binding	refers to managing EA processes under the right direction based on strategy	[20]
Support	refers to supporting implementation by considering appropriate plan, strategy, tools, and mechanism	[20]
Innovation	refers to continuous innovation to enhance enterprise's business, processes, and activities	[21]
Adaptiveness	refers to effectively and efficiently build, maintain, and apply the whole parts of EA	[21]
Alignment	refers to providing appropriate business and IT process for making alignment within EA.	[21]

A structured, self-administered questionnaire was created and made available on the World Wide Web. The questionnaire was designed to be short (21 questions) and easy to complete with questions phrased in closed-ended format. The seven point Likert scale answers have been selected for each question, including: strongly agree, agree, somewhat agree, neither agree nor disagree, somewhat disagree, disagree, and strongly disagree. According to [22] the sample size among thirty and five hundred respondents is appropriate for conducting a survey. The following criteria have been set for survey population.

- Those who have practical experience on EA implementation with at least two years experiences
- Those who work as an Business Architect, Enterprise Architect, IT Manager in EA project with at least two years experiences
- Those who published related paper on factors, which affect the effectiveness of EA implementation

The followings null hypotheses and alternative hypotheses have been defined for each independent factor:

H0= There is no relationship between adaptiveness/ alignment/ support/ binding/ innovation and effectiveness.

H_A= There is meaningful relationship between adaptiveness/ alignment/ support/ binding/ innovation and effectiveness.

In order to evaluate the factors we used factor analysis to understand the underlying structure. In addition, this research used the Pearson correlation in order to identify the strength of the relationship between factors and effectiveness. Beside in order to have appropriate foundation for evaluating the factors this research used multiple regressions to explore the predictive ability of identified factors on effectiveness of EAIM. It also allows us to compare the predictive ability of particular factors and find the best factors to predict the effectiveness.

IV. Results

This section represents the results of evaluating the identified factors

A. Descriptive Statistics

This section represents the descriptive analysis based on general questions of designed questionnaire, which are related to respondent characteristics. Table II shows demographic profile of survey's respondents.

TABLE II
DEMOGRAPHIC PROFILES OF RESPONDENTS

Measure	Item	Frequency	Percent	Valid Percent	Cumulative Percent
learn Enterprise Architecture	Passing relevant courses	29	33.7	33.7	33.7
	Study related books	21	24.4	24.4	58.1
	Practical Knowledge	31	36	36	94.2
	Other	5	5	5.8	100
level of education	Bachelor's degree	3	3.5	3.5	3.5
	Master's degree	30	34.9	34.9	38.4
	PhD Candidate	13	15.1	15.1	53.5
	PhD	40	46.5	46.5	100
	Other	0	0	0	100
Current Position	Business Architect	3	3.5	3.5	3.5
	Enterprise Architect	56	65.1	65.1	68.6
	IT Consultant	4	4.7	4.7	73.3
	IT Manager	8	9.3	9.3	82.6
	Researcher	3	3.5	3.5	86
	Faculty- Academic Member	12	14	14	100
	Other	0	0	0	100
Experience	Less than 2 years	0	0	0	0
	2-5 years	9	10.5	10.5	10.5
	6-10years	38	44.2	44.2	54.7
	11-20years	33	38.4	38.4	93
	Above 20	6	7	7	100
EA Project	1-5 Projects	13	15.1	15.1	15.1
	6-10 Projects	39	45.3	45.3	60.5
	11-15 Projects	12	14	14	74.5
	16-20 Projects	12	14	14	88.5
	Over 20 Projects	10	11.6	11.6	100

TABLE III
DESCRIPTIVE OF QUESTIONS

	N	Minimum	Maximum	Mean	Std. Deviation
B1	86	2	7	6.15	1.223
B2	86	2	7	6.00	.946
B3	86	2	7	5.85	1.023
B4	86	2	7	5.92	1.054
A1	86	1	7	5.27	1.260
A2	86	1	7	5.29	1.197
A3	86	1	7	5.37	1.237
I1	86	2	7	5.79	1.097
I2	86	2	7	5.90	.854
I3	86	2	7	6.07	1.104
I4	86	1	7	5.78	1.100
AL1	86	2	7	5.79	.909
AL2	86	4	7	6.06	.757
AL3	86	4	7	6.03	.694
AL4	86	3	7	6.01	.775
AL5	86	4	7	5.94	.725
S1	86	3	7	6.24	.825
S2	86	3	7	6.23	.807
E1	86	1	7	5.71	1.115
E2	86	1	7	5.85	1.143
E3	86	3	7	6.22	.925
Valid N (Listwise)					

According to Table II, 31 respondents (36%) have practical knowledge, in contrast 29 (33.7%) of respondents passing relevant courses and 21 of respondents study related books. Moreover, majority of respondent have PhD degree which is 40 (46.5%) while 3 (3.5%) of respondents have Bachelor degrees. Most of respondent Position are Enterprise Architects with 56 (65.1%), meanwhile 8 (9.3%) of respondents are IT managers and IT consultants, business architect, researcher, and faculty member response 4 (4.7%), 3 (3.5%), 3 (3.5%), and 12 (14%) respectively.

Furthermore, Most of respondents have 6-10 years' experiences in EA with 38 (44.2%) and 33 respondents (38.4%) have 11-20 years' experiences, while 6 respondents (7%) have above 20 years' experience in EA projects. Descriptive statistics is useful and suitable for checking respondent (N Valid), missing value (N missing), the Minimum and Maximum, Mean (average) for each variables and Std. Deviation (Standard Deviation) for each of them.

Table III shows descriptive table of Items for each factors and the effectiveness of EA Implementation

B. Data Analysis

This section illustrates factor analysis and reliability of main questionnaire. Moreover, the correlation and regression is represented in order to demonstrate correlation of each factor to dependent variable.

1. Factor Analysis

Factor analysis is a statistical method to classify the observations in smaller groups; it is one of the most common methods in researches. It was introduced about 100 years ago by psychologist Charles Spearman to detect hidden characteristics and statistical observations and categories; moreover, this analysis is used for data reduction and structure detection [23].

As a whole, before doing factor analysis, we should ensure adequacy of sample; that current data is suitable for factor analysis. In this regard, KMO & Bartlett test is used, KMO measure should be greater than 0.7, otherwise, factor analysis is not valid for sample. Moreover, Bartlett test should be significant, in other words, less than significant level 0.05.

As shown in Table IV, KMO measure is **0.706** (> 0.7) so the current data set is suitable for factor analysis. Also, Bartlett test sig.= **0** (<0.05) means variables have enough correlation to provide reasonable basis for factor analysis [28]. Principal axis factor analysis was conducted on all 21 items of effectiveness factors in questionnaire.

TABLE IV
KMO & BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.706
Bartlett's Test of Sphericity	Approx. Chi-Square	1187.018
	df	210
	Sig	.000

Table V shows factor loading for each of the 21 items. These 21 items related to the five variables used in this research. According to [24] only factor loading greater and equal 0.5 (≥ 0.5) are considered. Each of items should locate in one column separately without considering the sign.

The first four item's high loadings located in first factor, which was "*Binding*", it means that B1, B2, B3, and B4 are cluster in first group which define by high loading. Variables, which measure "*Adaptiveness*" is in column 3, variables for "*Innovation*" are in column 4, variables for "*Alignment*" are in column 1, variables for "*Support*" are in column 6, and variables for measuring *"Effectiveness*" are in column 5.

TABLE V
FACTOR LOADING MATRIX

	Component					
	1	2	3	4	5	6
B1	-.234	**.676**	.131	.420	.184	.142
B2	-.065	**.801**	.247	.192	-.065	.264
B3	.155	**.826**	.232	-.084	.017	.050
B4	.240	**.838**	.029	.115	-.028	.138
A1	-.060	.180	**.783**	.286	.078	-.044
A2	.135	.152	**.852**	.105	.200	.023
A3	.262	.247	**.808**	.066	.223	.024
I1	.233	.070	.127	**.534**	.152	.424
I2	.158	.049	.452	**.359**	-.117	.361
I3	.136	.094	.156	**.831**	.134	.253
I4	.206	.173	.221	**.788**	-.021	-.173
AL1	**.763**	.084	-.237	.394	-.055	-.177
AL2	**.680**	.091	.217	.014	-.308	.244
AL3	**.655**	-.037	.303	-.080	-.131	.488
AL4	**.839**	.121	-.021	.211	-.015	.227
AL5	**.763**	.005	.272	.035	.012	.090
S1	.099	.209	-.013	.074	.092	**.847**
S2	.240	.256	-.030	.100	-.177	**.823**
Effectiveness1	-.085	-.034	.138	.011	**.901**	-.050
Effectiveness2	-.080	.003	.113	.056	**.933**	-.036
Effectiveness3	-.109	.135	.188	.464	**.557**	.087

B= Binding; A= Adaptiveness, I= Innovation, AL= Alignment; S= Support; Effectiveness
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 8 iterations.

Based on factor analysis all variables of one group should be in one factor and for each variable we should select high loading from other reminder factors, totally factor analysis group variables with similar characteristics together. Factor loading of "I2" in column 4 is not desirable due to its low loading in contrast to other indicators of Innovation so it can be omitted from other analysis

2. Reliability

Reliability is an instrument to determine the stability of the results of the tests [25]. There are various methods to measure reliability. In this research, "***Cronbach's Alpha***" was used to test reliability. It is usually used to measure internal consistency, and ranges between 0 and 1; if **α** is close to 1, it means it is reliable [26] but as a whole this measurement should be greater than 0.7 for being reliable [28].

Table VI shows all Cranach's alpha measurement for the entire factor's group are above 0.7 which is an acceptable level and have high reliability for this research which states that sufficient internal consistencies have been judged for the reliable measurement.

TABLE VI
RELIABILITY STATISTICS

Factor	Cronbach's Alpha
Binding	**.848**
Adaptiveness	**.884**
Innovation	**.746**
Alignment	**.846**
Support	**.865**
Effectiveness	**.816**

3. Correlation

In order to investigate the relationship between the factors and effectiveness of EA implementation, the correlation technique is employed. To evaluate this relationship, Pearson correlation statistical technique was used by means of SPSS 19.0. Moreover, in order to determine the strength of the relationship, interpretation was done based on the Cohen structure [27]. Table VII shows the correlation between independents and depend factors

As shown in Table VII, there is a strong correlation between the effectiveness of EA implementation as dependent variable and binding, adaptiveness, innovation, alignment, and support as independent variables. Based on the correlation statistical test, "*Pearson correlation"* and Cohen (1998) for binding r = 0.565 and p-value=0 (<0.05), these measurements indicate that there is a positive and strong relationship between **"**Binding**"** and effectiveness of EA implementation.

According to Table VII, the Pearson correlation for MA (Adaptiveness) is r= 0.577 and p-value=0 (<0.05), (H0 rejected) these measurements indicated that there is a positive relationship between "Adaptiveness" and effectiveness of EA implementation and this relationship is in significance level.

According to Table VII, the Pearson correlation for MI (Innovation) is 0.568 and p-value=0 (<0.05), (H0 rejected) these measurement indicated that there is a positive and strong relationship between "Innovation" and effectiveness of EA implementation and this relationship is in significance level.

According to Table VII, the Pearson correlation for MAL (Alignment) is 0.537 and p-value=0 (<0.05), (H0 rejected) this measurement indicated that there is a positive relationship between "Alignment" and effectiveness of EA implementation and this relationship is in significance level.

According to Table VII the Pearson correlation for MS (Support) is 0.504 and p-value=0 (<0.05),), (H0 rejected) these measurement indicated that there is a positive and strong relationship between "Support" and effectiveness of EA implementation and these relationship is in significance level.

Consequently, all identified factors based on the Pearson correlation analysis have significant relationships between independent variables and dependent variables, so all the H0 hypotheses are rejected in favor of H1.

TABLE VII
CORRELATION

		ME	MB	MA	MI	MAL	MS
MME	Pearson Correlation	**1**	**.565****	**.577****	**.568****	**.537****	**.504****
	Sig. (2-tailed)		**.000**	**.000**	**.000**	**.000**	**.000**
	N	86	86	86	86	86	86
MMB	Pearson Correlation	.565**	1	.392**	.350**	.305**	.374**
	Sig. (2-tailed)	.000		.000	.001	.004	.000
	N	86	86	86	86	86	86
MMA	Pearson Correlation	.577**	.392**	1	.323**	.457**	.432**
	Sig. (2-tailed)	.000	.000		.002	.000	.000
	N	86	86	86	86	86	86
MMI	Pearson Correlation	.568**	.350**	.323**	1	.345**	.254*
	Sig. (2-tailed)	.000	.001	.002		.001	.018
	N	86	86	86	86	86	86
MMAL	Pearson Correlation	.537**	.305**	.457**	.345**	1	.365**
	Sig. (2-tailed)	.000	.004	.000	.001		.001
	N	86	86	86	86	86	86
MMS	Pearson Correlation	.504**	.374**	.432**	.254*	.365**	1
	Sig. (2-tailed)	.000	.000	.000	.018	.001	
	N	86	86	86	86	86	86

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
NOTE: ME: Effectiveness, MB: Binding, MA: Adaptiveness, MI: Innovation, MAL: Alignment, MS: Support

4. Regression

Regression analysis provides the opportunity for researchers to predict the changes of dependent variable from independent variables and also identify contributions of each independent variable in explaining the dependent variable [27], for multiple regression, we use following equation:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 \quad (1)$$

These b0, b1, b2, b3, b4, b5 are Standardized Regression Coefficients (Beta). In previous section the correlation between dependent variable and independent variables is investigated and there is relationship between them, so it is possible to use regression analysis. Table VIII shows number

of models, entered and removed variable. Based on Table VIII, five independent variables entered and there is not any removed variable in this model. Now after entering all independent variables to model, following output achieved.

TABLE VIII
VARIABLES ENTERED/REMOVED

Model	Variables Entered	Variables Removed	Method
1	MS, MI, MAL, MB, MA	0	Enter

a. All requested variables entered.
b. Dependent Variable: ME

Table IX shows final model in which all independent variable are entered, R-square indicates that how much variance is there among the dependent variable (Effectiveness of EA implementation) which is explained by this model that includes all 5 independent variable as well.

TABLE IX
MODEL SUMMARY

Model	R	**R Square**	Adjusted R Square	Std. Error of the Estimate
1	.793[a]	**.628**	**.605**	.68405

R-Square=0.628, it means that 63% of the effectiveness of EA implementation changes can be interpreted when all five factors used, in other words mentioned independent variables explain 63% of the effectiveness of EA implementation.

Table X shows that whether the regression model is suitable or not, in other words, whether the independent variables can explain dependent variable changes or not.

TABLE X
ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	63.255	5	12.651	**27.037**	**.000[a]**
	Residual	37.434	80	.468		
	Total	100.689	85			

a. Predictors: (Constant), MB, MI, MA, MAL, MS
b. Dependent Variable: ME

According to Table X measure of p-value=0 (<0.05) indicate that combination of Binding, Adaptiveness, Innovation, Alignment, and Support significantly predict dependent variable (Effectiveness of EA implementation).

C. Effectiveness of EA Implementation

According to presented data analysis the independent variables including Binding (B), Innovation (I), Adaptiveness (A), Alignment (AL) and Support (S) have significant and positive relationship with the effectiveness of EA implementation as dependent variable. Thus all identified factors were significant contribute to the effectiveness of EA implementation at P<0.05. The effectiveness of EA implementation in this research was predicted by Binding (β= 0.252), Adaptiveness (β=0.221), Innovation (β=0.299), Alignment (β=0.195) and Support (β=0.168) and these variables together explain 63% of variance of EA implementation (R2=0.628).

V. DISCUSSION AND LIMITATION

Although there are some researches in the literature about the factors of the effectiveness of EA as mentioned in Section II, the main feature of this research is on considering the factors that affect the effectiveness of EAIM. In this regards, binding, adaptiveness, innovation, alignment, and support are the factors that this research evaluated and they are related to development, management, and maintenance processes of EAIM.

Innovation is the factor, which has the highest influence on the effectiveness of EAIM. Innovation refers to continuous innovation in order to enhance enterprise's business, processes, and activities; it also contains four indicators including: continuous improvement, appropriate governance mechanisms, flexibility, and agility. Innovation concerns on providing better environment for EA implementation by considering the appropriate governance, continuous improvement, flexibility and agility.

Since, today there is lack of effective EAIM [14], considering the identified factors could provide appropriate foundations for developing the effective EAIM. There are some limitations on this study including: 1) the sampling of the survey is limited; however the respondents were expert; 2) the implementation of the identified factors in real project could provide more information rather than statistical analysis..

VI. CONCLUSION

This paper analyzes the results of a survey that aims to explore the factors of the effectiveness of EAIM and specifically the relationship between factors and effectiveness of the output and functionality of EA project.

As a result, this research contributes to the generic literature on factors in Enterprise Architecture. It highlights a specific set of five factors for effectiveness of EAIM: alignment, adaptiveness, support, binding, and innovation. The research then shows that there is a statistically significant and positive relationship between each of the five factors and effectiveness of EAIM. Second, it emphasizes the importance of innovation on the effectiveness of EAIM. Finally, the following benefits are achieved based on this research:

- Provide an indication of the measurement implementation approaches being used by the Enterprise Architects
- Point to behaviours that are preventing the effective use of EAIM —thereby understanding the importance of the factors
- Provide an indication of how well measurement practices are being transitioned into use by the Enterprise Architects
- Provide an effective instrument for measuring the effectiveness of EAIM.

ACKNOWLEDGMENT

The authors would like thank to Dr. Roslina Binti Ibrahim and Dr. Rasimah Che Mohd Yusoff for guidance and support on this research.

REFERENCES

[1] A. ˇSaˇsa and M. Krisper, "Enterprise architecture patterns for business process support analysis," *The Journal of Systems and Software,* vol. 84, p. 27, 2011

[2] T. Clark, B. S. Barn, and S. Oussena, "A method for enterprise architecture alignment," in *Practice-Driven Research on Enterprise Transformation*, ed: Springer, 2012, pp. 48-76.

[3] B. Darvish Rouhani and F. Nikpay, "Agent-Oriented Enterprise Architecture: new approach for Enterprise Architecture," *IJCSI International Journal of Computer Science Issues,* vol. 9, pp. 331-334, 2012.

[4] F. Goethals, W. Lemahieu, M. Snoeck, and J. Vandenbulcke, "An overview of enterprise architecture framework deliverables," *Banda RKJ (ed) Enterprise Architecture-An Introduction*, 2006.

[5] R. Winter and R. Fischer, "Essential layers, artifacts, and dependencies of enterprise architecture," *Journal of Enterprise Architecture,* vol. 3, pp. 7-18, 2007.

[6] S. Aier and J. Saat, "Understanding processes for model-based enterprise transformation planning," *International Journal of Internet and Enterprise Management,* vol. 7, pp. 84-103, 2011.

[7] S. Bente, U. Bombosch, and S. Langade, *Collaborative enterprise architecture : enriching EA with lean, agile, and enterprise 2.0 practices*. Waltham, MA: Morgan Kaufmann, 2013.

[8] B. Darvish Rouhani and S. Kharazmi, "Presenting new solution based on Business Architecture for Enterprise Architecture," *International Journal of Computer Science Issues,* vol. 9, p. 5, 2012.

[9] H. M. Chung and G. McLeod, "Enterprise Architecture, Implementation, and Infrastructure Management," in *Proceedings of the 35th Hawaii International Conference on System Sciences* Hawaii, 2002.

[10] K. Medini and J. P. Bourey, "SCOR-based enterprise architecture methjodology," *International Journal of Computer Integrated Manufacturing,* vol. 25, pp. 594-607, 2012/07/01 2012.

[11] F. Ahlemann, *Strategic enterprise architecture management : chjallenges, best practices, and future developments*. Berlin ; New York: Springer, 2012.

[12] A. Ortiz, F. Lario, and L. Ros, "Enterprise Integration—Business Processes Integrated Management: a proposal for a methodology to develop Enterprise Integration Programs," *Computers in Industry,* vol. 40, pp. 155-171, 1999.

[13] S. Leist and G. Zellner, "Evaluation of current architecture frameworks," presented at the Proceedings of thje 2006 ACM symposium on Applied computing, Dijon, France, 2006.

[14] B. D. Rouhani, M. N. Mahrin, F. Nikpay, and P. Nikfard, "A Comparison Enterprise Architecture Implementation Methodologies," in *Informatics and Creative Multimedia (ICICM), 2013 International Conference on*, 2013, pp. 1-6.

[15] B. Darvish Rouhani, M. Nazri Mahrin, F. Nikpay, and B. Darvish Rouhani, "Current Issues on Enterprise Architecture Implementation Methodology," in *The 2014 World Conference on Information Systems and Technologies (WorldCIST'14)*, Portugal 2014.

[16] J. Saat, S. Aier, and B. Gleichauf, "Assessing the Complexity of Dynamics in Enterprise Architecture Planning–Lessons from Chaos Theory," in *Proceedings of 15th Americas Conference on Information Systems (AMCIS 2009), San Francisco*, 2009.

[17] B. van der Raadt, M. Bonnet, S. Schouten, and H. van Vliet, "The relation between EA effectiveness and stakeholder satisfaction," *Journal of Systems and Software,* vol. 83, pp. 1954-1969, 2010.

[18] J. M. Morganwalp and A. P. Sage, "Enterprise architecture measures of effectiveness," *International Journal of Technology, Policy and Management,* vol. 4, pp. 81-94, 2004.

[19] B. A. Kitchenham and S. Charters, "Guidelines for performing systematic literature reviews in software engineering," 2007.

[20] K. D. Niemann, "Safeguarding: Controlling Enterprise Architecture Development," *From Enterprise Architecture to IT Governance: Elements of Effective IT Management,* pp. 195-209, 2006.

[21] T. Iyamu, "The Factors affecting Institutionalisation of Enterprise Architecture in the Organisation," in *Commerce and Enterprise Computing, 2009. CEC'09. IEEE Conference on*, 2009, pp. 221-225.

[22] U. Sekaran, *Research methods for business: A skill building approach*: John Wiley & Sons, 2006.

[23] B. Thompson, *Exploratory and confirmatory factor analysis: Understanding concepts and applications*: American Psychological Association, 2004.

[24] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson, and R. L. Tatham, "Multivariate data analysis (Vol. 5)," *Engelwood Cliffs: Prentice-Hall,* 1998.

[25] E. G. Carmines and R. A. Zeller, *Reliability and validity assessment* vol. 17: Sage, 1979.

[26] L. J. Cronbach, "Coefficient alpha and the internal structure of tests," *Psychometrika,* vol. 16, pp. 297-334, 1951.

[27] L. Cohen, J. Fowler, P. Jarvis, and J. Wiley, *Practical statistics for field biology*: Wiley Chichester, 1998.

[28] K. C. Barrett and G. A. Morgan Jr, *SPSS for intermediate statistics: Use and interpretation*: Psychology Press, 2005.

[29] Nikpay, F., Selamat, H., Rouhani, B. D., & Nikfard, P. (2013, September). A Review of Critical Success Factors of Enterprise Architecture Implementation. In *Informatics and Creative Multimedia (ICICM), 2013 International Conference on* (pp. 38-42). IEEE

[30] Buchanan, R. (2001) Assessing Enterprise Architecture Program Value: Part 2: META Group Report. Stamford CT.

Babak Darvish Rouhani received his MSc in Software engineering from the Payame Noor University, Tehran-Iran in 2008. He is PhD candidate at Universiti Teknologi Malaysia in software engineering Darvish Rouhani research interests include Software Engineering, Enterprise Architecture, Agent-Oriented Architecture, and Agile Architecture.