

# Measuring the value of Enterprise Architecture on IT projects with CHAOS Research

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**Summary.** This paper reports the findings of an explorative quantitative study on the value of Enterprise Architecture (EA) on IT projects. In this study, we contributed to the research on the value of Enterprise Architecture by providing explorative empirical indications for the effects of Enterprise Architecture on 3076 IT projects in 28 organizations. These findings assist an understanding about the various effects of EA. In summation, our study provides strong indications for the value of Enterprise Architecture on IT projects and sets the foundation for further study in the matter.

**Key words:** enterprise architecture, IT projects, value

## INTRODUCTION

Although the variety in definitions of enterprise architecture (EA) does seem to indicate that the field of enterprise architecture is still in its infancy, enterprise architecture is becoming well-accepted, and its importance is growing.

There is a lot of literature on the benefits of enterprise architecture, however there is little empirical evidence of these benefits to be found yet [1]. Empirical evidence would provide much needed credibility for the acclaimed benefits.

But how does one measure this value? This is a very complex question.

We used the theory of Enterprise Engineering and Enterprise Governance [2] for the understanding and theoretical background of enterprise architecture. There, EA is described as a coherent and consistent set of principles and standards which provide normative guidance for the design of (complex) systems. Enterprise architecture consists of 4 main architectures: the business architecture, the organization architecture, the information architecture and finally the technology architecture, where IT architecture is the most important technology architecture today.

But why normative guidance? According to Hoogervorst [2], the major question in realizing a system, which happens intentional and cannot happen by accident, is *how* it is to be realized. Architecture precedes design and is the answer for this question, which implies it must be prescriptive. It cannot be a design (which is a description of a system) by itself but guides how design must be accomplished.

With this definition of EA and as we can consider an information system as a complex system, could we then measure the value of enterprise architecture by measuring the implementation where the design of the information system is realized?

It appears so. In research done in 2010 by Dr. Raymond Slot on the subject of the value of solution architecture [4], in which he studied the effect of architecture on 29 software development projects, he presents the following findings (amongst others):

- 19% decrease in project budget overrun
- 40% decrease in project time overrun
- Increased customer satisfaction, with 0.5 to 1 point – on a scale of 1 to 5
- 10% increase of results delivered

While these findings of Dr. Slot are impressive, and the research was done intensively on these 29 projects, we were not sure if the scale of his research guarantees these results for all real-world software development projects.

Through a partnership of the University of Antwerp Management School and The Standish Group International Inc., which opened their database of IT projects for the first time for academic research [3] we were able to investigate the value of EA on 3076 IT projects.

Do note however that IT projects is just one of the many fields where EA claims to provide value, which means our research only investigates a fraction of the benefits of EA.

## RESEARCH METHOD

In an ideal research environment, we would measure the results of an information system project done without EA, and then do the design and implementation all over again when it has been subjected to EA and measure the results again and compare both. But that is not possible.

### Choice of method

We have chosen an explorative quantitative approach to collect the required information. First by means of a survey, because this method provides a way to receive feedback from a large number of respondents in an acceptable timespan.

This survey provided us with a pool of organizations which have an Enterprise Architecture and information about what year they implemented and effectuated the EA. We identified 28 organizations, which together had done 3076 IT projects from 2007 to 2016 and had implemented an EA between 2011 and 2016.

However, since we could not assume the respondents would and/or could be completely objective, we followed up on these responses by data collection on these organizations and projects in the CHAOS database of The Standish Group.

We compared the end results of projects done without EA to those done subjected to EA to see if EA has any effect. As the projects were done in the same organizations, this allowed us to get a good before and after picture.

The exact approach we followed is shown in Fig. 1 and was performed as follows.

### Research approach

Step 1. Retrieve the contact information from the organizations in the CHAOS database of The Standish Group International Inc.

Step 2. Create a survey asking 1) if the organization has an Enterprise Architecture, and 2) when the Enterprise Architecture has been effectuated.

Step 3. Send the survey to the experts (CIOs, VPs, directors, and PMO project/program managers) of the organizations from Step 1.

Step 4. Select the surveys from respondents that say yes to having an Enterprise Architecture for further analysis, the other and non-responses are archived.

Step 5. Of the remaining organizations, find a time where there are enough projects 'before' and 'after' the introduction of EA. This will give a nice picture since the targets will be the same companies before and after EA.

Step 6. Archive organizations which have an EA before the set date (which don't have enough data before the introduction of EA).

Step 7. Find the projects linked to these organizations in the CHAOS database from step 1.

Step 8. Split the projects up in 'before EA' and 'after EA'

Step 9. Compare the 'before' and 'after EA' projects on indicators of project success and resolution (failed, challenged or successful).

### Argumentation

We wanted to approach our research question by observation in order to gain further understanding of the value of Enterprise Architecture for IT projects. While some effort has been made in the past [4] we felt that the evidence was still lacking

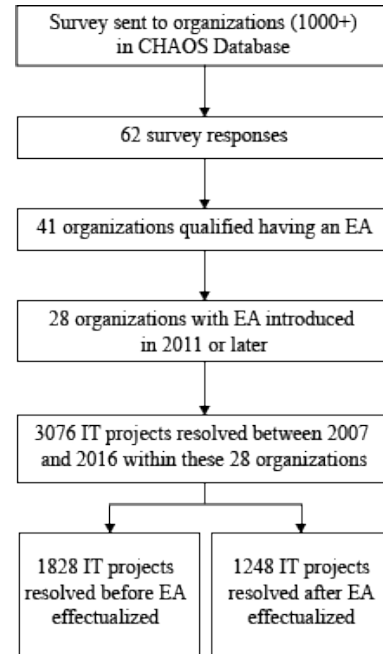


Fig. 1 Research approach flow chart

The Standish Group International has been formally researching the causes of software project success and failure since 1994. [5] Working with members to fill up their project database, it currently exceeds 120,000 registered IT projects (of which 50,000 are actively used). This provides a wealth of information and contacts in the field of project management.

This database, the CHAOS Database, has two parts: organizational profiles and project profiles. Organization profiles hold information about the organizations, while project profiles contain information concerning the projects performed in these organizations. There are about 50,000 current projects from more than 1,000 organizations in the CHAOS Database. The Standish Group collects, adjudicates, and approves about 5,000 new projects per year or an average of five projects per organization. Each organizational profile has 24 data points and each project profile has over 80 data points. [6]

During the last 23 years The Standish Group held the data private and no outside access was permitted. However, on March 8, 2016, at the Antwerp Management School, The Standish Group presented a view into the working of the CHAOS Database.

This research, on the value of EA on IT projects, would be the first joint effort by the Antwerp Management School and The Standish Group. The enormous amount of information on projects and associated organizations would provide us enough data for true empirical research.

Working with the Standish Group on this research, would allow us to send a survey to all their participating organizations and investigate the database to gather the information we need to, at least, provide an adequate answer the research question.

## RESULTS

### Influence of EA with modern resolution of projects

Modern resolution measures projects against the CHAOS database for on time, on budget, and satisfaction. This definition encompasses both a success rate for the project management of a project and for the project itself.

- Successful projects are projects completed on time and on budget, with a satisfactory result.
- Challenged projects are projects that were completed but late, over budget, with unsatisfactory results.
- Failed projects are projects that were cancelled at some point during the development cycle or not used after implementation.

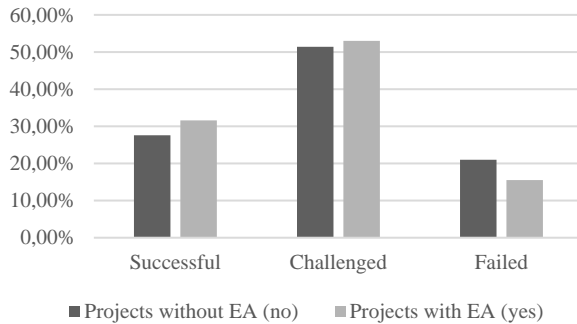


Fig. 2 Success rate of projects with modern resolution

We saw an increase of 14,5% of successful projects, and a decrease of 26,2% of failed projects when the organization has an Enterprise Architecture.

### Influence of EA with traditional resolution of projects

Traditional resolution measures projects against the CHAOS database for on time, on budget, and on target (scope). This means the project was resolved within a reasonable estimated time, stayed within budget, and contained a good number of the specified features and functions.

- Successful projects are projects completed on time and on budget, with all features and functions as initially specified.
- Challenged projects are projects that were completed but late, over budget, and did not meet the target specifications.
- Failed projects are projects that were cancelled at some point during the development cycle or not used after implementation.

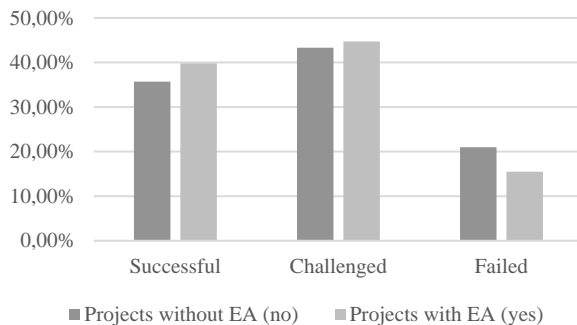


Fig. 3 Success rate of projects with traditional resolution

We can discern an increase of 11,5% of successful projects, and a decrease of 26,2% of failed projects for the organizations with an Enterprise Architecture.

### The value of the projects

Fig. 4 shows the range in value on a five-point scale from very high value to very low value.

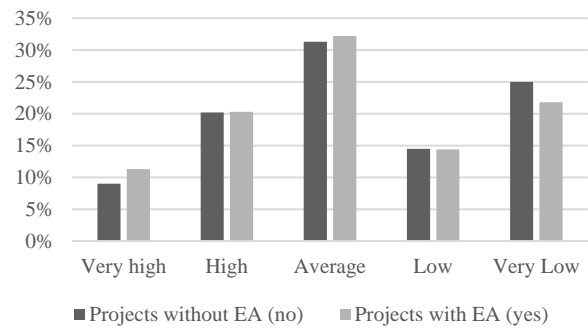


Fig. 4 Perceived value of projects

We saw an increase in the number of projects with very high value by 25,6% and a decrease of projects with very low value by 12,8% for the organizations with an Enterprise Architecture.

### Satisfaction of users/customers with the project

Fig. 5 shows the range in satisfaction (the project delivered customer and user satisfaction regardless of the original scope) on a five-point scale from very satisfied to not satisfied.

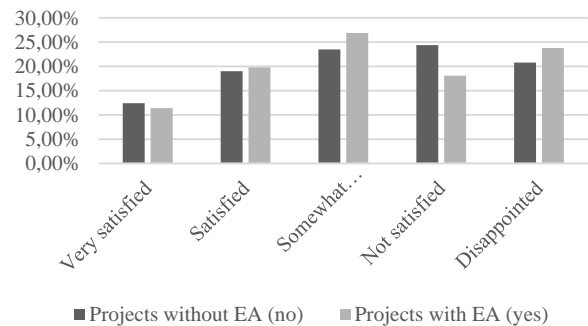


Fig. 5 Satisfaction of user/customers with the project

Interestingly, we saw a decrease of projects scored as 'very satisfied' with 8%, and an increase in projects scored as 'disappointed' with 14,4%.

However, if we put 'very satisfied' and 'satisfied' together and do the same with 'not satisfied' and 'disappointed', as visualized in Fig. 6, we can merely discern a difference in the positive ranges but see a decrease of 7,3% in the negative ranges.

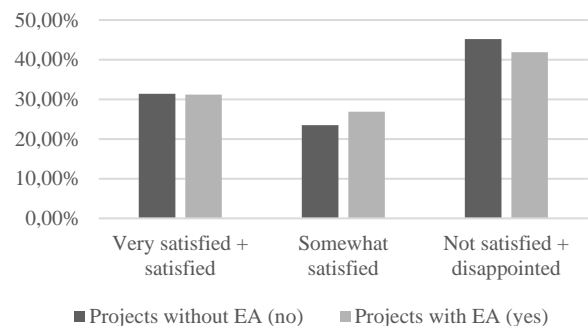


Fig. 6 Satisfaction of user/customers with the project (consolidated)

So, while we see a general move of projects going from 'disappointed' and 'not satisfied' to 'somewhat satisfied', which is a slight improvement, there is a 14,4% increase in projects being scored as 'disappointed'.

**Projects on goal**

Goal (the business objectives for the project are clear) is measured on a five-point scale.

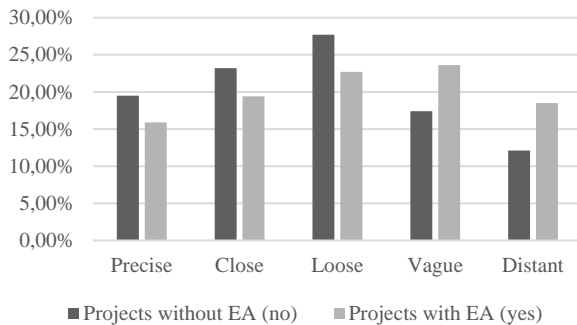


Fig. 7 Projects on goal

We saw a decrease of projects with precise (-18,5%), close (-16,4%) and loose (-16,4%) goals and an increase in projects with vague (+35,6%) and distant (+35,6%) goals.

**Projects on budget**

Has the project stayed within budget? This is a yes or no binary question.

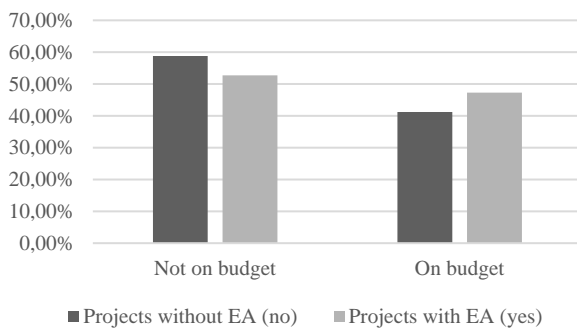


Fig. 8 Projects on budget

We saw a decrease of projects which weren't completed on budget with 10,4% and an increase of projects on budget with 14,8%.

**Projects on time**

Was the project resolved within a reasonable estimated time? This is a yes or no binary question.

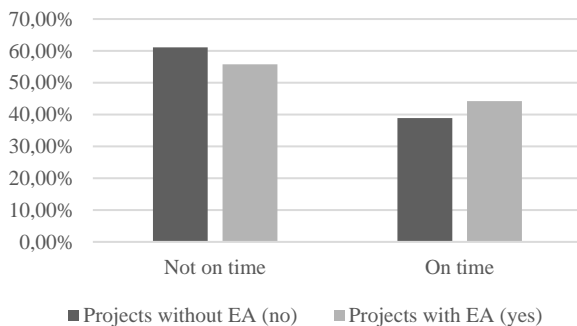


Fig. 9 Projects on time

We saw a decrease of projects which weren't finished on time with 8,7% and an increase of projects on time with 13,6%.

**Projects on target**

Did the project contain a good number of the specified features and functions? This is a yes or no binary question.

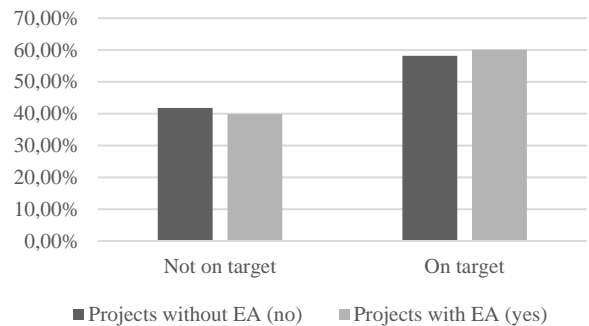


Fig. 10 Projects on target

We saw a decrease of projects not on target with 4,5% and increase of projects on target with 3,3%

**Projects by size**

In the CHAOS database the project size scales from Small to Grand. The project size is determined by the following parameters:

Size	Cost	Team members	Length
<b>Small</b>	Under \$1 million labor	6 or less	6 or less months
<b>Moderate</b>	\$1 million to \$3 million	7 to 12	7 months to 1 year
<b>Medium</b>	\$3 million to \$6 million	13 to 24	1 to 2 years
<b>Large</b>	\$6 million to \$10 million	25 to 50	2 to 4 years
<b>Grand</b>	Over \$10 million	Over 50	More than 4 years

Fig. 11 Project sizes

**Success rate of small projects with modern resolution**

A total of 859 projects qualify as small projects. Of these, 467 projects were executed without EA and 392 projects with EA.

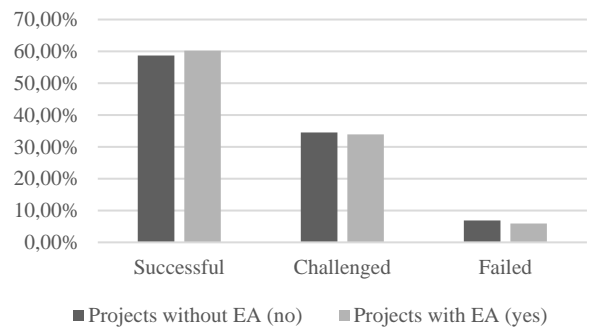


Fig. 12 Success rate of small projects with modern resolution

We saw an increase of successful projects with 2,6%, a decrease of challenged projects with 1,7% and a decrease of failed projects with 14,5%.

### Success rate of medium and moderate sized projects with modern resolution

A total of 1501 projects qualify as medium or moderate sized projects. Of these, 905 projects were executed without EA and 596 projects with EA.

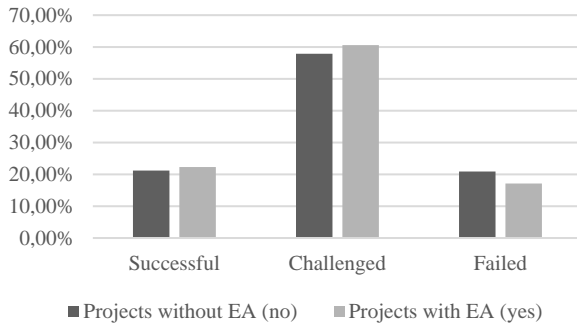


Fig. 13 Success rate of medium & moderate sized projects with modern resolution

We saw an increase of successful projects with 5,2%, an increase of challenged projects with 4,7% and a decrease of failed projects with 18,2%.

### Success rate of large and grand projects with modern resolution

A total of 716 projects qualify as large and grand projects. Of these, 456 projects were executed without EA and 260 projects with EA.

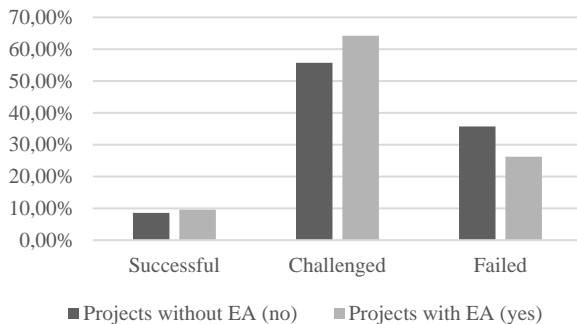


Fig. 14 Success rate of large and grand projects with modern resolution

We saw an increase of successful projects with 11,6%, an increase of challenged projects with 15,3% and a decrease of failed projects with 26,6%.

### Success rate of only grand projects with modern resolution

A total of 228 projects qualify as large and grand projects. Of these, 155 projects were executed without EA and 73 projects with EA.

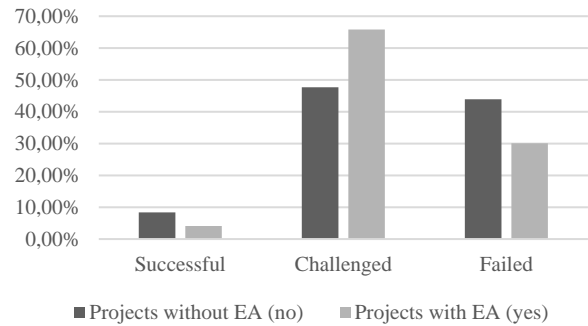


Fig. 15 Success rate of grand projects

We saw a decrease of successful projects with 51,2%, an increase of challenged projects with 37,9% and a decrease of failed projects with 31,4%.

## DISCUSSION

The first results from the survey looked promising. Of the respondents who had an Enterprise Architecture only 10% of the respondents thought that EA would bring no value at all, which means that 90% of the respondents thought EA would bring value to the table for projects. These results were in line with our hypothesis.

When investigating the 3076 projects executed by these 28 organizations, we also saw indications of advantages. When looking at the project end state, using the Modern Resolution we see an increase of 14,5% of successful projects, and a decrease of 26,2% of failed projects when the organization has an Enterprise Architecture. These results also came back using the traditional resolution: we could discern an increase of 11,48% of successful projects, and a decrease of 26,19% of failed projects for the organizations with an Enterprise Architecture. The slight difference between these resolutions is explained by the use of a different indicator. The traditional resolution measures the 'On Target' indicator, whereas the Modern Resolution measures the customer satisfaction.

### Tentative indications

#### Less failed projects after the introduction of EA

Over the whole line we can see a decrease in the number of failed projects after the introduction of EA, with an average decrease of 5,5 percent points (pp) or 26,2%.

#### More successful projects after the introduction of EA

We also see an increase in the number of successful projects, with an average increase of 4 percent points or 14,5%.

There is an exception for grand projects where we see a decrease of successful projects by 4,3 percent points or 51,2%.

#### Influence on traditional indicators of project success

We see an increase of 1,9 pp or 3,9% of projects which are on target, a 5,3 pp or 13,6% increase of projects delivered on time, and a 6,1 pp or 14,8% increase of projects on budget.

These observations seem to (partly) support the findings of Dr. Slot, so were not unexpected.

### Influence on modern indicators of project success

We were rather surprised with the results of the On Goal indicator (Fig. 7). As principles add to the requirements of the projects, we would expect the project goals to become clearer. We saw an opposite effect after the introduction of EA; project goals become more vague and distant and less precise and clear.

While The Standish Group sees this as a positive thing, it is hard to imagine that EA is the cause of this. There might be other variables at play here like the development process (agile versus waterfall), which we didn't investigate. We don't know either how much this variable or variables effect the rest of our research. Of course, there could be principles which guide software development projects to more agile methods, but this is just speculation. Is this an effect or a cause? In any case, further research is necessary.

We didn't observe more projects with a satisfactory result but do observe less projects with unsatisfactory results. However, the number of projects with a truly disappointing result did decrease.

We can see an increase in the number of projects with very high value by 2,3 pp or 25,56% and a decrease of projects with very low value by 3,2 pp or 12,8% for the projects subjected to Enterprise Architecture.

### The larger the projects get, the less successful they become

The relative number of successful projects decreases the larger the projects get, which is on par with the observations of The Standish Group [7], so nothing surprising there.

### The larger the project size, the more value EA has (until a certain point)

Although the success of projects drops the larger they get, apparently, the larger the projects gets, the more value EA has (with grand projects as an exception, as seen in Fig. 15). This is visualized in Fig. 16.

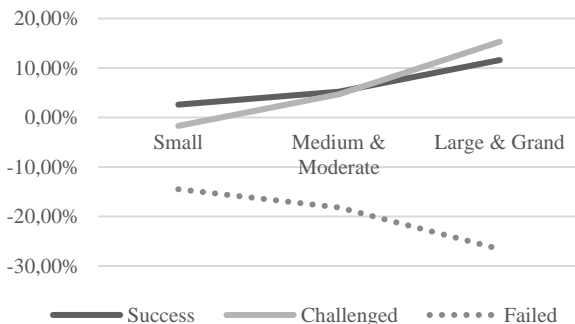


Fig. 16 Influence of EA on projects

We observe that with the introduction of EA the percent change of successful and challenged projects positively increases going from small up to large and grand projects.

At the same time, we see a decrease in failed projects going from small to large and grand projects.

We can assume that the larger the project gets, the more requirements and the bigger designs get. We speculate that with a larger design, the value of EA becomes more apparent, because the larger a design gets it will be subjected to more principles that guide the design.

The Enterprise Architecture most likely has more effect on the design of the system to be developed, then on the project process to realize the system. This is shown in the Generic System Development Process (GSDP) model [8] [9], where architecture touches the function and constructional design, but not the engineering and implementation.

However, if we look at grand projects alone, we see a more than 50% decrease in successful projects. Research by The Standish Group already

indicates that only 5% of the Grand projects are successful [7]. Maybe this size of projects might not even be helped by EA because of the sheer number of requirements which might conflict with existing principles. Have we passed some critical border? In any case, this requires more research into the matter.

Is enterprise architecture then a panacea for IT projects? Using the CHAOS database allows us to put the value of EA in perspective of other 'variables', like the project size, agile vs waterfall process, effectiveness and maturity of the project sponsor, among others. While not conclusive yet, our research indicates it to be of 'moderate' influence, less than having a good sponsor, a small project size, or an agile process, but more than project management frameworks, like PRINCE2. This is not that unexpected, in our view, as EA predominantly has influence on design, not on the execution of the project.

As our research only was of exploratory nature, much more research in the matter has still to be done. First indicative follow-up research hints that the value of EA is most to be found in pre- and post-implementation.

### IMPLICATIONS

#### Implications for practice

While the findings hint that there might be (significant) value in EA for IT projects, this is still explorative research. This means we cannot make any conclusive recommendations yet.

#### Implications for research

As this research gives significant indications for value of Enterprise Architecture on IT projects, it is imperative that this should be further investigated in order to provide a definitive and conclusive answer.

### CONCLUSION

In this study, we contribute to the research on the value of Enterprise Architecture by providing explorative empirical indications for the effects of Enterprise Architecture on IT projects. These findings assist an understanding about the various effects of EA. In summation, our study provides strong indications for the value of Enterprise Architecture on IT projects and sets the foundation for further study in the matter.

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