State of Enterprise Architecture practice in Finnish Higher Education sector

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1. ABSTRACT

Enterprise Architecture (EA) has been practiced in Finnish Higher Education (HE) sector for several years. In 2011 the Finnish parliament ratified an act mandating all public sector organisation to adopt EA by 2014. Despite the Act, several studies have shown that the maturity of EA is low in Finnish public sector. To support the development of EA practice in Finnish HE sector, an EA Special Interest Group (EA-SIG) was founded in 2012. To shed light to the current state of the EA practice in Finnish HE sector, this paper reports the findings from a recent EA maturity study conducted by EA-SIG. The findings indicate that currently only half of the Finnish HE institutions have achieved the "defined" level of EA maturity. According to the study, the other half will achieve this level in two years.

2. INTRODUCTION

Enterprise Architecture (EA) has been practiced in Finnish Higher Education (HE) sector for several years. Officially the history of Finnish HE sector EA started in 2009 when eleven Finnish Higher Education Institutions (HEIs) started an EA-pilot as part of the RAKETTI-initiative. The pilot participants got a head start to prepare for the Act on Information Management Governance in Public Administration, which was ratified in 2011 (Finnish Ministry of Finance, 2011). The Act mandates all Finnish public sector organisations, including HEIs, to adopt EA by 2014. The report from 2014 revealed that the EA maturity in Finnish HE sector was low, even among the HEIs participating to the EA-pilot (Kella, 2014). Several studies has shown that the EA is not properly understood in Finnish public sector (Hiekkanen *et al.*, 2013; Lemmetti & Pekkola, 2012; Pehkonen, 2013; Tuomola, 2014). According to two recent PhD dissertations this is one of the main reasons for the low EA maturity (Seppänen, 2014; Syynimaa, 2015).

Finnish HE sector consist of Universities and Universities of Applied Sciences (UASs). Currently there are 15 universities and 25 UASs in Finland. To support the development of EA practice in Finnish HE sector, HEIs have founded an EA Special Interest Group (EA-SIG) in 2012. EA-SIG has provided general EA training and peer support for EA practitioners in Finnish HE sector.

In order to shed light to the current status and maturity of EA practice in Finnish HE sector, this paper presents findings from a recent EA maturity study conducted by EA-SIG in the end of year 2015. In the future, the study will be conducted annually.

The rest of the paper is organised as follows. The research methodology of the paper is described in Section 3 and results in Section 4. Section 5 concludes the paper by summarising the findings of the paper and by providing some suggestions.

3. RESEARCH METHODOLOGY

The EA maturity study was conducted as a web questionnaire. The questionnaire was based on the EA maturity model of KARTTURI, The Guide for Developing Higher Education Enterprise Architecture (CSC,

2013). KARTTURI EA Maturity Model (KEMM) consists of eight EA domains and five maturity levels as seen in Table 1. Maturity levels of KEMM are based on CMMI (see http://cmmiinstitute.com) and TOGAF (The Open Group, 2009).

Table 1: KARTTURI EA maturity model (KEMM) matrix

Domain/Level	Initial	Partial	Defined	Managed	Strategic
EA descriptions					
EA method					
Governance processes					
Development and implementation					
Organisation					
Knowledge					
Substance support					
Interoperability					

As the KARTTURI is available only in Finnish, we will briefly introduce the maturity levels and domains of KEMM in English. On the *Initial* level EA related processes and EA organisation are not clearly defined. On the *Partial* level part of the architecture management processes, organisations, or tools are used. On the *Defined* level organisation's architecture descriptions are produced following standardised processes and templates, and activities are organised. On the *Managed* level usage and effectiveness of architecture descriptions and architecture management processes are regularly monitored. The results are analysed and corrective actions taken as required. On the *Strategic* level EA is a tool for organisation's strategic leadership and planning. In the *EA descriptions* domain the existing EA descriptions are assessed in terms of how they are stored and distributed. Also the level of how the EA descriptions can be utilised and the update processes are assessed in this domain. In the *EA method* domain the architecture methods and frameworks of the organisation are assessed. Similarly, in *Governance processes* domain, the governance processes related to EA are assessed. In the *Development and implementation domain*, the level of how the development of EA is organised and guided are assessed. Also the methods how the EA descriptions are implemented and published are assessed. In *Organisation* domain the organisation structure, roles and responsibilities of the EA practice are assessed, including the role of top-management in EA development. In the *Knowledge* domain, the level of knowledge of EA and related concepts of organisation's specialists, management, and other key stakeholders are assessed. In the *Substance support* domain, the level of how EA is integrated to HEI's substance activities and processes (i.e. teaching and researching) are assessed. Also the levels of how EA's support to substance is monitored and evaluated are assessed. Finally, in the *Interoperability* domain, the compatibility of HEI's internal architecture with the HE-sector reference architecture and other relevant reference architectures are assessed. (translated from CSC, 2013).

The questionnaire was organised in three parts: background questions, EA maturity assessment, and EA capability maturity assessment. Background questions of the questionnaire can be seen in Table 2.

Table 2: Background questions

Question	Options
Type of the organisation (required)	• University • HEI • Vocational institution • Vocational college • Other
HEI	• <list of HEIs> • Other
Name of the respondent	N/A
Role of the respondent (required)	• Enterprise Architect • CIO • Substance executive • Other executive • Other specialist
Estimation of EA work (FTE)	
Number of full-time architects	
Annual EA budget (€)	
Interoperability	
Estimate the influence of EA in your organisation	Scale: weak (0) – strong (5)

The maturity model related questions were organised in a matrix so that all questions for each domain were in one page as seen in Figure 1. Questions were in the form of claims which were derived from the KEMM (for details see CSC, 2013, part V). Each level consists of one or more claims representing the status of the particular level. Each level might be achieved currently, in the future (6, 12, or 24 months), or it might not be relevant at all.

Figure 1: Example of maturity model questions

The EA capability maturity were assessed by placing each of the eight domains in a quadrant seen in Figure 2. There were two axles: urgency and significance, which represented the current status of EA capability maturity in respondent's organisation.

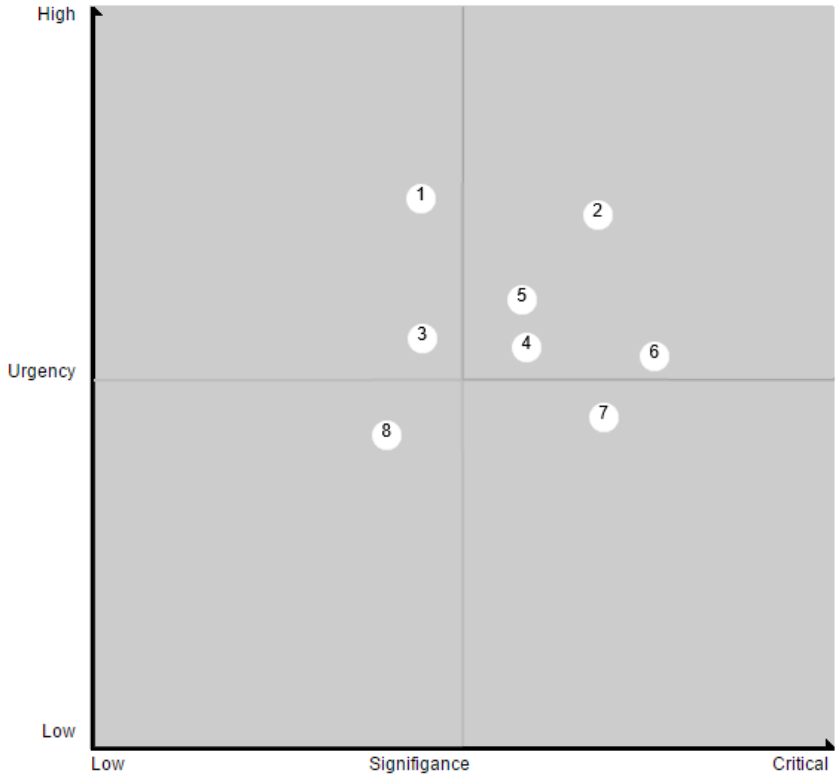

Figure 2: EA capability maturity assessment profile

4. RESULTS

In this section the results of the questionnaire are presented and analysed. The questionnaire was sent to all CIOs of Finnish HEIs and other interest parties.

4.1. Background information

Total number of 19 responses were received in time (see Figure 3). The quarter of the respondents (26%) were from universities and half (53%) from other HEIs. Most of the respondents were either Enterprise Architects (37%) or CIOs (37%).

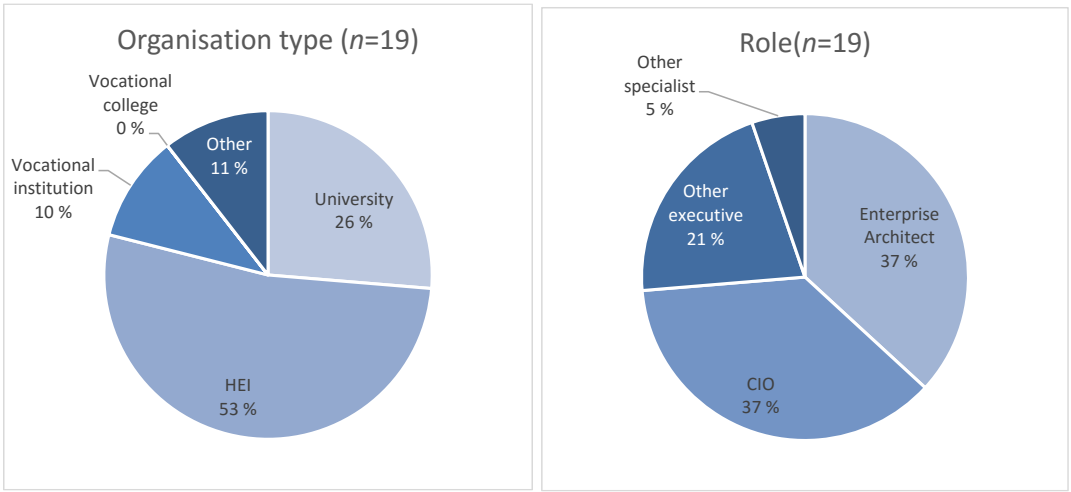

Figure 3: Respondents' roles and organisation types

The estimation of annual EA work were 2.75 FTE (*n*=19) and number of full-time EA personnel 0.47 (*n*=18). Assessment of the significance of EA work can be seen in Table 3. Most of the respondents (7) regards significance of EA work relatively weak and only one respondent as strong.

Table 3: Significance of EA work

(weak) **1**	**2**	**3**	**4**	(strong) **5**	***n***	$\bar{x}$
0	7	4	5	1	17	3

4.2. Enterprise Architecture maturity

As seen in Figure 1, there are one or more questions on each maturity level. We are interested on the maturity levels instead of individual questions. Therefore, the answers were summarised per maturity level as follows. If there was only one question on the maturity level, that was also the value of the particular maturity level. For instance, the *initial level* in Figure 1 would get its value from the answer for the first question. If there was more than one question, the value for the maturity level was the mode of the answers. For instance the *partial level* in Figure 1 would get the value which has the most occurrences in questions 2 to 4, i.e., if the second question would be assessed as *current* and two remaining as *+6 months* the value of the *partial level* would be *+6 months*. In case of two modes, the strongest would be selected, i.e. if there is two *current* and two *+6 months* answers the value would be *current*.

KEMM is similar to the other capability models in terms that in order to achieve a certain maturity level also the requirements of all lower levels needs to be fulfilled. For instance, in order to reach the *partial* level, one must first fulfil the requirements of the *initial* level. However, as it can be seen in the following figures, there might be more HEIs for instance on *partial* level than there are on *initial* level. This is caused by the design of the questionnaire, as the respondents have stated their own perception of the maturity on each level.

The current EA maturity of Finnish HE sector can be seen in Figure 4. The figures represent the percentage of the HEIs on each level. As it can be noted, practically all HEIs have achieved the *initial level*. Also the *partial level* is achieved by all HEIs except for the *EA method* and *governance and implementation* domains. These two domains also have the lowest maturity. *EA knowledge* domains on the other hand has the highest maturity. This clearly demonstrates that the investments made to EA training during the last few years have been valuable. It should also be noted that there are some HEIs that have achieved the *strategic level* at least in one domain. *Interoperability* domain is an exception, as none of the HEIs have achieved the *strategic level*.

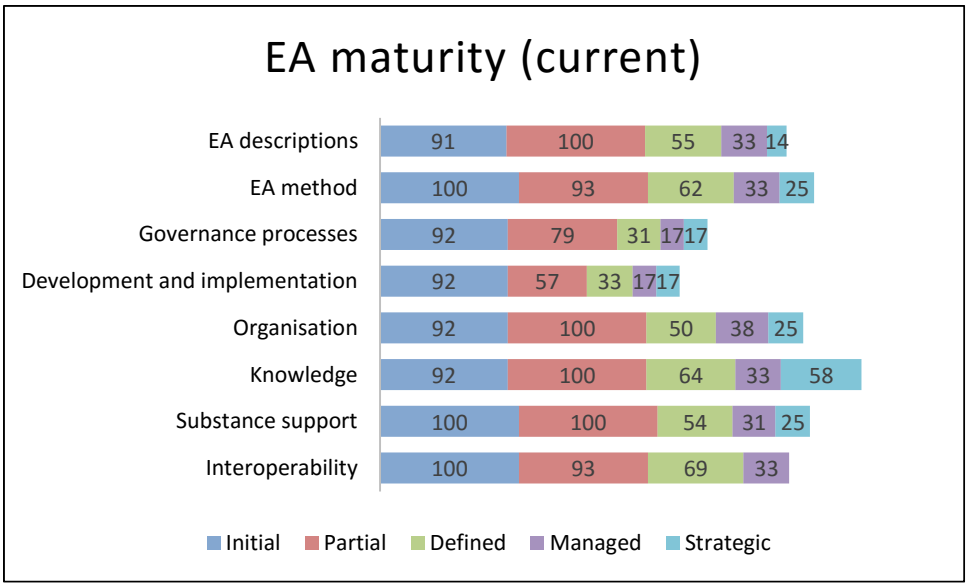

Figure 4: Current EA maturity (percentage)

During the next 6 months HEIs are focusing their efforts to increase the maturity of *EA method* and *governance and processes* domains (Figure 5). Some attention is also given to *Development and implementation* and *Interoperability* domains.

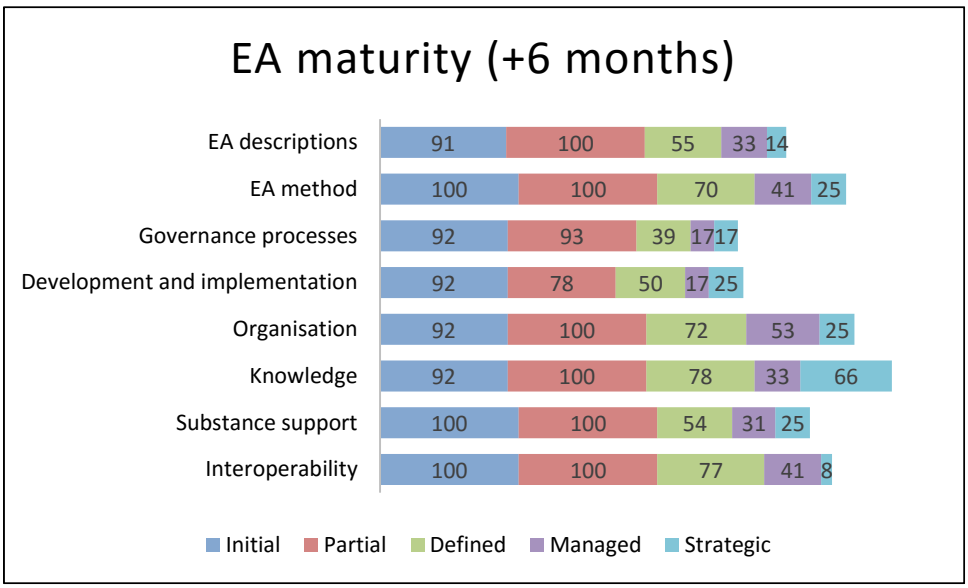

Figure 5: EA maturity after 6 months (percentage)

During the next 12 months the maturity of the different domains are levelling, except for the *development and implementation* (Figure 6). At least 25% of the HEIs will achieve the *strategic level* maturity in one or more domains.

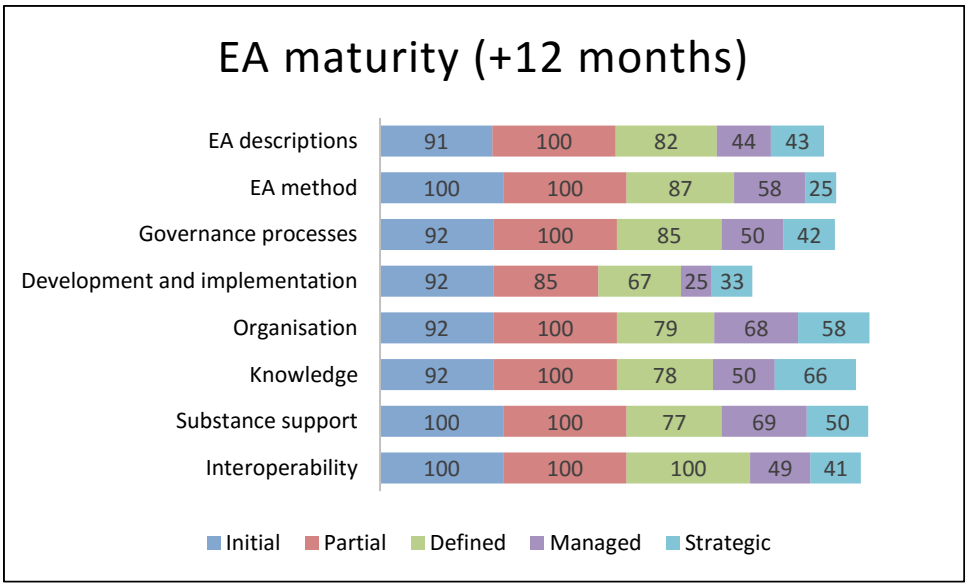

Figure 6: EA maturity after 12 months (percentage)

In 24 months the EA maturity will be on high level. *Substance support* domain will have the highest maturity, as all HEIs will achieve the *managed level* and 75% the *strategic level* (Figure 7). This indicates that HEIs are working with the issues which are relevant to their core-business. Besides the information security, optimising education technology and student success technologies are the top IT issues in 2016 (Grajek, 2016).

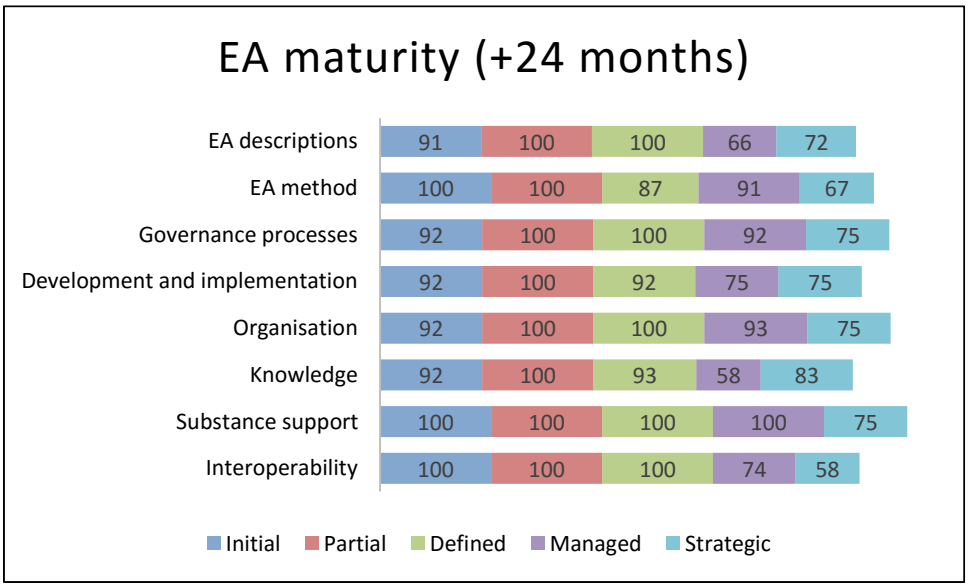

Figure 7: EA maturity after 24 months (percentage)

The overall development of EA maturity is illustrated in Figure 8. The percentage of HEIs achieving the *defined level* is raising steadily from 50% to 100% during the next 24 months. Also the percentage of organisations on the *managed level* and *strategic level* are increasing.

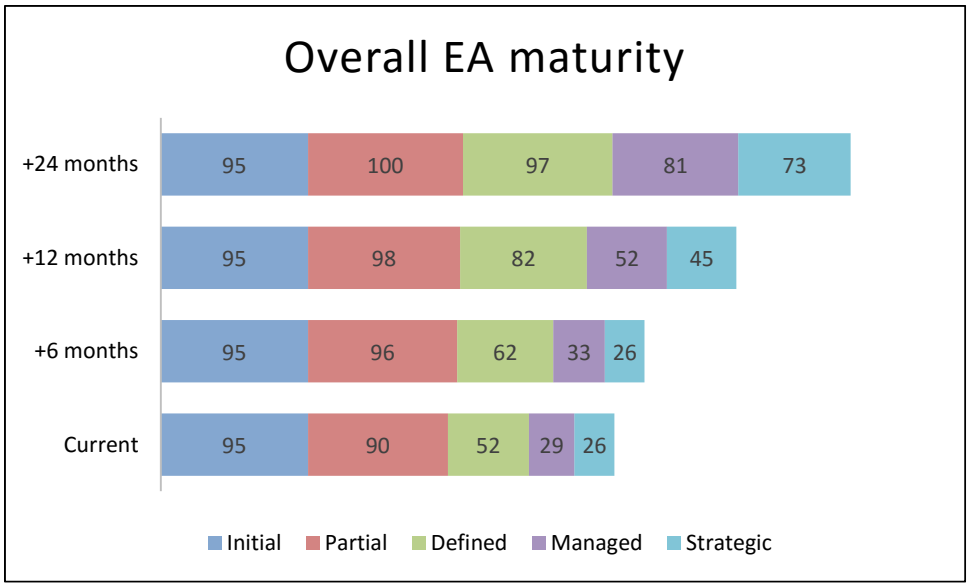

Figure 8: Development of overall EA maturity

4.3. Enterprise Architecture capability maturity

The maturity of EA capability refers to the levels of urgency and significance of each KEMM architecture domain. In other words, how critical and urgent each domain is to HE sector. The maturity of EA capability is illustrated in Figure 9. As it can be seen, *Substance support* is the most significant and urgent maturity domain. Another domain with high urgency is the *Knowledge* domain, which is interesting, as it is currently the most mature domain.

The average of all significance assessments is 2.97 which is in line with the background question average seen in Table 3.

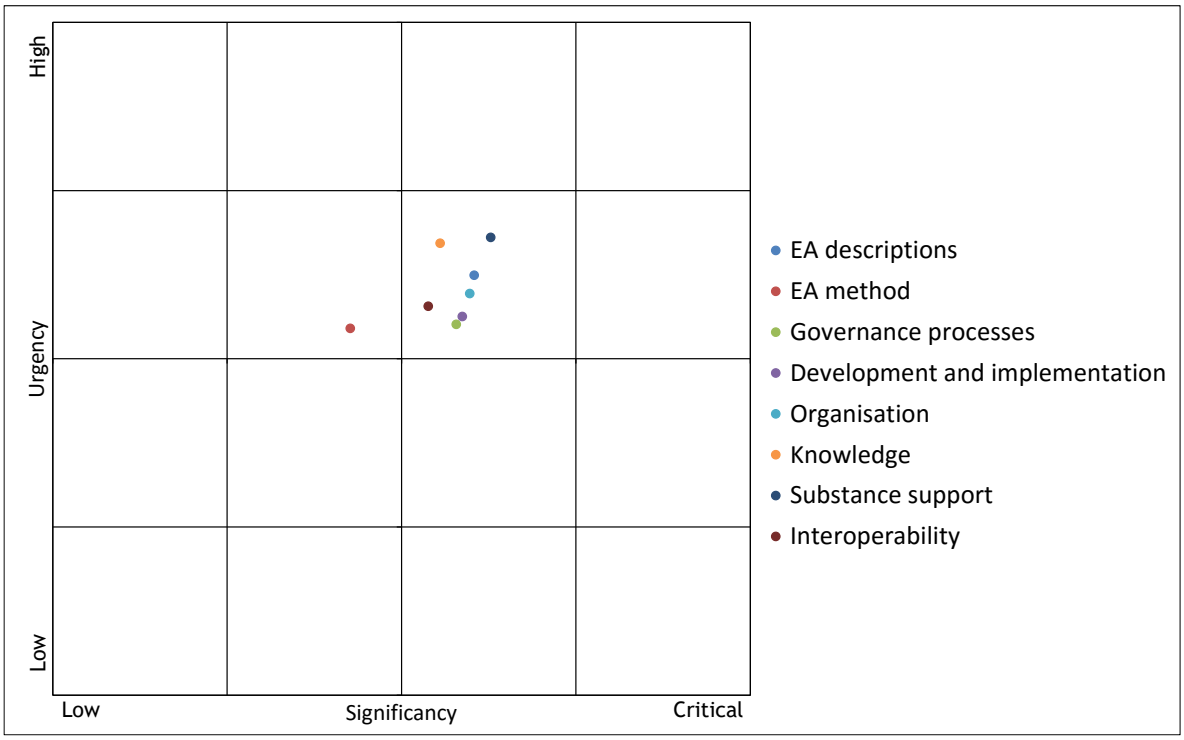

Figure 9 Enterprise Architecture capability maturity (*n*=17)

5. DISCUSSION

This paper presented findings from a recent EA maturity study conducted among Finnish HE sector. As the results indicates, the current EA maturity in Finnish HE sector is still low. Practically all HEIs have achieved the *partial* level but only 50% of the HEIs have achieved the *defined* level. The results are in line with the overall EA maturity of the Finnish public sector (Finnish Ministry of Finance, 2015). According to respondents, the *defined* level will be achieved by all HEIs during the next two years. Time will show whether this estimation is too optimistic or not.

According to the results, Finnish HE sector should focus on increasing the significance of EA work, which is currently relatively low. One way to increase the significance is to increase the awareness of EA and its benefits among the top-management. Also the maturity of *Governance processes* and *Development and implementation* domains should be given attention to. EA training focusing on these domains might help to achieve higher maturity levels.

This paper has some limitations which authors would like to express. The number of the respondents (*n*=19) is too low to make definitive statistical conclusions. There are 40 HEIs in Finland, so, at best, the respondents represent 47.5% of the Finnish HE sector. Therefore, the results and conclusions should be regarded as indicative.

Authors encourages other European HEIs to conduct similar studies to explore the current and future maturity of EA. European wide research would allow HEIs to benchmark their performance against peers and plan their development activities accordingly.

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7. AUTHORS' BIOGRAPHIES

Dr. Nestori Syynimaa MBCS CITP works as an Enterprise Architect for CSC - Finnish IT Center for Science, as a freelance trainer for the leading Finnish ICT-training company Sovelto Plc, and is the founder of Gerenios Ltd. He is also a member of the Finnish EA-SIG. His is experienced trainer in Enterprise Architecture and Office 365. Previously he has worked as CIO, CTO, and senior consultant in ICT industry since 2000. He holds BBA from Seinäjoki University of Applied Sciences and M.Sc. (Econ. & BusAdm with major in CS) from University of Vaasa, Finland. He received his Ph.D. from Henley Business School, University of Reading, UK. His second Ph.D. dissertation on EA is under pre-examination in University of Jyväskylä, Finland. He also holds several industry certificates including TOGAF, ITIL, Microsoft Certified Trainer, Microsoft Certified Educator, and MCSA (Office 365).

Patrik Maltusch is the head of EA architecture team at Aalto University, Finland. He is also chairman of the Finnish EA-SIG and one of the lead educators who have coached administration staff in the national Higher Education EA schooling program. Past experience include working as a customer service instructor for nearly ten years and further fifteen years as network architect and business owner for internal infrastructure design in a global Telco company. Patrik is also a distinguished and accredited security professional, risk manager, system auditor and a certified Higher Education Enterprise Architect. As entrepreneur and start up facilitator Patrik understands what staying practical means for business. For Patrik interoperability is the key to success in an ever growing and more complex and complicated ecosystem landscape. Something that can be achieved using EA methodology in a more visualized way.

Esa Suominen works as an Enterprise Architect at Helsinki Metropolia University of Applied Sciences. He is also secretary of the Finnish EA-SIG. He has long experience in IT sector at HE Institute. He has worked as Team leader at Information System Development group, Project Manager, IT Manager and in IT Support. He holds M. Sc. from University of Lappeenranta, Finland. He is interested in to implement Enterprise architecture and Project Portfolio Management in practical way at organisations.