THE RELATIONS BETWEEN IT WORK DISTRIBUTION, PROJECT BENEFITS MANAGEMENT AND ORGANIZATIONAL PERFORMANCE

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***Abstract*:**
In this paper we study the distribution of effort across IT development and maintenance activities, termed IT work distribution. We surveyed 87 Norwegian organizations as part of a longitudinal analysis including data for several decades. Between 1998 and 2018 we observe a stable pattern of IT work distribution with no increase in the amount of work that organizations put into value adding activities. Organizations that channeled more effort into value-adding activities reported significantly better realized benefits from their IT activities, a higher degree of competitiveness, and adopted IT project benefits management practices to a greater extent compared with others. We propose future studies to uncover potential causal relationships between our studied practices.

Keywords*:* *IT work distribution, IT projects, benefits management, benefits, competitiveness*

1 INTRODUCTION

For decades, practitioners and researchers have been seeking to find ways to improve the return from IT investments and efficient and effective ways of carrying out post-IT project activities such as maintenance and operations. Much research has focused on improving outcome of IT projects, while less research appears to also consider value that comes from maintenance activities. The body of research seeking to drive value from IT investments is vast, including software economics (Boehm, 1984; Boehm and Sullivan, 2000), value-based software engineering (Boehm, 2003; Boehm and Huang, 2003), benefits management practices (e.g., Ward et al., 1996; Ward et al., 2007; Zwikael, 2016; Laursen and Svejvig, 2016; Ul Musawir et al., 2017) and project portfolio management (De Reyck et al., 2005). Recognizing that IT related work often are organized in projects, researchers have also investigated various dimensions of IT project success and failure (e.g., Flyvbjerg and Budzier, 2011; Holgeid and Thompson, 2013; Sauer et al., 2007). It seems to be consensus that, given the vast amounts of money used on IT, even small improvements in value generation from this activity might carry large value for organizations, citizens, and societies (e.g., Goldfinch, 2007).

Boehm and Sullivan (1999, p. 937) suggest that "*Software is valuable when it produces information in a manner that enables people and systems to meet their objectives more effectively*". Given rapid changes in technology, researchers have stressed the importance of balancing effort on exploiting legacy systems and exploring new value adding IT initiatives (see, e.g., Luger et al., 2018; Horlach et al., 2017). The aim of both software development and maintenance activities is to ensure information system support to be relevant to the organization so that it contributes to the fulfilment of organizational needs. Studies have investigated work efficiency in relation to software maintenance (e.g., Concas et al., 2013). For the last three decades researchers have been studying various categories of development and maintenance activities (e.g., Lientz and Swanson, 1980; Krogstie and Sølvberg, 1994; Holgeid et al., 2000; Krogstie et al., 2006; Davidsen and Krogstie, 2010; Krogstie and Veld, 2015). Several of the studies have investigated the degree to which organizations are able to channel their effort into evolving their application portfolio towards functional

coverage expansion (termed application portfolio evolution), versus effort to keep current systems afloat (termed application portfolio upkeep).

While previous studies have provided IT work distribution statistics, there is not much research that have investigated associations between work distribution and performance characteristics such as actual benefits realization or competitive performance characteristics (Mikalef and Pateli, 2017). Nor have previous studies, to our knowledge, investigated variations in work distribution in relation to the adoption of management practices intended to improve value from IT related work. If IT work distribution has connections with actual benefits realization and competitive performance, organizations can aim at optimizing work distribution accordingly. As much IT related work are organized in projects, we find it especially interesting to view IT work distribution in relation to IT project benefits management that involves practices such as IT project business case creation, benefits management during project execution, and post-project benefits harvesting that extends benefits management well beyond the boundary of the project lifecycle (Ward et al., 1996). If benefits management practices are associated with specific IT work distribution characteristics, benefits realization and competitive performance, organizations have yet another lever to pull to achieve higher levels of performance. Uncovering connections between IT work distribution, benefits management and value creation can be of practical use in organizations that seek to improve return on their IT investments.

In this paper we present the results from a survey investigation performed in Norwegian organizations between end of 2018/early 2019, following up a five years cycle of similar investigations since 1993. We seek to better understand the effort organizations put into IT development and maintenance. Further, we investigate how IT work distribution relates to the adoption of benefits management practices. Finally, we try to uncover association between IT work distribution, benefits management and performance characteristics measured by benefits realization and competitive performance factors. Such advancement of knowledge can potentially help organizations to be evidence based when choosing management practices in their quest for improved IT investment return (Kitchenham et al., 2004; Dybå et al., 2005).

Motivated by a wish to contribute to improving the rate of return from IT-related activities, we established the following main research questions that will be further hypothesized in a separate section.

RQ1: How does work distribution in our sample of organizations correspond with previous studies?

RQ2: How does benefits management relate to distribution of work, with emphasis on total application portfolio upkeep and value-adding application portfolio evolution activities?

RQ3: How do work distribution and benefits management relate to high performance characteristics such as realized benefits, competitiveness, financial performance, and customer satisfaction?

The remainder of this paper is structured as follows. The next section presents a background by highlighting basic concepts and previous work. Then, we introduce our hypotheses followed by the survey design and the survey results. We reflect on the validity and limitations of this study and summarizes our results relative to the hypotheses and suggests future work.

2 BACKGROUND

In this section, we will first present basic concepts related to work distribution before we give a brief overview of benefits management.

2.1 IT Work distribution

Effort related to development and maintenance can be split into various types. In this paper we use "*IT work distribution"* for the distribution of effort across activity types presented in FIGURE 1. The activity types are well established among researchers; categories of work were originally defined by Swanson (1976) and have been gradually refined (Krogstie, 1995; Krogstie and Veld, 2015). *Corrective maintenance* (FIGURE 1, 2a) is performed to identify and correct processing, performance, and implementation failures; *adaptive maintenance* (2b) is performed to adapt software to its changing technical environment; *non-functional perfective maintenance* (2c) is performed for example to improve performance and enhance maintainability

of the software; *functional perfective maintenance* (1a) is performed to change or add new program features. Software development efforts are split between *development of replacement systems* (2d) and *development of new systems with new functionality* (1b). Application portfolio upkeep is the effort needed to keep the existing application portfolio afloat (2a, 2b, 2c and 2d). User support (3) and IT operations (4) are included in total application portfolio upkeep. Application portfolio evolution consists of activities that help advance the IT portfolio by adding or enhancing functionality (1a and 1b).

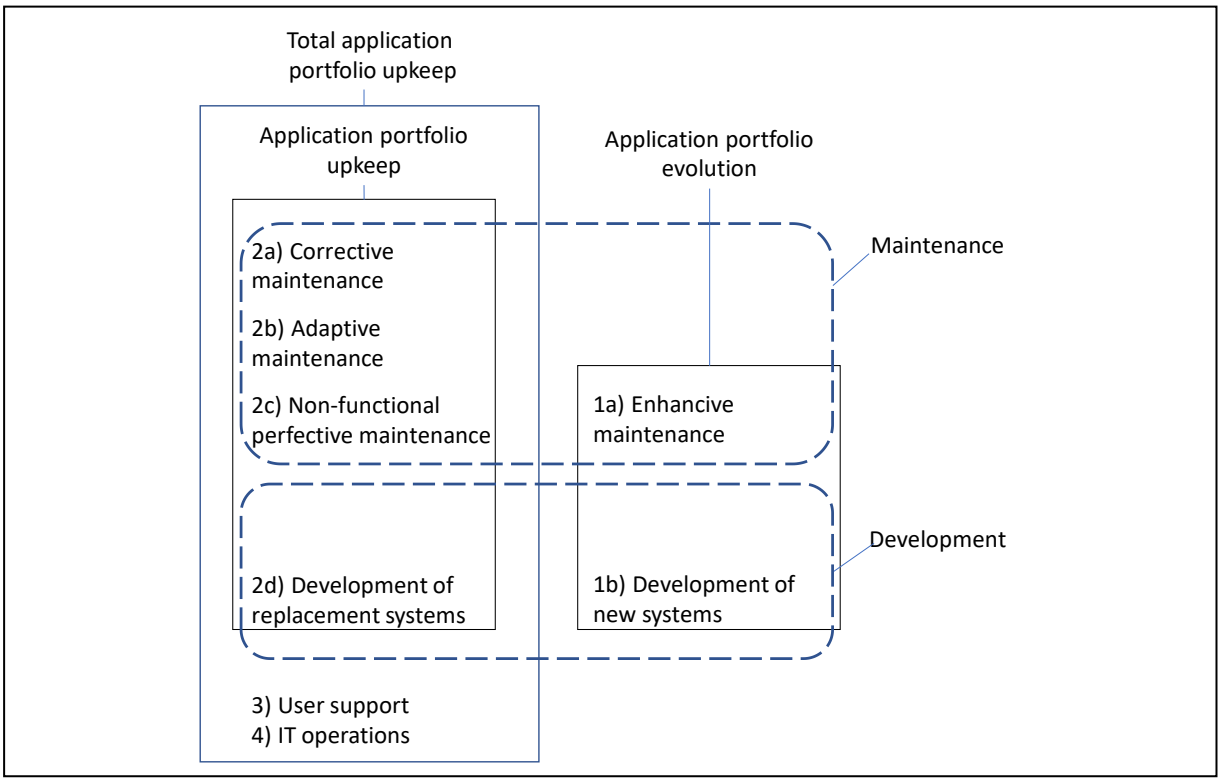

FIGURE 1: TYPES OF DEVELOPMENT AND MAINTENANCE ACTIVITIES

Six previous studies form the basis for our longitudinal analysis of work distribution. Lientz and Swanson (1980) report a 1977 study of American organizations, and an array of studies of Norwegian organizations have been carried out with 5-year intervals: surveys carried out in 1993 (Krogstie and Sølvberg, 1994); in 1998 (Holgeid et al., 2000); in 2003 (Krogstie et al., 2006); in 2008 (Davidsen and Krogstie, 2010); and in 2013 (Krogstie and Veld, 2015). The previous studies have mainly focused on assessing the work distribution and compared it with previous studies to uncover changing patterns in how IT-related activities are distributed across the various work categories, with an emphasis on understanding the share of work going into activities that are presumed to add business value, such as application portfolio evolution, versus work performed to keep the systems afloat. The previous studies have to a limited extent sought explanation of the various work distributions by for example trying to relate IT work distribution to the use of management practices that potentially might help foster an orientation towards improved value from IT-related activities. In the following we will introduce one such practice: Benefits management.

2.2 Benefits management

IT benefits management is defined by Ward et al. (1996) as "(t)he process of organizing and managing so that potential benefits arising from the use of IT are actually realized" (p. 214). Ward et al. established a process model with five elements: (1) *identifying and structuring benefits* is concerned with the identification of benefits and considerations of how to measure the benefits; (2) *planning benefits realization* encompasses all activities needed to realize each benefit, including potential process and organizational changes; (3) *executing the benefits realization plan* is the actual implementation of the benefits plan as an integral part of the project management plan; (4) *evaluating and reviewing results* is concerned with the evaluation of actual

benefits delivered, as well as identification of actions to recover missed benefits; and (5) *potential for further benefits* is about further capitalization on the investments made.

Target benefits are found to be effective when they are comprehensive by reflecting the view of stakeholders, specific, and attainable (Zwikael et al., 2018). Ul Musawir et al. (2017) found benefits management to have a significant positive correlation with project success; both project management success (cost, time, quality/scope), project ownership success (project owner's success in realizing the business case) and project investment success (actual value generated from the investment). Other researchers have found the use of benefits management to be positively related to the level of confidence in successful benefits delivery (Lin and Liu, 2005). Other researchers have found various patterns of management practice adoption to indicate increased success in benefits delivery. Ward et al. (2007) and Jørgensen (2016) found successful delivery of client benefits to be associated with the application of benefits management practices during project execution, avoiding fixed-price contracts, putting less focus on low price in the selection of providers, and application of core agile practices. Jørgensen et al. (2017) found similar characteristics: different project outcomes were associated with different contract types, variations in how the provider is selected, how the client is involved in the project, the use of agile practices, and the use of benefit management during project.

The depth and breadth of organization-wide integration of benefits management has been found indirectly to enable organizations to achieve planned strategic goals by reinforcing project portfolio management processes, and alignment of business and IT increase this effect (Mohan and Ahlemann, 2014). Both project management and benefits management practices have been reported to be required for ensuring project investment success (Badewi, 2016). Benefits management has been reported to be perceived as having high effectiveness, but to be hard to implement (De Haes and Van Grembergen, 2008). In general, benefits seem hard to quantify (Flak et al., 2008; Terlizzi and Albertin, 2017). Terlizzi and Albertin (2017) found a number of barriers to benefits management adoption: benefits seem hard to quantify and difficult to isolate from other initiatives; benefits management appears hard to adopt in agile settings due to continuous value delivery (this has recently been addressed by Hannay et al. (2017)); the process can be slow and bureaucratic; controlling costs and benefits constitutes a non-mandatory task; there is a lack of knowledge of benefits management; difficulty is found in using tools and techniques (such as calculating NPV); and there is resistance from managers in implementing necessary controls to identify and assess benefits.

The dynamics of an organization and its environment call for continuous review of the projects through the lifecycle, and the progress needs to be monitored on an ongoing basis against the business case (e.g., Doherty et al., 2008; Doherty et al. 2012; Franken et al., 2009). The ability to continuously review benefits realization in projects comes with great promise to increase the probability for successful benefits realization (Mohan et al., 2016). In a study investigating how 36 companies in Australia defined and measured the success of IT projects, Thomas and Fernandez (2008) report, "We found that companies that formally defined success, consistently measured success and acted on the results, had improved IT project outcomes and better utilized project resources" (p. 739). Papers such as those of Peppard et al. (2007) and Maes et al. (2017) stress the importance of a continuous focus on benefits throughout (and beyond) the project execution, and ongoing focus and commitment to the benefits are required for effective benefits realization. Such attention should also be directed towards change management to ensure that actual benefits are realized (Lin and Pervan, 2003; Ward et al., 1996).

Researchers have reported that organizations typically put an emphasis on benefits management in the early phases of a project, i.e., identification of benefits and business creations, and that organizations lack a lifecycle perspective on benefits management where benefits are managed throughout and beyond the project (e.g., Ashurst et al., 2008; Hellang et al., 2012; Ward et al., 1996; Ward et al., 2007). Typically, organizations adopting benefits management do so by taking a rather fragmented approach, by adopting a benefits identification process or business case creation to document the rationale for investment approval. Instead of a continuous and structured approach towards benefits management, researchers have found ad hoc and fragmented approaches to be common (Berghout et al., 2011; Kuiper et al., 2011; Smith et al., 2008).

3 HYPOTHESES

The following hypotheses were formulated to answer the research questions presented in the introduction. We formulated an inter-investigational hypothesis to compare our results with results from previous investigations, and intra-investigational hypotheses to consider associations within our data.

3.1 Inter-investigational hypothesis

The IT work distribution has been quite stable since 1998 as is elaborated in the results section: the level of maintenance activity has been between 73% and 66%, and the level of application portfolio evolution has been between 35% and 39%. We expected the work distribution in our present study to remain within this range, although we would be pleasantly surprised to see a shift of effort from application portfolio upkeep to application portfolio evolution. We formulated the following inter-investigational hypothesis.

H1 *(related to RQ1)*: There is no difference between the percentage of time spent on application portfolio evolution in our survey and what has been previously reported.

3.2 Intra-investigational hypotheses

Several studies have shown positive effects of benefits management practices on actual benefits delivery, some already introduced in the background section. Other contributions include, e.g., Lin et al. (2007), Serra and Kunc (2015), Smith et al. (2008) and Standing and Lin (2007). Researchers have found positive effects on actual benefits realization from the identification and structuring of benefits (Badewi, 2016; Jørgensen, 2016; Ward et al., 2007), planning benefits realization (Jørgensen, 2016; Mohan and Ahlemann, 2014; Mohan et al., 2016), benefits management practices during project execution (Jørgensen, 2016; Jørgensen et al., 2017; Mohan and Ahlemann. 2014), and evaluating and reviewing realized benefits (Jørgensen, 2016; Mohan and Ahlemann, 2014; Mohan et al., 2016; Thomas et al., 2007; Ward et al., 1996). Overwhelming empirical evidence seem to show that organizations that are adopting benefits management practices do reap higher levels of benefits for the business. We were curious if organizations that manage benefits also put more effort into value adding activities such as application portfolio evolution (defined as enhancive maintenance and new development, see *FIGURE 1*) compared with organizations without distinct practices for driving benefits from IT activities. One might expect that organizations with attention to benefits would try to channel its resources towards value adding activities.

Potential associations between management practices should be interpreted with caution as they can be affected by how the practices are adopted. For example, although benefits management practices reach far beyond project borders, prior research have found benefits management practices to seldom be performed in the post-project period (see the background section). Therefore, the occurrence of benefits management practices in relation to maintenance activities such as corrective maintenance not organized in projects, might be rare. Further, we recognize that there might be many reasons for an organization's IT work distribution, thus potential associations with one single management practice need to be interpreted with caution. However, as benefits management per definition is a process of organizing and managing so benefits from IT can be realized (Ward et al., 1996), and is a process that extends throughout – and beyond – the project lifecycle, we formulated the following hypothesis.

H2 *(related to RQ2)*: There is no difference between the percentage of time spent on total application portfolio upkeep and application portfolio evolution between organizations that to a larger or smaller degree adopt benefits management.

As a reaction to rapid innovations in the digital era, researchers and practitioners have suggested a two-speed approach when considering IT work in traditional organizations, often presented as "bimodal IT" defined as "*the practice of managing two separate, coherent modes of IT delivery, one focused on stability and the other on agility. Mode 1 is traditional and sequential, emphasizing safety and accuracy. Mode 2 is exploratory and nonlinear, emphasizing agility and speed*" (Horlach et al. 2017 referencing Gartner, 2015). Legacy applications in traditional organizations might be subject to Mode 1 and leveraging new technologies might call for a more exploratory approach (Mode 2). Organizations might run into a dilemma; how to continuously balance the need for *exploiting* the legacy systems which serve core business processes today while also *exploring* new possibilities for achieving competitive advantage tomorrow by, e.g., evolving their application portfolio by developing new functionality. Proper balancing of *explore* and *exploit* can be

rewarding as presented by Luger et al. (2018) who describe *ambidexterity* as the ability to dynamically balance exploration and exploitation, "*[..] which emerges from combining capability building processes (to balance exploration and exploitation) with capability-shifting processes (to adapt the exploration–exploitation balance)*" (Luger et al., 2018, p. 449). Rothaermel and Alexandre (2009) propose to "*simultaneously extend the definition of ambidexterity to balance different activities in a trade-off situation*", and state "*Although managing these trade-offs frequently presents nontrivial organizational challenges, we further suggest that an organization's ability to reconcile and harness these trade-offs can enable it to effectively improve the firm's performance*" (p. 759). Lee et al. (2015) found IT ambidexterity to enhance organizational agility which is ability to effectively sense and respond to market conditions. Organizations need to adapt to a changing business environment. Those that can set aside resources for developing new functionality while at the same time are able to leverage existing assets will likely be better able to address new business needs, and thus perform better. We formulate the following hypothesis, and we are aware of no previous studies investigating distribution of work in relation to performance characteristics such as benefits realization and competitive performance characteristics including financial performance and customer satisfaction (Mikalef and Pateli, 2017).

H3 *(related to RQ3)*: There is no difference in percentage of time spent on application portfolio evolution between organizations that report the following:

- (H3a): high levels of perceived realized benefits from IT investments compared with organizations with lower levels of realized benefits.
- (H3b): high levels of perceived competitiveness compared with organizations with lower levels of competitiveness.
- (H3c): high levels of perceived financial performance compared with organizations with lower levels of financial performance.
- (H3d): high levels of perceived customer/user satisfaction compared with organizations with lower levels of customer/user satisfaction.

There might well be a connection between H2 and H3 in that if H2 is rejected and we find that organizations high on application portfolio evolution also adopt practices proven to have a positive impact on benefits, then H3 should also be expected to be rejected.

4 SURVEY DESIGN AND DEMOGRAPHIC DATA

A survey was conducted in the end of 2018 aimed at Norwegian professionals representing a wide array of private and public organizations. An online survey was designed using the survey tool SurveyGizmo, and several test runs of the survey were performed. The questionnaire was sent to 735 organizations. A total of 684 received the questionnaire as 43 of the emails bounced and eight were not delivered. We requested the survey to be completed by senior IT managers or individuals that were knowledgeable about IT investments and related practices in their organization. The respondents were anonymous, as were their projects and organizations.

The questionnaire had four main parts. Part I asked for demographic information, such as years of experience and sector (private/public). Part II asked questions regarding IT work distribution, in line with previous investigations such as those of Krogstie and Sølvberg (1994), Holgeid et al. (2000), Krogstie et al. (2006), Davidsen and Krogstie (2010), and Krogstie and Veld (2015). Part III asked questions regarding adoption of benefits management practices and the level of benefits realized from the organizations' IT investments. The questions were based on several previous studies, including those of Ward et al. (1996) and Ward et al. (2007). Part IV asked questions to establish an indication of the organizations' competitive performance, financial performance, and customer satisfaction. Part IV was inspired by the measurements of competitive performance used by Mikalef and Pateli (2017). Relevant questions from the form is found at https://folk.idi.ntnu.no/krogstie/publications/2019/Nokobit/survey.pdf

The sample of respondents had the following characteristics:

- A total of 87 valid responses were collected, which is 12.7% of the 684 organizations that received the questionnaire. The number of respondents are higher than the other Norwegian studies that we compare

with, and the valid response rate is within the range of previous studies (10.7%–22.3%); Krogstie and Sølvberg (1994) received 52 valid responses (14.9%), Holgeid et al. (2000) had 53 valid responses (10.7%), Krogstie et al. (2006) had 54 valid responses (22%), Davidsen and Krogstie (2010) had 67 valid responses (22.3%), and Krogstie and Veld (2015) had 68 valid responses (17.5%).

- Of the respondents, 67 (77%) were employed in the private sector and 23% (20) in the public sector.
- Most of the respondents had several years of experience at their current organizations: 11–20 years of experience, 34% (30); 5–10 years, 54% (47); 2–4 years, 10% (9); and 0–1 year, 1% (1).
- The organizations' IT departments had between 6 and 150 employees (mean 30.7, median 25, std. dev. 38.6, and between 1 and 40 consultants (mean 7.3, median 4, std. dev. 9.0).

5 RESULTS

We analyzed the survey responses by using SPSS and non-parametric Mann–Whitney tests, not assuming normality of the response variables. In statistical analysis, erroneous conclusions can be drawn if effect sizes are not considered in addition to statistical significance (Kampenes et al., 2007). Where applicable, we therefore include a representation of the effect size by showing mean ranks.

TABLE 1: DISTRIBUTION OF TYPE OF WORK

ID	Type of work	N	Min. %	Max %	Mean %	Std. Dev.
1	Corrective maintenance	88	5	21	11	0.055
2	Adaptive maint. (e.g., adjusting existing system to new architecture)	88	5	21	9	0.034
3	Enhancive maintenance (new functionality)	88	5	40	12	0.046
4	Perfective maintenance (enhance non-functional characteristics)	88	5	15	8	0.024
5	Replacement system	88	0	33	9	0.045
6	New development with new functionality	88	5	25	8	0.032
7	Operations	88	2	35	22	0.068
8	User support	88	1	30	21	0.059
9	Maintenance = 1+2+3+4	88	25	83	40	0.099
10	Development = 5+6	88	10	50	17	0.062
11	Maintenance as % of total = 9 / (9+10)	88	36	88	70	0.077
12	Development as % of total = 10 / (9+10)	88	12	64	30	0.077
13	Application portfolio evolution = 3+6	88	15	51	20	0.056
14	Application portfolio evolution as % of maint.+dev.=(3+6)/(9+10)	88	21	55	35	0.074
15	Total upkeep, user support and operations = 1+2+4+5+7+8	88	49	85	80	0.056

TABLE 2: DISTRIBUTION OF TYPE OF WORK COMPARED WITH PREVIOUS INVESTIGATIONS

ID	Category	Mean values (%)						
		2018	2013	2008	2003	1998	1993	1977
1	Corrective maintenance	11	10	8	9	13	10	11
2	Adaptive maintenance	9	10	6	7	8	4	12
3	Enhancive maintenance (new functionality)	12	13	11	13	15	20	21
4	Perfective maintenance	8	8	9	8	5	5	6
5	Replacement system	9	8	10	10	8	11	NA
6	New development with new functionality	8	8	11	12	10	18	NA
7	Operations	23	23	24	23	23	NA	NA
8	User support	21	19	20	17	19	NA	NA
9	Maintenance = 1+2+3+4	40	41	35	35	41	40	49
10	Development = 5+6	17	17	21	21	17	30	43
11	Maintenance as % of total = 9 / (9+10)	70	73	66	66	73	59	53

12	Development as % of total = 10 / (9+10)	30	27	34	34	27	41	47
13	Application portfolio evolution = 3+6	20	21	23	25	25	39	NA
14	Application portfolio evolution as % of maint. + dev. = (3+6) / (9+10) (API)	35	35	37	39	38	56	NA
15	Total upkeep, user support and operations = 1+2+4+5+7+8	80	79	77	73	76	NA	NA

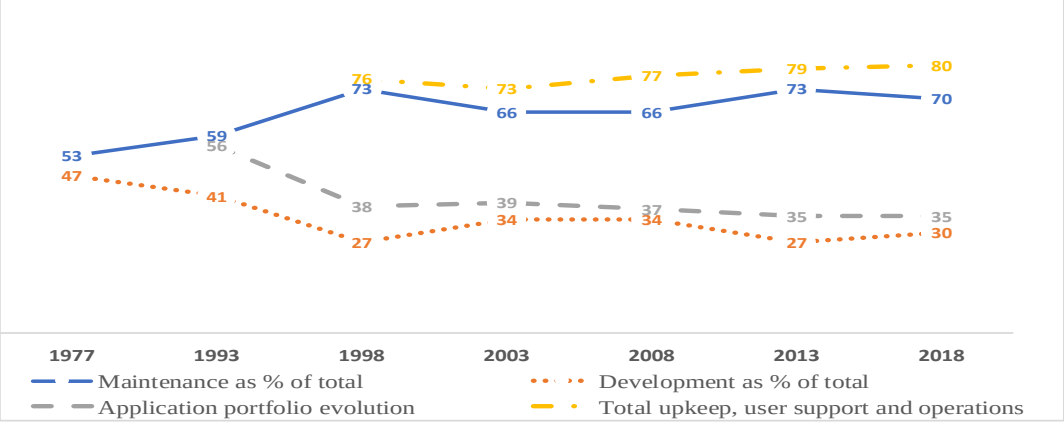

FIGURE 2: A LONGITUDINAL VIEW OF WORK DISTRIBUTION PERCENTAGES: MAINTENANCE AND DEVELOPMENT (DISREGARDING OTHER WORK), APPLICATION PORTFOLIO EVOLUTION AND TOTAL UPKEEP

RQ1: How does work distribution in our sample of organizations correspond with the studies previously reported?

TABLE 1 presents distribution of work details in our survey, and TABLE 2 presents comparisons with previous studies. The level of maintenance activities (Table 1, lines 1, 2, 3, and 4) is at the same level as previous studies (presented in Table 2), as does the level of development activities (lines 5 and 6), application portfolio evolution (lines 13 and 14) and application portfolio upkeep (line 15). In Table 2, year of study in columns 3–9 refers to the respective studies as follows: 1977 (Lientz and Swanson, 1980); 1993 (Krogstie and Sølvberg, 1994; 1998 (Holgeid et al., 2000); 2003 (Krogstie et al., 2006); 2008 (Davidsen and Krogstie, 2010); 2013 (Krogstie and Veld, 2015); 2018 (this study).

RQ2: How does benefits management relate to distribution of work, with emphasis on total application portfolio upkeep and value-adding application portfolio evolution activities?

TRENDS in important variables are illustrated in Figure 2.

Table 3 presents the various benefits management practices that we measured. From this, we generated a benefits management index (BMI) that is the mean value of the adoption rates. TRENDS in important variables are illustrated in Figure 2.

Table 3 shows a pattern of high levels of benefits management adoption in the early project lifecycles, and then rather less adoption in the later stages. This is in line with previous research presented in the background section of this paper (e.g., Ashurst et al., 2008; Hellang et al., 2012; Ward et al., 1996; Ward et al., 2007). Trends in important variables are illustrated in Figure 2.

TABLE 3: ADOPTION OF BENEFITS MANAGEMENT PRACTICES

Variable	**Always**		**Often**		**Some-times**		**Seldom**		**Never**		**Don't know**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Business case or similar	19	22	56	64	12	14	0	0	0	0	0	0
Plan for benefits realization	18	21	60	69	0	0	9	10	0	0	0	0
Clarified responsibility for benefits	0	0	51	64	19	24	9	11	0	0	1	1
Assessing benefits realization during exec.	0	0	3	3	51	59	9	10	0	0	24	28
Evaluation of realized benefits	0	0	33	38	23	26	30	34	0	0	1	1
Quantification of realized benefits	0	0	0	0	33	38	12	14	18	21	24	28
Re-estimation of benefits	0	0	0	0	0	0	86	99	0	0	1	1

Post-project identification of further benefits	0	0	0	0	3	3	83	95	0	0	1	1

We split the respondents into two groups based on median BMI (3.17) and compared the distributions of application portfolio upkeep and application portfolio evolution, respectively, by using the Mann–Whitney U Test (TABLE 4). We found that organizations with high BMI had a significantly higher level of application portfolio evolution compared with those with low BMI. Also looking at total upkeep (including user support and operations as part of upkeep, we find a similar result with a similar result with a significantly lower amount of upkeep for those organizations with a high BMI.

TABLE 4: PAIRWISE COMPARISONS: WORK DISTRIBUTION IN ORGANIZATIONS WITH LOW VS HIGH BMI

Response variable	**Pairwise comparisons: Organizations with low BMI vs high BMI**					
	Low (< 3.17)		**High (>= 3.17)**		**Mann–Whitney U Test**	**p (asymptotic significance, 2-sided test)**
	N	Mean rank	N	Mean rank		
Application portfolio evolution (API)	30	31.88	57	50.38	1,218.500	**0.001**
Total upkeep including user support and operation		55.02		38.20	524,500	**0.002**

TABLE 5: PAIRWISE COMPARISONS: WORK DISTRIBUTION AND PERFORMANCE FACTORS IN ORGANIZATIONS WITH LOWER VS HIGHER BENEFITS REALIZATION

Response variable	**Pairwise comparisons: Share of organizations with benefits Acceptable/High, Very High**					
	Acceptable/High		**Very High**		**Mann–Whitney U Test**	**p (asymptotic significance, 2-sided test)**
	N	Mean rank	N	Mean rank		
Competitiveness Index CPI	32	19.59	55	58.20	1,661.000	**<0.001**
Financial performance FPI		17.11		59.65	1,740.500	**<0.001**
Customer satisfaction CSI		22.41		56.56	1,571.000	**<0.001**
Benefits management BMI		19.44		58.29	1,666,000	**<0.001**
Application portfolio evolution API		33.98		49.83	1,200,500	**0.004**
Total upkeep TUI		51.89		39.41	627.500	**0.02**

RQ3: How do work distribution and benefits management relate to high performance characteristics such as realized benefits, competitiveness, financial performance, and customer satisfaction?

We split the sample based on the degree to which benefits were realized from IT activities, and compared the distribution of benefits management adoption (BMI), competitiveness (CPI), financial performance (FPI), customer satisfaction (CSI), level of application portfolio evolution (API), and total upkeep (TUI) (TABLE 5). We found that organizations with relatively high realized benefits, compared with others, had significantly higher levels of the performance indicators CPI, FPI, and CSI, and significantly higher levels of BMI and API (thus significantly lower level of TUI). We were curious to dig deeper into characteristics of the high-performing organizations, and we found that private organizations deliver significantly higher benefits from their IT investments compared with public sector organization ($p < 0.001$) (TABLE 6). That said, public organizations deliver more in line with their original benefits estimates ($p = 0.036$). Future studies are needed to explain these differences between public and private organizations (see the conclusions and further work section).

TABLE 6: PRIVATE VS PUBLIC ORGANIZATIONS: BENEFITS REALIZATION AND C-SUITE SATISFACTION

Variable	**Public**		**Private**		**Mann–Whitney U Test**	**p (asymptotic significance, 2-sided test)**
	N	**Mean rank**	**N**	**Mean rank**		
Perceived benefits realization	20	27.48	67	48.93	1,000.5	**<0.001**
Benefits as planned/expected	20	53.65	67	41.12	477	**0.036**
C-suite satisfaction	20	40.8	67	44.96	734	0.482

Inspired by Ward and Daniel (2008) and Ward et al. (2007), we looked at realized benefits versus C-suite (top management) satisfaction (Table 7). Our results differ from those of Ward et al. (2007) in that most of our studied organizations are in the "high value added" category, i.e., 50% or more of the IT projects deliver better than expected benefits, and the C-suite managers are satisfied. We do have a few respondents reporting that their IT investments do not deliver benefits as expected, and not surprisingly this corresponds well with perceived dissatisfaction in the C-suite. Contrary to Ward and Daniel (2008), we have no respondents ending up in the "not appreciated" or "getting away with it" categories.

TABLE 7: RELATIVE LEVELS OF SUCCESS (ADOPTED FROM WARD AND DANIEL, 2008)

Success and satisfaction	**Management satisfaction: Dissatisfied/Neutral**	**C-suite/management satisfaction: Rather/Very satisfied**	**Total**
>= 50% of projects deliver expected benefits	**"Not appreciated"** 0 respondents Ward et al. (2007): 16%	**"High value added"** 69 respondents (79%) Ward et al. (2007): 27%	69 (79%)
< 50% of projects deliver expected benefits	**"Low value added"** 18 respondents (21%) Ward et al. (2007): 43%	**"Getting away with it"** 0 respondents Ward et al. (2007): 14%	18 (21%)
Total	18 (21%)	69 (79%)	87 (100%)

As discussed in the introduction and where we presented our hypotheses, rapid advances in technology calls for organizations to balance how they spent their time. Proper balancing of exploiting current assets and exploring new areas have been shown to have positive effects on organizations' performance (e.g., Rothaermel and Alexandre, 2009). As our findings show, organizations that are able to channel more work into evolving their application portfolio, thus adding new functionality, do generate more benefits for the business and have better overall competitiveness compared with those who channel more work into keeping legacy afloat (TABLE 5). This revelation might appear obvious, but as we see from our longitudinal analysis organizations do not improve on average in terms of shifting work towards application portfolio evolution. We propose that organizations can benefit from being aware of their own IT work distribution and monitor levels of application portfolio evolution over time so that potential needs for improvement can be identified and measures for improvement implemented. As organizations strive to find ways to improve return on their IT investments, they can also find inspiration in our finding that benefits management practices appear to be associated with actual benefits realization and competitive performance, and that organizations with highest levels of performance do both benefits management and are able to channel much effort in to application portfolio evolution. This applies to both public- and private-sector organizations, however public-sector organizations appear to have largest potential in improving IT project benefits realization (TABLE 6).

6 VALIDITY OF STUDY

Some of the main limitations of our study are presented below.

- *Population*. We surveyed a population of Norwegian public and private organizations. This might affect the generalizability of our results. A multi-country study could be of interest to validate the generalizability of our findings as well as potentially to uncover additional aspects. That said, we have chosen the population for longitudinal analysis since several previous studies have been performed on similar populations in Norway.
- *Sample and response rate*. We received 87 responses from a variety of Norwegian organizations, as presented in the survey design section. Although the number of responses is higher than most of the studies we compare with, and above the thresholds for acceptable analysis suggested by Galtung (1967), we consider that the validity of our study would benefit from even bigger samples. The valid response rate of 12.7% is within the range of previous studies, but among the studies with low valid response rates. We would prefer a higher response rate to mitigate the risk of ending up with a sample of respondents that is not representative of the surveyed population of private and public Norwegian organizations. One reason for a relatively low response rate was that many addresses was general company addresses, thus might not have reached the right person.
- *Understanding of concepts*. When performing a survey there is a risk that the respondents do not share a common understanding of the basic concepts. Studies have found that respondents sometimes use their own definitions, even when the definitions are presented at the outset of the survey (Jørgensen, 1994). To some extent we consider this risk to be mitigated by using well established questionnaires for both

work distribution practices and the adoption and effects of benefits management. Furthermore, this risk was mitigated by performing pre-survey test fill-outs of the questionnaire.

- *Unit of analysis*. We chose the *organization* as unit of analysis, and we deliberately kept our analysis consistent with this unit throughout to facilitate internal validity and to enable relevant comparisons across previous studies of work distribution that also have used the organization as unit of analysis. Several studies of benefits management (e.g., Ward et al., 1996; Ward et al., 2007) have also used the organization as the unit of analysis; however, some studies have contributed by selecting a project as the unit of analysis, for example by asking respondents to select a recent project and answer questions with this in mind (e.g., Jørgensen, 2016). We recognize that a project-level study could give richer understanding of the inner workings of the fabric of the organization; however, we made a trade-off against the benefits of performing a longitudinal analysis on the basis of many previous studies that used the organization as the unit of analysis.

7 CONCLUSIONS AND FURTHER WORK

Revisiting our hypotheses, we conclude the following:

- ***H1*** *(related to RQ1)*: There is no difference between the percentage of time spent on application portfolio evolution in our survey and what has been previously reported: H1 not rejected. As presented in TABLE 2, we see that the work distribution from the 2013 study is in line with our own. This is true across all variables, and thus we have not performed statistical tests to find significance levels, as the differences in percentages are very small. If we could have claimed significant differences, the effect sizes would have been meaningless (see the discussion in the results section referring to Kampenes et al., 2007). We recommend that the stable level of application portfolio evolution to be subject to further investigations to uncover what drives the apparent lack of improvement (see the further work section).
- ***H2*** *(related to RQ2)*: There is no difference between the percentage of time spent on application portfolio upkeep and application portfolio evolution between organizations that to a larger or lower degree adopt benefits management: H2 rejected. From TABLE 4 we see that organizations with a high BMI have significantly higher percentages of application portfolio evolution and significantly lower percentages of total application portfolio upkeep. We do not claim to have uncovered a causal relationship between BMI and work distribution; however, we do observe a significant difference between the groups with relatively low and high BMI. Future studies might look into if this can be explained by variations between small- and large-scale development and maintenance efforts; for example, organizations with large scale projects might adopt of benefits management techniques while organizations doing smaller and incremental efforts might not. Such variations in practice usage can be of importance to take into consideration in future studies.
- ***H3a-d*** *(related to RQ3)*: There is no difference between percentage of time spent on application portfolio upkeep and total application portfolio evolution between organizations that report relatively high versus low performance characteristics (realized benefits from IT investments, competitiveness, financial performance, and customer satisfaction): H3a-d rejected. As presented in TABLE 5, we observe significant differences in work distribution across groups with high versus low performance characteristics. We have specifically split the sample into two groups according to the level of benefits realized from IT investments, and we observe significant differences in CPI, FPI, CSI, BMI, API, and TUI. Private organizations in our sample achieve significantly higher perceived benefits from their IT investments compared with public organizations. Overall, and contrary to a previous study by Ward and Daniel (2008), the organizations in our sample do for the most part deliver benefits according to expectation and to the satisfaction of the C-suite (TABLE 7). As discussed while presenting our hypotheses, we suspected that a connection between H2 and H3 might exist, and our results support this suspicion: H2 is rejected, as we found organizations high on application portfolio evolution to adopt benefits management practices that are shown to have a positive impact on benefits. As expected per evidence presented in the background section, and supported by our statistical analysis, H3 is rejected.

Our findings have implications for practice for several reasons: first, organizations should be aware of the lack of improvement in level of value-adding IT-activities. This is a bit disappointing considering the long-time search for ways to increase value from investments in IT, as presented in the introduction. Second, organizations might be inspired to implement benefits management practices; we found that organizations that implemented IT project benefits management practices spent significantly more time on application

portfolio evolution compared with others. Organizations that achieve good client benefits from IT investments tended to implement benefits management practices and achieved higher levels of competitive performance. Third, public-sector organizations might benefit from reflecting on why they lag their private counterparts in IT project benefits realization.

To our knowledge, this is the first study to investigate IT work distribution in relation to IT project benefits management practices and potential impact on performance indicators (perceived benefits realized, competitiveness, financial performance, customer satisfaction). We have paved the way for future studies in the intersection of work distribution and management practices to gain further knowledge that can help organizations achieve higher levels of performance. Future studies are needed to uncover causal relationships between our studied practices and to validate our findings by further addressing the limitations of our study such as population and sample size. Particularly interesting is the stable tendency of organizations to spend much time on application portfolio upkeep instead of value-adding application portfolio evolution. We welcome surveys with larger samples as well as case studies in order to better understand this rather worrying tendency. In a world of rapid technological development, we would presume that organizations could benefit from easy-to-comprehend guidance on how to turn the tide on upkeep efforts. We have shown that organizations that succeed in achieving work distribution skewed towards value-adding activities (application portfolio evolution) use benefits management practices to a greater extent and—importantly—are characterized by higher levels of performance. We welcome research that goes deeper into providing causal understanding, preferably where additional promising management practices are factored into the picture. Finally, we call for more research to enhance our understanding of the apparent differences in benefits realization between public and private organizations.

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