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Managing the changing understanding of benefits in software initiatives ☆

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ABSTRACT

When deciding to develop new software, that decision should be based on a clear understanding of the intended benefits the system can lead to. But what if the understanding of those benefits fluctuates. In this article, we investigate the understanding that stakeholders have or build of the benefits of the system under development, and what role that understanding plays. We conducted four studies: an exploratory study based on 22 interviews on nine projects that had explicit incentives to conduct benefits management, a confirmatory study based on a survey (n=110) of concepts of benefits understanding developed in the first study, and two explanatory studies arranged as focus groups (five participants in each) on issues that arouse during analysis of the first two studies. We find that it is common for stakeholders' understanding of benefits to change during and after development (reported by 96% of respondents from their latest digitalization efforts). Predicting and managing the changes to understanding of benefits is not straightforward. This leads to uncertainty, both for investment decisions and how to manage benefits. We conclude that, rather than focusing on cookbook recipes for benefits management, more emphasis should be focused on helping practitioners embrace changes to understanding of benefits.

1. Introduction

The purpose of any software solution is to enable stakeholders to generate benefits. Having an *understanding* of what these benefits are and which stakeholders generate and consume those benefits at what points in time is essential for developing an appropriate solution. The topic of this article is that this understanding of benefits may very well change during the lifecycle of a system under development. Since the true benefits of a system may only be evident over time and may be many-faceted and perhaps not even directly observable, the understanding of a system's benefits may be accurate to varying degrees. Further, changes in that understanding may be more or less warranted. For example, actual changes in benefits (such as improved efficiency in a task not being of value if new regulations makes the task unnecessary) may, or may not, be captured by practitioners' understanding. Nevertheless, the understanding that stakeholders have of a system's benefits, however valid, is what we have before the fact and is what motivates development work. Any changes to that understanding is important to capture.

Many practitioners report that changes in both internal and external circumstances relative to the development effort may result in *new* benefits being identified, and that, sometimes, *planned* benefits will not be achievable (Lin and Pervan, 2003). Moreover, requirements might change due to shifting political support or as a result of more information becoming available at later stages of development (Williams et al., 2020). Farbey et al. (1999) state that "... many of the most spectacular benefits obtained from the introduction of new information systems were unplanned". All this suggest an incremental approach to benefits identification, and indeed, benefits management models – often variants of the so-called Cranfield Benefits Management Model (Ward and Daniel, 2012) – that usually promote an incremental approach at the program or investment level to identifying benefits.

Beyond the observation that stakeholders' view of the benefits of a system under development can change, previous research has uncovered several interesting results: First, there are indications that practitioners mostly identify benefits at, or prior to, initiation time (Holgeid et al., 2021). Also, even though practitioners are aware and expect that their understanding of benefits is likely to change during development, there are seldom processes in place to handle these changes during the course of a project (Williams et al., 2020). Further, available methods that may be used for keeping track of such changes are not used (Jørgensen, 2016a). Possible explanations for not taking advantage of the changing understanding of benefit include the lack of concrete methods for operationalizing such changes (Hannay et al., 2017a,b) and a general perception among practitioners that benefits are hard to predict and that substantial effort spent on trying to manage benefits would

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be wasted (Ashurst et al., 2008). Also, a new understanding of benefits may arise suddenly (in a user validation, for example), and it has been pointed out that it is not feasible to develop and update business cases in such a rapid pace (Terlizzi et al., 2017).

This last point raises an important dilemma underlying the utilization of the changed understanding of benefits. If changes to understanding of benefits happens faster than organizations are able to evaluate the consequences of those changes, it will be difficult for organizations to make educated decisions.

Agile management and development are designed to "embrace change" so that one may adapt according to new information. Certain agile practices, such as the frequent deployment of software and flexible scope, have a positive impact on the realization of benefits (Holgeid and Jørgensen, 2020). It is reasonable that frequent deployment puts practitioners in situations where their understanding can be updated (by observing the software solution in use after deployment). Also, having flexible scope, might give team members the autonomy necessary to utilize changes in understanding of benefits, without having to wait for updated business cases. However, current research on the effects of agile methodology as a whole on benefits realization is diverging. While interviews with practitioners have found that agile has a positive effect on realization of benefits (Marnewick and Marnewick, 2022), a recent survey of digitalization efforts found no significant effect of using agile on the realization of benefits (Tanilkan and Hannay, 2023).

It has been speculated, based on the emphasis that practitioners put on various control factors, that agile, in practice, may be embracing change relevant only to the traditional control factors time, cost and scope, and that somehow, benefit considerations fall outside of the agile learning cycle (Tanilkan and Hannay, 2022a). Then, having benefits management as a designated process (to ensure benefits considerations) might not give the intended effects (Breese et al., 2015a). Studies show that projects that have customers who are highly involved in the planning of benefits and in benefits management during development are also perceived as most successful on benefit success criteria (but also on time, cost, scope). At the same time, there is little use of benefit metrics and monitoring techniques, of elicitation and use of benefits-related feedback during development and of benefits reporting and managerial followup during project lifecycles (Jørgensen, 2016a). This may signify that benefits management is perceived as advantageous, but that actual benefits management practices are far from being employed to the same extent as those for, e.g., cost control.

Seeing that stakeholders' understanding of benefits can change in different ways, we argue that it is necessary to take a proactive, rather than reactive, position to managing these changes. It seems clear that incremental benefits management frameworks (which mainly have a portfolio-level perspective) are not enough. These frameworks need to be filled with concrete procedures and methods, integrated into daily work, to manage changes to benefit understanding at all involved levels of the organization. Although several methods have been proposed for benefits management during development (Hannay, 2021; Larman and Vodde, 2010; Leffingwell, 2011; Reinertsen, 2009; Marnewick and Marnewick, 2022), we believe a deeper understanding of the underlying mechanisms are necessary. To this end, we investigate what types of changes to understanding of benefits arise, how common these changes are, and if, and how, they are managed by practitioners.

The necessity for exploring stakeholders' changing understanding of benefits emerged as a specific theme during the analysis of a more general study on the use of benefits management in the industry. In the present article, we present the sub-study that gave rise to this theme. We then report on three follow-up studies. In sum, these four studies contribute to building an understanding of the nature of how stakeholders' understanding of benefits changes during the lifecycle of a software system, and how practitioners manage those changes.

Section 2 is the background section. The first study (Section 3) is an exploratory study based on interviews, where the notion of *changing understanding of benefits* emerges when analysing the interview data in an inductive manner. The second study (Section 4) is a questionnaire-based survey explicating the changes to understanding of benefits in terms of how common changes to understanding of different parts of benefits are, and how changed understanding is utilized. The third and fourth study are arranged as focus groups. The first focus group (Section 5) focuses on the implications of changing understanding of benefits on investment decisions and ways of managing the uncertainties of stakeholders' understanding of benefits. The second focus group (Section 6), focuses on mechanisms that practitioners have to utilize changed understanding of benefits in decision making. In Section 7, we provide a discussion for the sum of our findings. Limitations are discussed in Section 8, before we conclude in Section 9.

Table 1
Definitions.

Term	Definition
Benefit	"... an outcome of change which is perceived as positive by a stakeholder" (Bradley, 2016)
Benefits management	"The process of organizing and managing such that potential benefits arising from the use of IT are actually realized" (Ward et al., 1996)
Benefits realization	Realization of a benefit happens when a potential benefit materializes as useful for a stakeholder
Change in benefits vs. Changing understanding of benefits	A benefit in the real world can change, and/or our understanding of a benefit can change. Here, we are primarily concerned with practitioners' understanding of benefits.

2. Background

To set the context for our discussion, we summarize relevant terminology in Table 1, before we present an overview of how stakeholders' changing understanding in general, has affected ways of working in software organizations since the early software efforts in the 1950's. We will also provide an overview of how changing understanding of benefits are incorporated in normative models on benefits management. In the latter parts of this section, we look to literature on organizational learning, and consider stakeholders' changing understanding of benefits in the context of organizational learning.

2.1. Software process models and change

Since the early days of software engineering, various models for arranging software work have arisen with different approaches to handling change. Linear models – appearing already in 1956 (Kneuper, 2017) – such as the waterfall model (Bell and Thayer, 1976) and the V-model (Rook, 1986) assume that the development of software solutions can be managed in a predictable way, the iterative models – documented as early as 1957 (Larman and Basili, 2003) – assume that changes during development are inevitable. To cater for changes in stakeholders' understanding of the system under development, linear models advocate better preparations (Royce, 1987), while the iterative models build a process adapted to utilize what is learned during a project.

Although the early iterative models advocated handling change during project execution, the main learning tends to happen when users interact with the software solution in production after project termination. From around 2000, companies started releasing software more often, and by 2010, release cycles were happening daily (Bosch, 2014). In *DevOps*, development, quality assurance and operations are integrated, enabling cross-functional teams to continuously deliver operational features (Ebert et al., 2016). Further, *BizDev* suggests to integrate those making business decisions with those doing development, through continuous planning and budgeting (Fitzgerald and Stol, 2017).

On the face of it, DevOps and BizDev are perfect for utilizing an evolving understanding of benefits. Those who develop are integrated into where benefits are experienced, which ostensibly, should foster increased understanding of benefits during the entire lifecycle, when cross-functional teams persist throughout the lifecycle of the functionality that the team is responsible for, such as in continuous product development (Tanilkan and Hannay, 2023; Dingsøyr et al., 2023; Huang, 2022). Combining DevOps and BizDev into *BizDevOps* (Fitzgerald and Stol, 2017) would seem even better. However, it is automation that enables the rapid release cycles in these methodologies. There is an associated trend towards data-driven development, where the data – often at the very low level of button clicks and response times – is also generated automatically. This can come at the expense of stakeholder feedback at more substantial information levels that are relevant for benefits considerations (Sporsem, 2023).

Adapting to feedback and change is a central element of Agile (Williams and Cockburn, 2003), which underlies most modern development methodologies. As such, the agile manifesto (Beck et al., 2001) seemingly sets the stage for utilizing an evolving understanding of benefits. However, except for the mention of "valuable software", the operational principles can all be taken as scope adjustment measures without any mention of measures towards specifying and monitoring value (benefit).

2.2. Benefits management models

Although there are multiple methods in software engineering that foster project learning, there has been a focus in both academia and industry on *time*, *cost* and *scope* as success criteria for development efforts, whereas the explicit focus and measurement of *benefit* (and hence also the *benefit/cost ratio* Hannay et al., 2017a,b) as a success criterion is much less prevalent (Jørgensen, 2017). Even for agile, a stated strategy is to reduce the *cost* of utilizing changed understanding (Highsmith and Cockburn, 2001).

Time, cost and scope have traditionally been seen as enablers of the technical quality, or intrinsic quality, of a solution. Benefit, or extrinsic quality, has in due course also been seen as *enabled* by those project parameters. However, benefit, although the *raison d'être* and the desired result for development efforts, has not always been included as a project parameter to be managed actively (Hannay, 2021, p.16–17).

Benefits management is based on the assumption that in order to achieve the planned benefits of a software solution, benefits must be *actively managed* (Farbey et al., 1999). The question is what it means to manage benefits actively; and in particular, what the active management of the changing understanding of the benefits of a system means. In a literature review, Breese et al. (2015b) found six methods for benefits management in the research literature. We summarize these and other relevant methods and frameworks. We highlight any mention of handling the changing understanding of benefits.

Active Benefits Realization "... is a project management process for managing information systems development which is based on the idea of continuous evaluation, active participation of the primary stakeholders ..." (Remenyi and Sherwood-Smith, 1998). Software development is done iteratively, and solutions follow a staged delivery. After each iteration/delivery, the solution is evaluated, and stakeholders are given the opportunity to adjust or cancel the project. Active Benefits Realization "... is specifically designed to remove any potential for the stakeholders to be surprised at the end of the information systems development project" (Remenyi and Sherwood-Smith, 1998).

The *Benefits Realisation Approach* (Thorp, 2007) states that the types of solutions and benefits delivered by organizations evolve over time. To realize the benefits of IT investments, a mindset change in the knowledge economy is necessary based on the premises that *benefits do not just appear after a solution is delivered* (benefits evolve over time as people learn), *benefits are rarely realized according to plan* and *benefits realization is a continuous process* (of identification, implementation, checking results and adjusting the path). One should shift from traditional stand-alone projects to *program management*, *disciplined portfolio management* and *full cycle governance* (which supports the benefits management process from identification to realized benefits).

In *Benefits Realisation Management*, Bradley (2016) suggests a strong focus on stakeholder engagement and a six-phase cyclical process: 1. Set vision and objectives, 2. Identify benefits and changes, 3. Define initiatives, 4. Optimize initiatives, 5. Manage initiatives, and 6. Manage performance. Work in one phase can result in the need to refine work done in a previous phase. Also external factors can result in the need to redo work from previous phases.

Benefits Management, as suggested by Payne (2007), differs from the other models on benefits management in that it assumes that benefits can be identified and fully understood in the early phases of a project (the "feasibility" and "define" stages), although Payne does acknowledge that benefits are often identified iteratively in these stages.

Benefits Management, as suggested by Ward et al. (1996), focuses on the identification, realization and evaluation of benefits "... derived from IS/IT through business changes ..." (Ward et al., 1996). The model consists of five stages: *1. Identification of benefits*, *2. Planning benefits realization*, *3. Executing benefits plan*, *4. Evaluating results* and *5. Identifying further benefits*. The model is created with program and portfolio management in mind, and thus helps managers with prioritizing projects. Ward acknowledges that new benefits can be identified during software development efforts, but the model does not indicate concretely how to handle this.

Projects Benefits Management (Melton et al., 2008) is aimed at project managers, and is based on a linear process suggesting that projects move through four stages: *business case development* (selecting the right projects), *project delivery planning* (how to deliver the project right), *project delivery* (control and management of uncertainty) and *benefits delivery* (integrating the project into the business). Steering is done through portfolio management and the use of a stage-gate model.

Best Practice Framework for Benefits Realisation is based on a literature review on benefits management. The framework is an "... 'idealized' vision of how benefits realisation should be applied in practice" (Ashurst and Doherty, 2003). The framework acknowledges that, in addition to the planned benefits, incidental effects should be identified and managed, and suggests an iterative model consisting of three linear steps: benefits *planning*, benefits *delivery* and benefits *review*, where new understanding is taken into account in the next benefits planning phase. Central elements of the *Best Practice Framework for Benefits Realisation* is an organization's *Benefits Realisation Capability* (doing benefits management right) and *Benefits Realisation Learning* (improving how benefits management is done).

Active Benefits Management approaches benefits management from the viewpoint of investment appraisal and discusses techniques for evaluating of IT investments (Leyton, 1995). One argues that the costs of IS/IT solutions, as well as benefits of effectiveness and competitive advantage from IT solutions, is often difficult to predict and evaluate. The focus is on improving approaches for investment appraisal and on how an understanding of benefits can be obtained before committing to an investment. When understanding of benefits change, this should be " ... embedded in a feedback loop to the business planning process ..." (Leyton, 1995).

Managing Benefits suggests that "[b]enefits management is concerned with informing investment decisions and optimization of benefits realization" (Jenner et al., 2014). Portfolio management should be used to ensure that organizations prioritize the right projects. Further, practitioners should actively search "... for benefits via ongoing participative stakeholder engagement" (Jenner et al., 2014), and four types of opportunities are identified: new users/markets, new uses/applications, changes to meet current users/markets, and changes to meet unanticipated/ emergent users/markets. These opportunities are managed at the portfolio level, using stage gates.

Managing Programme Benefits in the *Gower Handbook of Programme Management* (Hudson, 2020) approaches benefits management from a programme viewpoint, suggesting that: "There is no other purpose in doing a programme than to deliver value and realize benefits". Here, benefits management consists of four stages: moving from *Identify* through *Evaluate* and *Plan* to *Realize* and then continue with a new cycle starting from *Identify* again. A fifth activity is *Manage*, which happens in all the stages. Although it is argued that "... benefits can be dependent on complex cause and effect relationships with changes and intermediate benefits ...", we found no traces of how to acquire, or handle changes in, the understanding of benefits.

Benefits Realization Management: A Practice Guide by the Project Management Institute (2018) connects business strategy to benefits management through project, program and portfolio management. The proposed lifecycle model consists of three stages: *identify benefits*, *execute benefits realization management plans* and *sustain benefits*. The guide proposes a top-down approach to benefits identification, but acknowledges that the planned benefits can change, including the identification of new benefits.

The *Guide for Effective Benefits Management in Major Projects* by the Infrastructure and Projects Authority (UK) (2017), provides guidance on how to conduct benefits management at project, program and portfolio level. Much focus is on how to identify and quantify benefits prior to starting a project, but there is also recognition that new benefits and disbenefits can emerge throughout the whole lifecycle of a project. The guide suggests to check during the project that the planned benefits remain relevant and achievable. Evaluation can be done by evaluating lead and lag indicators. Lead indicators of benefits realization are preferred, because these indicators are pre-emptive. That is, they provide data early enough that benefits realization can still be affected. Lag indicators are collected after realization efforts has been made. This is exemplified by staff turnover, where measuring turnover is suggested as a lag indicator, while staff morale is a lead indicator.

The *Guide to Benefits Management* by the Norwegian Agency for Public and Financial Management (Direktoratet for Økonomistyring, 2014) describes how benefits management fits into a stage-gate model suggested by the same organization. Emphasis is put on the understanding of benefits, stakeholders and what is needed in order to realize the benefits, prior to starting projects. Also, the guide suggests that the amount of effort spent on benefits identification and specification can vary between project types. The stage gates are used as checkpoints to gain updated information on the benefits and factors affecting realization of benefits. Identification of new (unexpected benefits) and changed value of benefits after project initiation is mentioned, and it is suggested that business managers need to consider if benefits still should be realized after the understanding of the benefits has changed.

Common for all these methods is that they are built to give management control over investments and to increase the predictability of the benefits to be achieved. Although several of these methods suggest an iterative approach and acknowledge that the understanding of benefits often changes during the course of an investment, there seems to be consensus that any decisions as to the utilization of such changes to understanding should be made by managers external to the project working to deliver the benefits. As there are no mechanisms for rapidly obtaining management decisions for taking advantage of new understandings of benefits inside projects, the models might be iterative on an investment level, but are tied to linear thinking at the project level. While research on, and models for, software process models have evolved from linear process models, through iterative models to models for effectively handling rapid changes, models for benefits management do not have mechanisms in place to make effective use of (rapidly) changing understanding of benefits.

Further, the benefits management models promote mindsets and intentions, but do not operationalize the strategic thinking into methods. Several techniques and methods have been presented for linking project work to benefits (Biffl et al., 2006; Boehm and Huang, 2003; Karlsson and Ryan, 1997); more specifically, *Large Scale Scrum* (LeSS) (Larman and Vodde, 2010), *Scaled Agile Framework* (SAFe) (Leffingwell, 2011; Reinertsen, 2009) and *Benefit Points* to link product elements to project objectives and to link project objectives to business goals (Hannay et al., 2017a,b; Hannay, 2021; Haaber and Grøhøj, 2018; Hannay et al., 2019). The notion of benefit points explicitly includes benefit and the benefit/cost ratio as development parameters together with cost, time and scope. This enables the direct management of benefits, rather than benefit being indirectly controlled via cost, time and scope.

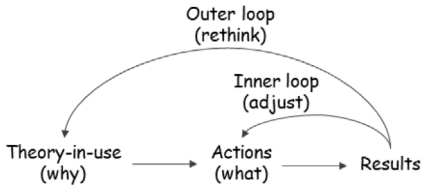


Fig. 1. Single- and double-loop learning.

2.3. Benefits management double-loop learning

Organizational learning, defined as "... the process through which organizations change or modify their mental models, rules, processes or knowledge, maintaining or improving their performance ..." (Chiva et al., 2013) provides an interesting context in which to consider stakeholders' changing understanding of benefits. The objective of organizational learning – to help organizations operate in an unpredictable environment and respond to unforeseen events (Garvin et al., 2008) – is particularly relevant.

To frame the discussion, we shall cast our findings from the four studies in terms of *single- and double-loop learning* (Argyris and Schön, 1996), in which organizational learning is modelled as an inner and an outer feedback loop (Fig. 1). In single-loop learning, an organization changes its actions to adjust (inner loop) for deviations in expected results, where the expected results and actions are governed by the organizations underlying assumptions and belief systems, or *theory-in-use* (Argyris, 1993). An example of single-loop learning is using the detection of systematic deviation from company values in products to improve production processes (Argyris and Schön, 1996, p. 21). In double-loop learning, observation of the results triggers the organization to rethink (outer loop) the organization's underlying theory-in-use, which then influences the actions and alters the foundations for single-loop learning. An example would be the revamping of company values that might imply a different production process altogether.

While the focus is on the organization, it is the individuals in the organization who experience learning. This learning becomes organizational as far as the individuals represent the organization and to the extent that individual learning becomes embedded in the organization's theory-in-use. Further, learning can happen at various parts (sub-organizations) of an organization, and what passes as an organization does not have to be a large corporation or agency. In our discussion it is the development initiative, or the initiative together with the organized group of stakeholders, which is the organization of interest.

The organization's theory-in-use may have both explicit and tacit elements. The main point is that the theory-in-use is what actually acts as a foundation for action, in contrast to an organizations's *espoused theory* (Argyris, 1993) which is the explicit official foundation for action and which may, or may not, correspond to the theory-in-use.

Fig. 2 shows our formulation of double-loop learning in the context of benefits management. The iron triangle metrics of time, cost and scope are what are worked on and adjusted in single-loop learning according to progress and productivity on the system under development.

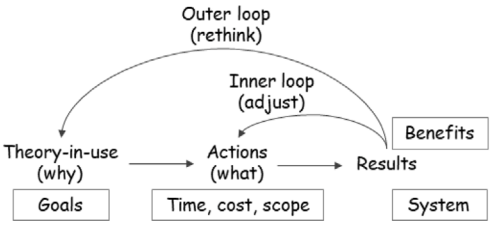


Fig. 2. Benefits management as a way of promoting single- and double-loop learning.

There are usually goals (explicit and/or tacit) in a business case for the development initiative. The benefits management literature advocates a deliberate approach to identifying and stating such goals and to assess benefits realization in the resulting system against those goals. This in itself is not double-loop learning. However, the focus of the current discussion is that the understanding of what benefits the system is capable of, might change. This, in turn, may warrant a change in the development initiative's goals; in other words a double-loop learning cycle.

2.4. The concept of 'Benefit'

Authors describe benefit in various ways. In the context of benefits management learning, where the experience of benefit is the basis for learning, it is useful to view benefit as a property of the system, as indicated in the righthand side of Fig. 2. Here, "system" is to be understood as the totality of the IT system (under development) and the stakeholders and organizations that interact with, or are affected by, the IT system. The system thus has the potential for benefit, but is not the benefit itself. This harmonizes with (Bradley, 2016): "This distinction [between the benefit itself and the change which gives rise to it] is important as it helps us to understand that benefits (for example, improved image, increased customer satisfaction, more sales, faster regulatory approval of new pharmaceutical products), cannot directly be made to happen."

Further, the relationship between benefits and goals is central in the double-loop learning model. It is the experience of benefit which might warrant a revision of goals. But goals are at the same time the criteria upon which we can say that a system has the potential for benefit (Hannay, 2021; Hannay et al., 2017a). Fig. 3 illustrates the relationship between benefit and goals: The blue boxes represent the system. The lowermost box is the (physical) system itself. The next box up represents what the system does in functional terms (here denoted "result goals"), while the upper-most blue box represents the high-level user stories – "epics" – that describe how stakeholders can use the system to perform work tasks using that functionality. The green boxes represent goals at various levels. Process goals (called "objectives" in Hannay et al. (2017a)) express desired effects of the system on the relevant work and life processes of stakeholders. This is the goal level that one should relate to when assessing benefit according to Hannay et al. (2017a). Benefit is then expressed as the system's (estimated) contribution to the various process goals. Process goals can be mapped to goals at higher levels, such as enterprise and societal goals (uppermost green boxes). Mapping benefit from stakeholder-specific epics to process goals is in line with (Jenner et al., 2014): "Benefits are advantageous to stakeholders, both within and outside the organization; for example, the latter include customers and shareholders (private sector), citizens, and other departments agencies (public sector). An active approach to stakeholder engagement is a key success characteristic of effective benefits management."

The goals exemplified in Fig. 3 are expressed in measurable terms on various scales. Note that one can determine goal achievement on scales that are nominal, ordinal, interval and ratio, which means that also achievement on qualitative goals can be measured. Assessing the

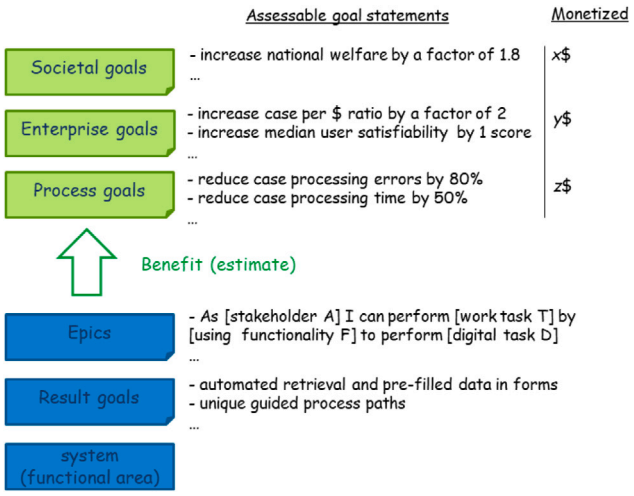


Fig. 3. Benefits and goals. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

desired or actual contribution of the system on goals can also be quantified; for example using relative *benefit points* (Hannay et al., 2017a), analogously to story points for cost. Measurability is central in the benefits management literature; e.g., "A benefit is understood to be a measurable improvement that derives from the outcomes obtained" (Payne, 2007) and "The measurable improvement from change, which is perceived as positive by one or more stakeholders, and which contributes to organizational (including strategic) objectives" (Jenner et al., 2014).

Although goals can be expressed on a variety of metrics, in the end, it is possible to translate goals (even "soft" ones) to financial outcomes, indicated by the "monetized" column in Fig. 3. This is important for return on investment deliberations, but it is important to keep clarity in notions. Referring to Payne (2007), the HaCIRIC literature report (Sapountzis et al., 2008) states that "Therefore he introduces definitions and differentiates between terms 'outcome', 'benefit' and financial impact. Outcome has two meanings depending on its context. At macro level, desired outcomes are the strategic changes that a programme is designed to fulfil. At micro level, outcomes are the changes to day-to–day operations that project outputs cause. Benefits are measurable improvements resulting from outcomes. Financial impact is the improvement in business financial performance that results directly or indirectly, from achievement of one or more benefits" (Sapountzis et al., 2008).

While Fig. 3 exemplifies a particular goal structure, other goal structures, such as Lean Value Tree (LVT), Goal, Question Metric (GQM) and Objectives and Key Results (OKR), are also in use. Moreover, and as mentioned above, goals may be present only tacitly, and there are indications that practitioners experience difficulties relating to goals and goal structures even when goals are explicitly stated (Tanilkan et al., 2023). In the benefits management double-loop learning model, we make no assumptions on the explicitness of goals or the exact understanding that stakeholders have of the concepts of benefit and goal, other than that the assumption that the experience of what the system is capable of (benefit) somehow can have bearings on in what direction development efforts should go (goals).

3. Study one - a qualitative study of benefits management in public-sector IT-projects

Although there is a fair amount of guidance on how to conduct benefits management in the normative literature (as we saw in Section 2.2), it is not clear how practitioners actually conduct the business of benefits

management (Aubry et al., 2021). In order to gain further empirical knowledge on the practice of benefits management we conducted an exploratory qualitative study in organizations that had positive incentives to use benefits management. As mentioned in the introduction, it was during this study that it emerged that practitioners experienced challenges related to the changing understanding of benefits (Tanilkan and Hannay, 2022b). Following (Corbin and Strauss, 2015), who argue that focusing on one theme from a larger study enables the exploration of that theme in greater detail, we report on the part of the larger study pertaining to the exploration of stakeholders' changing understanding of benefits.

3.1. Research method

The study is inspired by grounded theory methodology (Corbin and Strauss, 2015), structured according to the step-wise deductive induction (SDI) method (Tjora, 2020). The SDI method employs induction, deduction and abduction structured in the following phases:

1. Case selection and data generation
2. Processing of raw data
3. Coding
4. Code grouping
5. Concept development
6. Concept discussion
7. Theory creation (not used here)

While inductive analysis applies to raw data and aims to establish generalizations from that data, deduction starts with generalizations and aims to check if these generalizations apply to specific instances (Hyde, 2000). We use inductive analysis to ensure that themes and concepts emerge from empirical data, without the preconceptions of existing theories or methodologies (Thomas, 2006). Deduction is then used to verify the inductive results. Combining induction and deduction, we aim for the results to be a concentrate of the raw data. Abduction is the process of filling in conceptual gaps and exploring patterns to find a likely conclusion from the observed phenomena. In the concept development phase, we use abduction, combining the identified code groups with existing relevant research, to create and elaborate on concepts for benefits management. The induction, deduction, abduction cycle as a general approach (Lynham, 2002) has been recommended for theory building in software engineering earlier (Sjøberg et al., 2008, p. 217–218). The six phases, and how they have been applied in this study, are described below.

3.1.1. Case selection and data generation

We wished to investigate how benefits management is practised. Sampling organizations at random to investigate benefits management practices would likely give sparse results, because the adoption of benefits management practices vary considerably (Holgeid et al., 2021; Ashurst et al., 2008; Breese et al., 2015b). We therefore chose to use purposeful sampling (Patton, 2015).

We decided to sample from a funding program at the Norwegian Digitalization Agency which supports public sector organizations in their digitalization projects. A requirement for funding is that the project explicitly uses benefits management practices and submits plans and reports on how to generate and realize benefits. In the funding program, development projects are limited to three years. Funding is granted up to 50 percent of the project costs, with an upper limit at NOK 15 million (approx. USD 1.9 million). All the projects that received funding from this program in 2016 were invited to participate in the study reported here. Out of eleven projects who received funding, nine chose to participate in the study.

Interviews. Data was collected using semi-structured interviews with an interview guide consisting of questions sorted under themes that corresponded to high-level research questions on benefits management in the large. We asked followup-questions during the interviews to clarify, and to follow up on topics not covered in the guide, for which the interview subject showed a particular interest.

In total, we conducted 22 interviews with personnel involved in the projects. Four interviews were conducted with one researcher and one respondent. One interview was conducted with one researcher and two respondents. The remaining interviews were conducted with two researchers and one respondent. The interviews varied in length from 25 to 120 min, mainly due to differences in the amount of information the respondents provided. All interviews were recorded using an audio recorder. The full list of interview questions are available at https://tinyurl.com/PubSecBM. The collected data is not made available due to strict confidentiality agreements.

Roles interviewed. In the invitation to participate in the study, we asked to schedule interviews with people in project roles such as *benefits responsible*, *project manager* and *product manager*. It turned out that organizations used different roles in their project organization. Also, some people were not available, mostly due to reorganizations or the use of external resources as project participants. Somewhat independent of the roles we requested, we ended up interviewing persons with, and without, formal roles attached to benefits management. These included people working to ensure that the project delivered a solution fit for realizing benefits, people responsible for benefits realization (internal and external) and people working to influence others in order to realize benefits.

Selection test. The purpose of the selection test, is to check if the selected cases are suitable for studying the phenomenon of interest.

The interviewed organizations proved to be rich in information on the use of benefits management in practice. The width of relevant topics emerging from the data turned out to be too large to include all results in one paper. As a result, only one of the developed concepts are explored here, which is stakeholders' changing understanding of benefits.

3.1.2. Processing of raw data

All audio recordings were transcribed by a professional transcription company, giving 612 pages of transcribed text. The first author then read the transcribed texts and listened to the audio files simultaneously to ensure that the transcriptions were correct.

Data test. The purpose of the data test, is to check if the empirically collected data is suitable for studying the phenomenon of interest. We perceived the data to be rich in information related to benefits management in practice, including change in stakeholders' understanding of benefits. Based on these observations, we decided that the generated data had the potential to be the basis for the development of concepts or theories.

3.1.3. Coding

After transcribing the interviews, the transcriptions were coded in NVivo (release 1.6.1) by the first author. The purpose of this coding was, as suggested by Tjora (2020), to 1: extract the essence from the empirical data, 2: reduce the data size, and 3: prepare for idea generation based on details in the empirical data.

All codes were created inductively, describing the respondents' statements. Only data that was considered relevant to the use of benefits management in practice, was coded. This resulted in 1558 codes, including 368 codes that were relevant to stakeholders' changing understanding of benefits.

Code test. To ensure that codes were consistent representations of the data, and to mitigate some of the potential biases that can arise when only having one coder (O'Connor and Joffe, 2020), we applied the following coding tests (Tjora, 2020):

Test 1: Could the code have been created prior to coding? If the answer is yes, this indicates an *a priori*, data-independent code, which suggests that the code is unnecessary, and one should rethink, or omit, the code. If the answer is no, this suggests a potentially valid code, close to empirical data.

Test 2: What does the code, in itself, say? If it simply places text segments into a container (e.g., what was talked about), the code may be considered unnecessary and used merely for sorting data, and one should rethink the code. If the code reflects concrete content (e.g., what was said), this suggest a justifiable code.

To enable readers of this paper to assess the coding and the use of the codes, the results section (Section 3.2), provides extracts from the interviews and the codes used for these extracts, grouped by code groups.

3.1.4. Code grouping

In order to reduce data to a manageable amount for analysis, we grouped the codes inductively into code groups according to thematic consistency. During code grouping, two levels of code groups emerged. Having more than one level of code groups is supported by Tjora (2020, p. 210) when there is a large number of code groups (more than 3–5 code groups).

Grouping test. Code grouping and testing the code groups were done in an interleaved manner. When a candidate code was under consideration for inclusion in a group, the following code grouping test was performed: If the content of the group, after adding the code, would still be consistent, on the one hand, and still differ thematically from other groups, on the other hand, then the code was admitted to the group. Otherwise, a new code group would be created.

3.1.5. Concept development and discussion

Based on the code groups, concepts were developed and explored using abduction (Alvesson and Sköldberg, 2018). In this paper we report on one of these concepts, which was developed by viewing the code groups in light of published research on benefits management and the evolution of software process models (Section 2), combined with iterations of discussions among the authors. This led to the concept *changing understanding of benefits*, which is a more general, thematic label that described the coded phenomena, encompassing the code groups reported in the results section below.

Concept test. As suggested by Tjora (2020), we evaluated if the developed concept was an appropriate representation of the code groups. This was done by evaluating if the code groups fitted into the concepts. In addition to checking the code groups against the concept, the second study in this paper (Section 4), is also an important test of the concept.

3.2. Results

The step-wise deductive induction analysis resulted in several emergent themes giving rise to a conceptual model which will be presented in a later paper. A central concept in that model is *Changing understanding of benefits*, which is the basis for this article. The concept is empirically founded on the observation that *the understanding of benefits tend to change when working to develop software solutions and when realizing benefits based on those solutions*. The concept is built on the following six high-level code groups (A–F) and low level code groups (i–iii):

A. New benefits
   - (i) New internal benefits
   - (ii) New external benefits

B. New user groups
   - (i) Unexpected user groups
   - (ii) Invisible user groups
   - (iii) New user groups and benefits uncovered in conjunction

C. Increased understanding of known user groups
   - (i) Unexpected behaviour
   - (ii) Unexpected diversity

D. Need for benefits changed
   - (i) Reduced interest
   - (ii) Other/better suited solution available

E. Value of benefits changed
   - (i) Higher than expected
   - (ii) Lower than expected

F. Increased understanding of what was needed in order to realize benefits

These code groups represent attributes of benefits where stakeholders' understanding tend to change when working to develop and realize benefits.

In addition to the codes and code groups that motivated the concept of stakeholders' changing understanding of benefits, two code groups emerged that elaborated on the concept:

I. Disbenefits were mostly uncovered after solution was taken into use
II. Understanding of Benefits does not Always Change

In the following sections, we elaborate on the code groups that the concept is built on. We exemplify with phrases (and the code to which they were coded). After that, we elaborate on the two additional code groups.

3.2.1. New benefits

The identification of new, or further, benefits after project initiation occurred in several of the participating projects. Sometimes, new benefits were identified for external organizations, as can be seen in the following example. *Code: Benefits for external organization were identified during the project*:

> INTERVIEWER: ... were the benefits for [external organization] identified before or after the project started?
> RESPONDENT: No, they were identified during the project.

Other times, new benefits were identified for the organization owning the system under development (internal benefits). *Code: Benefits identified after starting.*

> Sometimes you see things after starting. For example, you find that, we have saved time. Why has this happened? Or, things happen faster, or quality is improved.

3.2.2. New user groups

New user groups were identified after project initiation; sometimes unexpected, sometimes expected but not transparent to the participants. The following example describes an unexpected user group that found the provided solution and started using it. *Code: Unknown users got in touch with us.*

> ... sometimes things happen, that you hadn't thought about. Like these users that we had never been in touch with. That suddenly got in touch with us. ... I think that when we create new solutions, we will take this experience with us, that there can be users there, that we don't know about.

Unknown user groups can be a challenge when evaluating the realization of benefits. A concern about invisible users is illustrated in the following quote by a respondent discussing how unknown user groups makes evaluation of benefits realization difficult. *Code: Are there users we don't know about?*

> The big question right now is: "Is anyone using the solution that we don't know about?"

Sometimes new user groups and new benefits are identified simultaneously. In the following example the respondent reported to learn about a previously unknown user group and that the delivered functionality provided value to this user group that was not known before. *Code: Unexpected user reporting unexpected use.*

> ... we arranged a seminar, and there were two representatives from [organization]. By coincidence I heard that one said to the other: "Yes, and I use the [function]". "Ok. What do you use it for?" "You know, I use it to check [information need]".

3.2.3. Increased understanding of known user groups

Respondents report that sometimes user groups behave differently than expected. In the following example we see a user group that ended up using the solution more than anticipated. *Code: User group used solution more than anticipated.*

> We didn't expect a user group that had [characteristic] to represent much usage ... But it turns out many of them started using the new solution.

This is also relevant for organizations as user groups. *Code: More use than expected in sector.*

> We could not envision that especially the [sector] would be the ones with the largest benefits. It turns out that sharing with the [sector] has become the most used usage pattern.

Increased understanding of known users can also reveal challenges in realizing benefits. One organization reported to learn that there was unexpected diversity in users' domain competence, and that this hindered the creation of a process that would work for all users. *Code: Difference in user maturity hindered seamless process.*

> If you are going to make a process like this, things need to flow seamlessly. Otherwise it does not make sense. Here, it was not possible to make such a seamless, paper-free process, because some of the users were not mature enough.

3.2.4. Needs for benefits changed

We observed a change in needs for benefits in two different forms – reduced interest in the benefits as such, and reduced interest due to other/better suited solutions becoming available.

A reduced interest in the foreseen benefits was observed as a result of reorganizations in the receiving organization. One organization reported that the external project manager, who intended to take a solution into use, moved to a different position. The new project manager turned out not to have an interest in the planned benefits. *Code: New project manager was not interested in the benefits.*

> This would have improved the knowledge base and reduced uncertainty for the project [in the receiving organization ...] The project manager in the [external organization] was very interested in this, and intended to include this in the project [...] The external project replaced the project manager [...] when following up with them, they replied that this [the suggested benefits] was not interesting to them.

This finding is supported by Breese (2012), who reports that "[s]takeholders will vary in their interest in different benefits ...". As a result, it seems that variation in the need for benefits is vulnerable to people changing positions.

Reduced interest was also observed as a result of negative consequences of realizing benefits. Here is an example where there was a fear that the benefit of reduced expenses in municipalities could lead to reduced budgets. *Code: Fear that benefits would lead to reduced budgets.*

> [...] there would be benefits for the municipalities, and they were afraid that this would lead to reduced budgets in the municipalities [...] Because that happens all the time.

Other respondents reported that parts of their planned benefits could be better delivered by solutions that others were working on. *Code: Others had developed more cost-effective solution.*

> ... another project had worked in parallel to our project, in order to create a [functionality] ... And they had already developed functionality related to [functionality], which is very related to what we were making. So we started talking together, and found out that it is much more cost efficient the way they did it.

In the private sector one might assume that this means that the organization had lost in competition, since someone else made a better solution, or made their solution available earlier. In the public sector, the mindset seems different. As can be seen in the following statement, people in the public sector seem to focus more on realization of benefits for society, rather than who creates the solution. *Code: Benefits realized by other solution.*

> It is our consideration that, although our project did not fulfil the specification, it has been realized by another public-sector organization. And the planned benefits from our analysis are still realizable.

We have not found previous empirical research reporting on changing needs for benefits, but the phenomenon is mentioned in guides on benefits management (Direktoratet for Økonomistyring, 2014).

3.2.5. Value of benefits changed

In our data, we found that the understanding of the value of benefits changed after the system was deployed. The perceived changed value of benefits came both in the form of higher and lower values than expected.

Values were lower than expected due to overly optimistic prior estimates, or because the project decided not to deliver the functionality necessary to realize the benefits to the full extent. Values were higher than expected due to underestimated adoption or due to unexpected benefits or user groups. An example of underestimated adoption is the following: *Code. Elegant solution led to higher adoption than anticipated.*

> ... the adoption was higher than expected for parts of the solution. Because the solution was so elegant, we received more users than we had ever expected.

Unexpected benefits or user groups (as seen in Sections 3.2.1 and 3.2.2) were reported to have a potentially large influence on the value of the total benefits. *Code: Solution had much more effect than anticipated.*

> ...[the solution] has much, much larger effect, perhaps tenfold, and perhaps more than that as well, than what we were able to point out in our analysis.

3.2.6. Increased understanding of what was needed in order to realize benefits

Regarding the need to adjust solutions after launch in order to realize benefits, respondents reported that they had assumed that by delivering the planned functionality, the benefits would be realized without further ado. In some cases this turned out to be the case, while in other cases, it turned out that the solution also had unexpected effects that needed mitigation. *Code: Need adjustments to mitigate negative effects.*

> INTERVIEWER: Were the benefits, such that if you just create the solution, the benefits would be realized by themselves, or was there a need for following up? RESPONDENT: No, the solution was all that was needed. INTERVIEWER: Ok, so following up was not necessary? RESPONDENT: ... in hindsight, we see that ... we also have other negative effects, that we should have done something about. For example, we have the case where the user submits a contact form in addition to a digital form.

The submitted contact forms described in the quote above had a negative impact on the benefits of reduced work, because the contact forms had to be handled manually, increasing the workload for the organization.

Other respondents also reported the need for adjustments in order to realize the full benefits. *Code: Have made adjustments and needs further adjustments.*

> I believe there is a need for further adjustments to the solution we have created. We have already made adjustments after launch, and in some areas, we have gained pretty large cost reductions. But there is more potential there, for things we do not quite nail, that we need to ... that we are still working on.

Unexpected responses to solutions or benefits can lead to an increase in the effort needed to realize benefits.

One example of unexpected resistance towards accepting the proposed benefits occurred in an organization that had recently been through a downsizing. This, the respondent argued, made employees sceptical to the proposed benefits. *Code: People perceived benefits realization as threat of downsizing.*

> When we were notified that we would receive funding, we started sharing information about the benefits internally ... At first, we were not taken seriously ... People didn't understand what we meant by benefits realization. They thought we were only interested in saving money ... It is worth noting that we have just come out of a serious downsizing in 2015, which probably affected peoples' responses ... People felt threatened ... "are you going to streamline me out of here?" This was never the intention. So it required us to spend time on explaining.

The unexpected need for increased effort to realize benefits can also happen without resistance. Respondents report that they informed benefits recipients about the new solution, but that they didn't follow up with the recipients. When there are many recipients, it is challenging to find cost-effective ways of following up. *Code: Sent information to municipalities, but are sure that it is not utilized.*

> ... there are many small municipalities. Even if we send information to them, it is not certain that they have time to read it, and at least, not to act on what we send ... We are required to conduct user surveys, but we have not done that yet ... because we know what the answer will be ... and it will not be positive.

3.2.7. Code groups that elaborate on stakeholders' changing understanding of benefits

In addition to the above code groups, two code groups emerged that did not fit as part of the concept. Still, we perceived that the two code groups were relevant elaborations on the concept.

Disbenefits were mostly uncovered after solution was taken into use. One interesting observation about the time of change to understanding of benefits was the timing of identification of disbenefits. It turns out that all the reported disbenefits were identified after the solution was taken into use. The following is an example of a disbenefit that was identified late. *Code: Dependence on discontinued product.*

> But [distributor] has later removed this product from the market. This is a commercial of the shelf product that is integrated into our solution. They have stopped supporting the product, so we are negotiating with them to gain access to the source code, because we need access to make changes.

Table 2 provides descriptions and reported mitigation of the reported disbenefits.

Understanding of benefits does not always change. Although experiencing changes to stakeholders' understanding of benefits seems to be a recurring topic among the respondents, one of the respondents reported on a sub-project that did not experience changes in understanding of benefits. This project was conducted using the waterfall model, because both the respondent's organization and their subcontractor had sufficient understanding of the benefits and the solution. This allowed them to conduct the sub-project without the need for changes (neither to benefits, time, cost nor scope). *Code: Delivered according to specification.*

> [Organization] was going to deliver the solution to us. We created a specification together, and tuned it. So it was ... it turned out very very nicely.

3.3. Discussion

When looking at the six aspects of change uncovered in this study in retrospect, observations of new benefits arising after a project has been initiated, was documented in empirical research already in 1996 (Ward et al., 1996) and supported by later research (Lin and Pervan, 2003; Tanilkan and Hannay, 2022b; Changchit et al., 1998; Semmann and Böhmann, 2015). Similarly, that other users and user groups may benefit from the system has been empirically documented in, respectively, Marsh et al. (2016), Hobday et al. (2019), Henriksson et al. (2022) and Dhillon (2005). Increased understanding of what is needed in order to realize benefits and resistance to new solutions or benefits is commonly reported as a central motivation for guides on benefits management (Ward and Daniel, 2012; Jenner et al., 2014; Bradley, 2016; Thorp, 2007; Payne, 2007). Similar observations can be made for changing understanding of the value of and need for benefits.

It is thus not a new observation that the understanding of benefits can change. What we provide is an empirically documented overview of six different aspects of stakeholder's understanding of benefits that has been reported to change. Further, we set these in a double-loop learning model.

In Fig. 4, we place the observed changes to understanding of benefits in the double-loop learning model introduced in Section 2. They are placed under results, where experiences and observations related to benefit happen. If changes to understanding lead to changes in the implicit or explicit goals of the organization (or perhaps other assumptions that drive organizational actions), double-loop learning has happened. If changes to understanding of benefits lead to changes in development actions, without changing the underlying goals or assumptions in the

Table 2
Overview of reported disbenefits.

Disbenefit	Description	Mitigation
Concerned that the new solution will lead to a colder world	User interacts with computer in stead of a person	Take part and affect positively
Dependence on distributor	Based solution on off the shelf product that was discontinued	Negotiate access to source code
Reduced access to information for users		Provide information in alternative way or discuss the need for the information
Impatient users lead to increased load on customer service	Respondent reported that people expect faster response from a digital service	
Increased amount of work for line organization	New process uncovered flaws in case processing, which led to increased work in processing	
Increased amount of work for line organization	New system led to increased user activity	
Large peak of work for line organization	When informing users of new solution, led to large peak of usage	Inform users in a way that helps spread their use over time

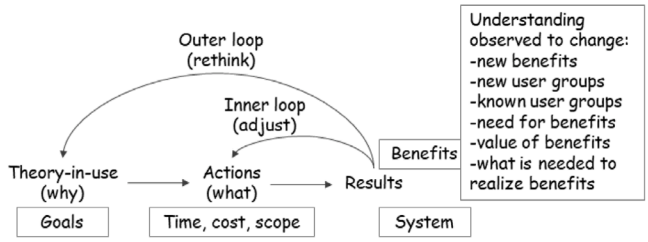


Fig. 4. Changing understanding of benefits included in the model of double-loop learning.

(project) organization, single-loop learning has occurred. Further, when changed understanding of benefits have no effect on organizational assumptions or actions, no organizational learning has happened.

As noted in Section 3.2.7, disbenefits were mostly uncovered late. We speculate that this could be due to the inherent positive nature in goal formulation. Although goals can me made to avoid negative effects, such as disbenefits, it is our impression that goals are mostly geared towards describing positive effects that one wants to obtain. If organizations focus exclusively on positive goals, such as benefits, there might not be mental space to receive new understanding of disbenefits.

In Section 3.2.7, we observed a sub-project where the respondent reported that no changes to benefits, time, cost nor scope were expected. In such a setting, it might make sense to use a linear model. After all, agile and iterative practices are sub-optimal if there is no need to adapt to change. Royce (1987) suggests that linear process models are only suited for simple projects. We speculate that simple in terms of benefits understanding could mean that the practitioner has sufficient understanding of the benefits, so that the understanding will not change much after initiation of the project.

This leads to an important question that we believe warrants further research: Is it possible to predict to what degree there will be changes to benefits understanding during and after a project? If an organization knows that their understanding of the benefits are likely to change, one should probably adopt ways of working that enable changes in benefits understanding to happen as early as possible.

Given the changes in understanding of benefits reported above, it may seem puzzling that guides on benefits management do not provide methodology on how to utilize such new understanding of benefits inside projects. In the normative models of benefits management, making the software solutions is done in the execution phase. According to Ward and Daniel (2012) organizations can use any process model they want inside the execution stage, but there is limited advice on how to utilize stakeholders' changes to understanding of benefits. We have only found one reference in the field of benefits management suggesting how to handle changed understanding of benefits within the software lifecycle. Ward and Daniel (2012, p. 78) suggests that when new benefits are identified "[...] the business project manager should obtain agreement on appropriate action to revise the plan to accommodate the benefit or defer any action until step 5 [Establish the potential for further benefits]". This approach might be viable if changing understanding of benefits is an exception, but a recent study (Tanilkan and Hannay, 2022b) indicate that changed understanding of benefits seem to be common, and that changed understanding can happen in all phases of software investments.

So, one possible explanation for the lack of methodological support for handling changes could be that the identification of new benefits after initiation is assumed not to be common. Another explanation could be a conception that decisions regarding benefits should not be made in a project setting, but rather at a strategic level where goals are fixed. Indeed, the double-loop learning model we put forth also ostensibly suggests that dealing with changed understandings of benefit belongs at some higher organizational level (the outer loop). Although the organization in question is the project, adjusting the goals relevant for the project might seem as an activity that belongs outside the project. The question is whether goals should be more flexible and more alterable from within the project. There is also important single-loop learning to be considered. Changes in benefits understanding can have implications for prioritizing the backlog and for keeping track of how much potential benefit is realized in the increments constructed so far (Hannay et al., 2017a,b).

It seems relevant to find out if changing understanding of benefits, as observed here, only occur in special cases (as seems to be the underlying assumption of the normative models of benefits management), or if changing understanding of benefits is a common phenomenon. This is the topic for the study described in the next section.

4. Study two – a survey on acquiring and utilizing benefits insights

Study 1 uncovered *changing understanding of benefits* as a central theme in practitioners' minds. In Study 2, we investigate how common changing understanding of benefits are, and how practitioners handle these changes to understanding. Specifically, we posed the following research questions:

RQ1: *To what degree does the changing understanding of benefits occur in practice?*

RQ2: *Could changes to the understanding of benefits have materialized earlier?*

RQ3: *How were changes in the understanding of benefits utilized by practitioners?*

RQ4: *Are changes to the understanding of benefits utilized appropriately?*

While RQ1 and RQ4 are directly motivated by the results of study one, RQ2 and RQ3 are also motivated by Section 2.1 – assuming that early learning is a foundation for timely utilization of new information.

Answering these research questions also help us to assess the relevance of the concept of *changing understanding of benefits*. Further, they shed light on factors underlying problems practitioners encounter when working to realize benefits, and hence should give rise to useful information for choosing how to organize work.

4.1. Research method

To answer the above research questions, we conducted a survey with an online questionnaire. Data was collected during a webinar in June 2021.[1] During the webinar, IT-professionals shared experiences from different ways of organizing digitalization efforts.

4.1.1. Survey questions

The survey questions directly relevant to answering the research questions are listed in Table 3. The full list of survey questions and responses can be found at https://tinyurl.com/pvscpd.

Respondents were asked to base all answers on the latest IT-based product development they had taken part in, where the product or part of the product had been taken into use. As discussed by Jørgensen (2016b), selecting the last project "... reduces the risk that the sample of projects is biased towards the most successful or the largest software projects ..." (Jørgensen, 2016b).

Questions SQ2–SQ4 (Table 3) were asked for each of the six types of change (A–F) identified in Study 1, here reformulated to fit in the questionnaire text:

A. We identified new benefits
B. We identified new user groups
C. We acquired new understanding of known user groups
D. We identified that the need for the benefits changed
E. We identified that the value of the benefits changed
F. We acquired new understanding of what was required to realize the benefits

Only those change types (A–F) that received a positive response in SQ2 were followed up in SQ3 and SQ4.

In addition to the survey questions, the following demographic information was collected:

- number of years in development of software solutions
- number of years as a leader in software development
- for the latest software development effort, where (parts of) the solution has been taken into use:
  - role in effort (product owner, developer, or both)
  - size of effort in terms of maximum personnel
  - successfulness of effort (5-point scale very unsuccessful – very successful, don't know)
  - product ownership (public or private sector)
  - practices/ways of organizing work

4.1.2. Respondents and response rate

All webinar participants were invited to participate in the survey. At the time the invitation was announced, 140 persons were present in the webinar. In total 124 persons participated in the survey. Fourteen persons stopped after the demographic information was collected. These were not included in the analysis. Thus, $n_3 = 110$ respondents finished the first three pages of the survey, $n_4 = 105$ respondents finished the first four pages, and $n_5 = 92$ respondents finished the entire survey.

Success in realizing benefits based on the products, were reported to be ($n_3 = 110$) *very successful or successful*: 62%, *neutral*: 27%, *unsuccessful or very unsuccessful*: 8% and *don't know*: 3%. Overall, the success in realizing benefits, reported here, seems to be higher than reported in similar studies (Jørgensen, 2016b).

Among the respondents ($n_3 = 110$), 35% represented the product owner side only, 49% represented the product developer side only, while 15% represented both sides.[2] The respondents' average experience with the development of digital solutions ranged from under a year to 50 years, with a mean of 17.7 years and median of 20 years. The number of years of experience as a manager in this field ranged from zero to 30 years, with a mean of 7.1 years and median of 5 years. Further, 68% of the respondents reported on products owned by the public sector, while 32% reported on products owned by the private sector. Respondents also reported on practices/ways of organizing work multiple responses possible, ($n_5 = 92$), with 24% reporting to use linear models (waterfall, V-model etc.), 85% agile, 30% DevOps, 2% BizDev and 14% used program organization.

From previous dialogue with webinar participants, it was evident that practitioners organize digitalization as projects and using other organization forms (such as development work in the line organization or using continuous product development Huang, 2022). Creating a measure for the size of work, that enables comparing projects and work that does not have a defined end date, (which seems common in continuous product development), we decided to ask for approximately how many people were actively involved in the work at most. This measure has the downside, that it tells us little about the duration or investment size, which are often part of size measures. Nevertheless, size of work ranged from 4 to 350 participants, with a mean of 37 and a median of 15 participants.

4.1.3. Pilot

The survey underwent two rounds of evaluation prior to the data collection. In the first round, four colleagues at the Simula Metropolitan Center for Effective Digitalization of the Public Sector responded to the survey and gave feedback. In the second round, six practitioners from the IT-industry responded to the survey in an online meeting with the first author. The practitioners gave feedback and discussed options during the meeting. Both rounds of piloting resulted in adjustments to question phrasing and to the introduction to the survey.

4.2. Analysis

To analyse the data, we used descriptive statistics to answer all research questions. We considered using statistical tests to compare results across groups of our data (such as between the different types of change (A–F), between efforts that could have provoked earlier changes to understanding, between the utilizations of changed understanding and the appropriateness of that utilization). Whether one type of change occurs more often than another is interesting, but with the high frequency of occurrence reported here, being prepared for change seems relevant for practitioners across all the types of change (A–F). For the efforts that could have provoked earlier changes to understanding, testing for differences is also less relevant, because for

[1] Parts of the data collected in this survey, has been published separately in Tanilkan and Hannay (2023) There is no overlap between the results published in Tanilkan and Hannay (2023) and the results published here (except for demographic information).

[2] Summing these percentages gives a total of 99%. This is due to rounding error, and the provided results are correct for the number of decimal places.

Table 3
Survey questions.

Question	Answer options
SQ1 *Did you experience changed understanding of any of the following types?*	For each of A–F, multiple choice: - Yes, during development - Yes, after functionality was taken into use - No, not experienced in this case
SQ2 *Concerning the types of changes that you selected in the previous question, do you think the changes in understanding could have occurred earlier?*	For each of A–F, multiple choice: - Yes, if we had done a better analysis - Yes, if we had organized the work differently - Yes, some individuals had the understanding, but it was not escalated - Yes, other - No, the understanding could not have come earlier
SQ3 *What was the changed understanding used for?*	For each of A–F, multiple choice: - Used to change the solution - Used to re-prioritize development work - The benefits were realized without needing to change the solution - Used in a different project/work - We chose not to use this insight - Other
SQ4 *In your opinion, was the changed understanding used appropriately?*	For each of A–F, select one: - Yes, Partially, No, Don't know

practitioners, the need for better analysis or different organization is dependent on the situation they are in. Also, not knowing what type, or degree of, analysis is already being conducted, it is not meaningful for us to suggest that more analysis should be done. Some digitalization efforts might need much analysis, while other might need less. Similar observations can be made for the utilization and appropriateness of utilization of changed understanding.

4.3. Results

The results presented here are organized according to research questions.

To answer RQ1 (To what degree does the changing understanding of benefits occur in practice?), we used the percentage of respondents who reported changes to understanding after work started (SQ1). The results are summarized in Fig. 5a. We found that 96%[3] of the respondents reported to have experienced some form of change in benefits understanding after the work was started, with *what was required to realize the benefits* being most common (87%), closely followed by *known user groups* (86%) and*new benefits* (83%). Both *the need for the benefits* and *changed understanding of the value* (both 72%) are also common, while *new users* (50%) is the least common.

The majority of respondents reported changes to the understanding of benefits occurring before a solution was deployed into production (between 38% and 74%).[4] Still, a substantial amount of changes to understanding of benefits occurs after deployment. In decreasing order, these are,[5] *changed understanding of the value* (34%), *the need for the benefits* (31%), *what was required to realize the benefits* (23%), *new benefits* (22%), *known users* (21%) and *new users* (15%).

It is worth noting that 4% of the respondents reported that there were no changes in understanding of benefits in the work they reported on (bottom of Fig. 5a).[6] This harmonizes with the findings from the first study (see Section 3.2.7), where we saw that one sub-project was conducted without changes to understanding of benefits. It seems then, that although understanding of benefits tend to change, there are software product creation efforts where the understanding of benefits does not change.

In summary, our data indicate that changing understanding of benefits occurs frequently in digitalization efforts. It also seems a very small portion of digitalization efforts do not experience changes to the understanding of benefits.

RQ2 (Could changes to the understanding of benefits have materialized earlier?) is answered using responses to SQ2 (Fig. 5b). Depending on the type of change to understanding, portions of respondents reported that the changed understanding of benefits could *not* have come earlier (between 23% and 34%). Respondents also reported that the changed understanding could have come earlier *if they had done a better analysis* (21% to 33%) or *organized differently* (25% to 41%). The case that *someone in the organization had a changed understanding that was not escalated*, was less common but still present (14% to 26%). Respondents also report that *other* measures could have been taken (5% to 12%), but we do not know what these measures are.

The change in understanding of what is required to realize the benefits seems to stand out as the category where most respondents believe that organizing differently would have helped (41%). Also, the need for benefits is the category where respondents most often report that someone in the organization knew that the need for the benefits had changed, but the information was not escalated (26%).

In summary, respondents report that in some digitalization efforts, changes to understanding of benefits will occur after starting work on a new solution, regardless of their efforts to obtain the understanding earlier. In the majority of efforts, they report that changes to understanding of benefits could occur earlier if they had done a better analysis, organized differently, or utilized individuals' understanding better.

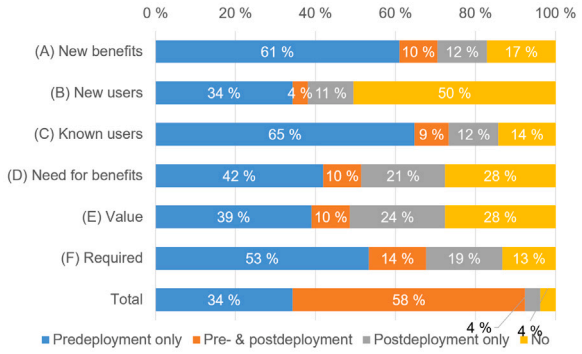
To answer RQ3 (How were changes in the understanding of benefits utilized by practitioners?), we use responses to SQ3. From Fig. 5c, we see that reprioritizing work is the most common utilization of changed understanding of benefits (45% to 57%), although identification of new benefits also often lead to changing the solution (48%). In addition to reprioritizing work, changing the solution under development (28% to 48%) and using the new understanding in another project (21% to 33%) are also common. Realizing the benefits without needing any change (8% to 14%) and not using the new understanding (3% to 8%) also occurs, but less frequently. Other utilization methods (5% to 14%) are also present, but we do not know what these methods are.

[3] Percentage found by summing the *predeployment only*, *pre- & postdeployment* and *postdeployment only* portions of the *Total* row in Fig. 5a.

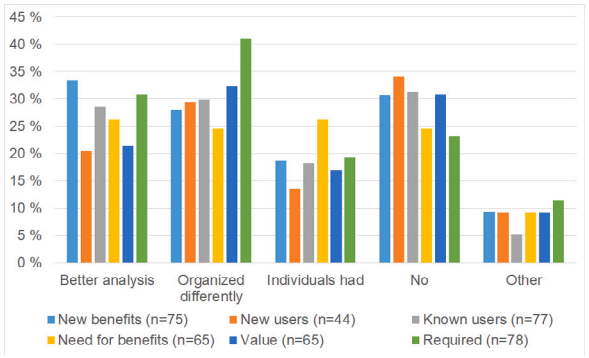
[4] Percentages found by summing the *predeployment only* with the *pre- & postdeployment* portions.

[5] Percentages found by summing the *pre- & postdeployment* with *postdeployment only* portions.

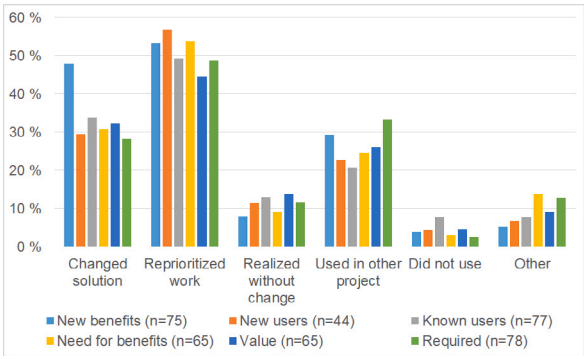
[6] Note that for the bottom row (Total), Pre- & postdeployment includes all those that reported any of the change types pre or post deployment. Predeployment only includes those that experienced change, but only pre deployment, and similar for postdeployment.



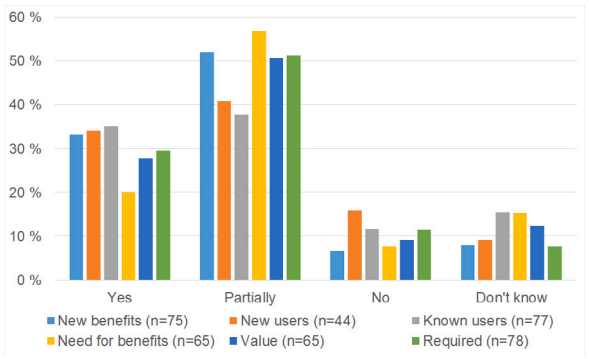
(a) Percentage of respondents (n_4=105) reporting to have experienced each change type (A–F) in their last IT product development. The bottom row (Total) presents the percentage of respondents reporting to experience any of the change types (A–F).



(b) Efforts that could have provoked earlier changes to understanding of benefits



(c) Utilization of changed understanding



(d) Appropriateness of utilization of changed understanding

Fig. 5. Changing understanding of benefits.

In summary, changed understandings of benefits were mostly used to reprioritize work, to change the solution under development or used in other projects. In some instances the benefits were realized without the need for change, and in a small number of instances, the new understanding was not used.

RQ4 (Are changes to the understanding of benefits utilized appropriately?) is answered using responses to SQ4 (Fig. 5d). For the most part, respondents report that the utilization of changed understanding of benefits were *partially appropriate* (38% to 57%) or *appropriate* (20% to 35%). A smaller amount of respondents report that the changed understanding was *not appropriately* used (7% to 16%) or that they *don't know* (8% to 16%).

In summary, the majority of respondents report that their utilization of changed understanding of benefits were appropriate or partially appropriate.

4.4. Discussion

Based on the above results, it seems evident that changes in stakeholders' understanding of benefits after an initiative has started are common. We made quantitative observations of how changed understanding of benefits influenced practitioners' actions, which strengthens the presence of the six change types in the double-loop learning model in Fig. 4.

Even more interesting, we observed that such changes in understanding are taken into account (more often than not), and that practitioners consider this utilization of new understanding mostly, or partially, appropriate. This means that changes in understanding of benefits has an effect on what the development initiative does (actions), as indicated by the lower-most frame in Fig. 6. However, it is not clear from our data if these changes in actions are the result of inner-loop learning or outer-loop learning.

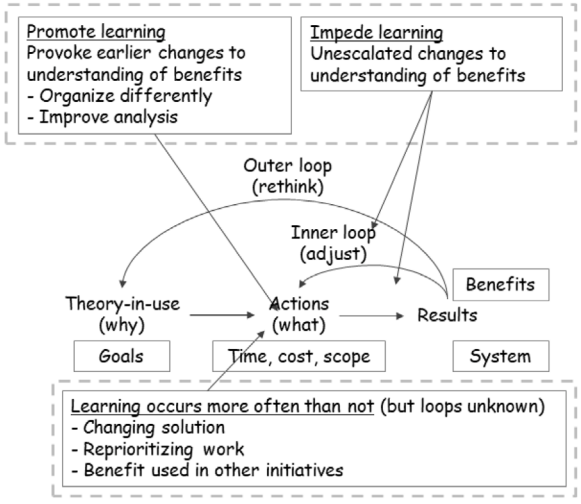


Fig. 6. Changing understanding of benefits included in the model of double-loop learning.

Nevertheless, two observations were made related to promoting and impeding learning. First, provoking earlier changes to understanding of benefits by emphasis on how to organize and analyse work (uppermost left frame in Fig. 6) is a set of actions, that, when deliberate, can be a step towards promoting learning. Second, changes to understanding of benefits that do not get escalated (in either loop) (uppermost right frame in Fig. 6) is an impediment to learning.

The magnitude and importance reported here is important both for how software work is organized and for investment decisions into digital solutions.

For the organization of software work, the amount of changes in understanding indicates the necessity for agile approach to development which fosters project learning on, not only time, cost and scope, but also benefit. Still, a portion of respondents report that they could have benefited from conducting a better analysis prior to starting work.

This raises the question as to when the two types of learning are called for, and whether it is possible to predict for one or the other. Also, for investment decisions, the amount of changed understandings of benefits are important, because they highlight new uncertainties regarding the returns. Although, the large uncertainty on the cost side of software investment is well known, uncertainty relating to benefits has gained less attention (Hannay et al., 2019). Seeing that 96% of digitalization investments have changes to benefits after an investment decision is made, warrants a stronger focus on benefits uncertainty.

It seems that evolved ways of delivering on software investments are needed, where those making investment decisions need continuously updated information on the predicted benefits of their investments. The next study explores topics that could help build a foundation for ways of delivering on software investments that are more in tune with benefits uncertainty.

5. Study three – focus group 1

Based on discussion in the previous section, and given that changes to benefits understanding is the "engine" that drives double-loop learning in our model, it is pertinent to ask:

- what implications on investment decisions changes to the understanding of benefits have, or should have.
- what available mechanisms practitioners have to ensure that changes to understanding of benefits arrive at the right time.
- if it is possible to predict the degree to which there will be changes to understanding of benefits in an initiative.

5.1. Research method

To explore these topics, we conducted a focus group with practitioners working with digitalization, selected from two sources: (1) The respondents to the survey reported in Section 4, based on their stated willingness to participate in further studies on the changing understanding of benefits. All those that had provided their email-addresses were invited to participate in the focus group. (2) A network of practitioners working with digitalization leadership and management in the Norwegian IT-industry or in the public sector. All practitioners in the network's steering committee were asked to participate. In total, this resulted in five participants in the focus group (two from the survey participants and three from the network). The participants had experience from a broad range of software product development and project activities, including roles as head of product development, investor, project manager and consultant. Their length of experience from software organizations, both private and public, ranged from seven to 27 years.

At the start of the focus group session, the primary author presented Fig. 5a to present the types changes to understanding we had found and how common they are. We also mentioned that 4% of the respondents from the survey did not experience changes to understanding of benefits in their last digitalization effort.

The theme guide consisted of three themes:

1. Given that stakeholders' understanding of benefits changes, what implications does this have for investment decisions?
2. What mechanisms do practitioners have to ensure that the changed understanding of benefits occurs at the right time?
3. Is it possible to predict that the understanding of benefits will change? If yes, how, and what information is needed?

The participants were asked to answer each of these thematic questions through discussion in the group, and to summarize their discussion on Post-it notes. The primary data source from the focus group was the Post-it notes written by the participants. Two researchers took part in the focus group. One acted as a facilitator, and the other took notes. Notes were taken when respondents made statements relevant to the themes that did not naturally fit on Post-it notes.

5.2. Results

We present the results for each of the three themes in the next three subsections.

5.2.1. Implications for investment decisions

The participants argued that there is a large degree of uncertainty regarding benefits, and perhaps larger than for cost. For investment decisions, there is much advice available to handle cost uncertainty, while they perceive such advice to be lacking for benefits.

The participants argued further that the implications that the changing understanding of benefits have, or should have, for investment decisions depends on the *structure of the funding* (term suggested by the respondents). The participants suggested that the structure of the funding includes: (a) investment size, (b) the source of funding (internal versus external) and (c) the decision processes involved.

Not much further was said about (a) the dependency on investment size. We speculate that larger investments often lead to larger (project) organizations, which tend to be more complex, leading to a higher probability of changes in understanding of benefits occurring and more difficulty in communicating the changes to decision makers.

The participants exemplified (b) the funding sources and (c) the decision processes with two real-world cases. In the first case, the funding source was external, and a thorough analysis of benefits was required prior to making the investment decision. During the project, the external funding organization required reports once a year. This, they argued, resulted in little ability to adapt the investment decision to any changed understanding of benefits. The other case was related to internal funding decisions, where projects were initiated by different parts of the organization, without there being any apparent reason why initiatives were taken. Decisions seemed ad-hoc, and it was unclear why projects were funded or stopped by the different parts of the organization. This also lead to difficulties in utilizing changes in understanding of benefits, since it was not always apparent who the decision makers were.

The participants suggested that portfolio management combined with what they termed smart metrics (e.g., benefit points Hannay et al., 2017a and value points Larman and Vodde, 2010) could help utilize changed understandings of benefits. There was some discussion about what smart metrics are, and some concern that it is difficult to devise smart metrics that help uncover the actual changes in understanding. The respondents argued that it is important to analyse needs and benefits ahead of investment decisions, but due to the uncertainty of benefits, it is also important that this analysis continues throughout the lifecycle of the investment.

5.2.2. Mechanisms to ensure that changes in benefits understanding occurs at the right time

When asked about mechanisms to ensure that changes in benefits understanding occur in a timely fashion, the participants' first response was *luck*. While this might seem like a justification to give up on managing the changing understanding of benefits, the remaining discussion proved to be quite to the contrary. The participants argued that actively "seeking out luck" is an approach for managing the timing of changed understanding. The idea is to conduct activities that increase the probability of provoking changes to understanding, and the participants

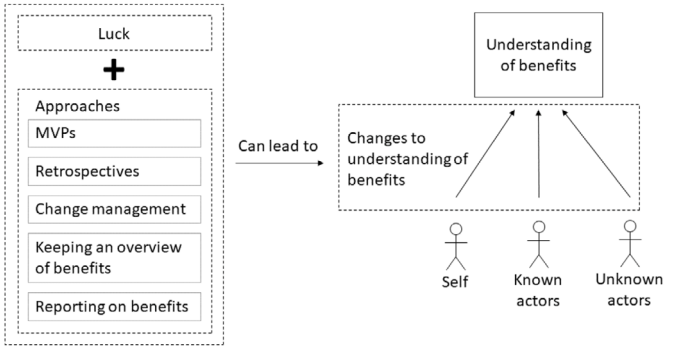


Fig. 7. Activities suggested by practitioners to increase the probability of the changed understanding of benefits occurring in a timely manner.

mentioned the following: develop in terms of *minimum viable products* (MVPs), conduct *retrospectives*, perform *change management*, keep *an overview of benefits* and require *regular updates of benefits*; see Fig. 7. All of these apart from the last two are more or less established best practices, while the last two can be seen as the added focus that is needed for fostering the awareness of changes in perceived benefits.

The participants emphasized that a focus on MVPs enables practitioners to try things out early, enabling early feedback on benefit (not just technical quality). They further suggested that running retrospectives, with a focus on benefit, regularly can facilitate that any changes in stakeholders' understanding of benefits are captured sooner rather than later. Change management was mentioned as presenting ways to reach people who are not involved in experiencing MVPs or joining retrospectives, and includes actively approaching and speaking with people who might have views on benefits. The participants argued that by talking about the project with different people new perspectives may arise. This could be the responsibility of a change manager, who would have a broad contact network and who would serve as a contact point where people can get in touch. Such an approach would allow for changed understanding coming both from known and unknown stakeholders. Keeping an overview of benefits helps make sure that what is known about benefits is not lost. Also, reporting on benefits, helps facilitate reflection and updating the understanding of benefits. Stakeholders note, however, that too much reporting is perceived to be negative.

5.2.3. *Predicting that changes to benefits understanding will occur*

Several participants stated that, in their view, the world of digitalization is dynamic, uncertain and sometimes difficult to understand. There are incidents that cannot be managed, which just need to be handled as they occur. Although the world of digitalization is unpredictable, the unpredictability varies from initiative to initiative. Some participants suggested to view the uncertainty as a continuum ranging from small to large and suggested a set of questions that they believe can help understand and predict the uncertainty. These are:

- The type of solution, is it tailor-made or based on off-the-shelf components?
- How much understanding of the domain do the participants have before starting the work?
- How much of the system and the organization needs to be changed?
- How well do project participants and decision makers understand the stakeholder needs – including what creates value, and also in what direction the project is heading?
- How well are users, needs, the market and technology understood?

Although mitigation of uncertainty was not part of the focus group questions as such, the participants volunteered the above suggestions as part of the predictability discussion.

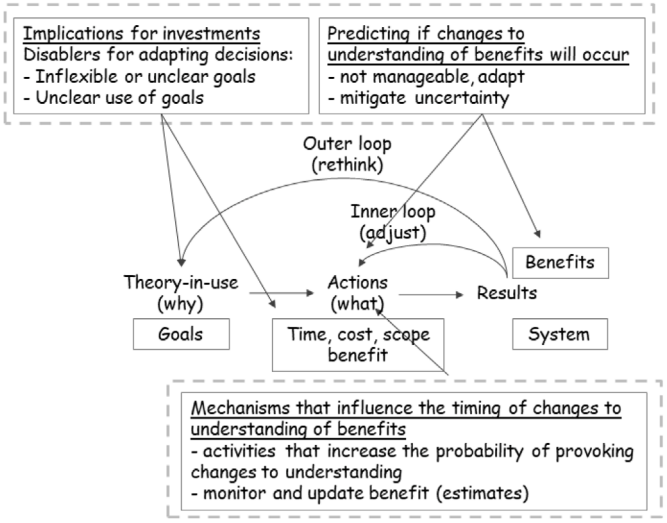


Fig. 8. Predicting changes to understanding of benefits and mechanisms that influence timing of changes included in the model of double-loop learning.

5.3. Discussion

Two examples of disablers for using changed benefits understanding for adapting investment decisions were mentioned: External funders hold the initial business case as binding leaving little flexibility, whereas internally funded initiatives are based on unclear and ad-hoc investment decisions making it hard to leverage changes in benefits understanding (leftmost frame in Fig. 8). The former may be seen as goal inflexibility, while the latter can be seen as goal opaqueness or an unclear use of goals (indicated by the two arrows pointing to *Goals* and to the arrow between *Goals* and *Actions*).

Practitioners do not see a planable solution to timing changes to benefits understanding. Rather, benefits estimates and benefits realization should be monitored, to allow practitioners to navigate in an uncertain changing environment. They did suggest best practice activities boosted by an added benefits focus that could increase the probability of provoking changes earlier. (See lowermost frame in Fig. 8.) These practices are a detailing of the related findings in Study 2 (Fig. 6).

Not surprisingly, then, predicting when changes to benefits understanding will occur was not perceived as manageable (rightmost frame in Fig. 8). Rather, stakeholders must adapt actions in real time and mitigate uncertainty. The participants listed five salient questions one might ask to help prepare adequately for uncertainty.

Practices already exist for handling uncertainty in software development. Agile development and management is designed for learning through interactions with stakeholders and responding to changes in the environment and in stakeholder perceptions (Fowler et al., 2001). Designing and developing MVPs fosters early learning, and continuous product development with its micro releases can mitigate risk by letting organizations to fail early and modestly. However, it may seem that learning is used for adjusting according to new information on the traditional iron-triangle control metrics, time, cost and scope rather than for adjusting work according to changed or evolving understanding of benefits. An additional problem we see based on the above results, is that new understanding can come from multiple sources, where known stakeholders are just one of those sources. DevOps-based frameworks which enables rapid deployment through automation tend to promote automatic user-data collection which severely limits the relevance of data for benefits considerations (Sporsem, 2023). The complementary approach BizDevOps may mitigate parts of this problem by acknowledging that new understanding can come both from user interaction,

from observing and interacting with the solution under development, and from the business side (Fitzgerald and Stol, 2017). Still, we do not know if this is sufficient to help practitioners to act on changes to the understanding of benefits.

In short, rather than focusing on static processes for the management of benefits, it seems practitioners are better off deliberately seeking out new information, and using that information to continuously steer software investments. In the next section, we provide empirical data on how this can be done.

6. Study four – focus group 2

In this focus group we wanted to further our understanding of how practitioners can exploit changed understanding of benefits. Particularly we wanted to investigate:

- the mechanisms that practitioners have to utilize any changed understanding of benefits in sound decisions.

6.1. Research method

The second focus group was similar in form to the one reported in Section 5. Due to the similarities, only differences in research method will be described here.

Focus group participants were selected from the same sources as the previous focus group, but none of the respondents participated in more than one of the groups. In total, five people participated as respondents in the focus group (three from the survey sample and two from the network). Their length of experience from software organizations ranged from 22 to 26 years, within roles such as change manager, benefits responsible, line manager, software developer, software architect, software tester, project manager and head of new strategy development.

The focus group session was (as in the previous study) initiated by presenting Fig. 5a, and describing the types of understanding that has been reported to change. Following the introduction, the single theme of this focus group was given to the participants:

- What strategies do practitioners have to ensure that the changed understanding of benefits that are encountered in the organization is utilized in sound decisions?

The respondents were divided into two groups of two and three participants, and both groups were given 50 min to discuss and prepare a presentation based on their discussion summaries on Post-it notes. The presentation was an addition compared to the first focus group session, where the Post-it notes were the primary data source. Here, the presentations were the primary data source. After the discussions, each group was given five minutes to present their work. The results presented below is the combined data from both groups' presentations.

6.2. Results

The participants' suggestions for ensuring sound decision making based on changes to understanding of benefits, are structured according to three topics: 1. Impediments to making sound decisions when the understanding of benefits change, 2. Where in organizations decisions should be made, and 3. How to provide decision makers with the information they need in order to make sound decisions.

For (1), the participants suggested that it is difficult to ensure that changes in understanding of benefits are utilized in sound decision making, for two primary reasons[7]: First, it is difficult to capture when there is a change in understanding of benefits. This includes finding out that there is a change in understanding somewhere in the organization, and allowing that information to move to those making decisions. Second, the participants argue that if there is a colloquial understanding of what is to be made and the benefits resulting from the solution, it is more likely that people who encounter changes in understanding will push that information towards the decision makers. However, achieving this colloquial understanding in an organization, they argue, is difficult. As a sidenote, participants also noted that it can take time to make a decision, simply because it requires work.

When discussing where in organizations decisions should be made (2), the participants argued that there should be as short a distance as possible between those making decisions and the place where changes to understanding occur. To this avail, participants suggested to organize teams around product areas, where decision makers are a part of the "regular work".

In order to provide decision makers with the information they need in order to make sound decisions (3), the participants raised three categories of suggestions:

i Practitioners who are not decision makers need relevant contextual information, in order to know when their new understanding of benefits should be forwarded to decision makers.
ii The new understanding needs to move from where it is obtained to the right decision maker(s).
iii For decision makers to make sound decisions when new understanding of benefits arises, they need relevant contextual information to understand the relevance and importance of the new understanding.

Although providing contextual information to those responsible for making decisions based on changes to understanding of benefits (i) was raised as important, not much was said about how this should be done. The focus group participants suggested that it is important to communicate the purpose of the project, both to decision makers and to others. One way of doing this, that the participants advocated, was through the use of storytelling.

Other people than those making project decisions also need to understand the project purpose (ii), because it helps them evaluate if changes in understanding of benefits are relevant and if the changed understanding should be pushed to decision makers.

When discussing how to enable new understanding of benefits to move to decision makers (iii), participants reported that during the recent corona pandemic, projects had been conducted with less involvement from middle managers and more involvement form top managers. This, they argued, had lead to better utilization of new information. After the pandemic had ended, the organizations had moved back to their previous way of working, increasing the distance between top management and those doing the work. As a result, the participants suggested that organizations should try to remove middle management positions that are not strictly necessary.

When working with people from different domains, the participants raised the concern that people talk at cross purposes, and that this could lead to new understanding not reaching decision makers. To mitigate this, participants suggested emphasizing the importance of recognizing each other, including openness to others' views, honesty, respect for all the different professions and allowing people to make experiences.

6.3. Discussion

We summarize the results from this study around (1) the discussed impediments to sound decision making, (2) where in organizations decisions should be made and (3) how to move relevant information to those making decisions (Fig. 9).

The impediments to utilizing changed understanding of benefits in relevant decision making (1) are difficult to handle in day-to-day work, because they are not visible to decision makers. This leaves

[7] Note that the participants were not asked to report on these challenges – they just emerged during the focus group discussions. As such the challenges should be seen as relevant contextual information, rather than a complete list of challenges.

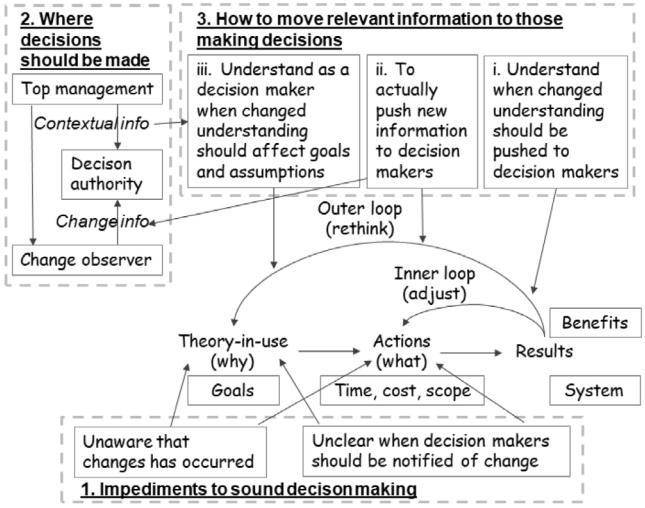


Fig. 9. The move of changed understanding of benefits from an individual to organizational goals and assumptions.

organizations in situations where actions should perhaps have been taken, but those responsible for taking those actions are not aware of the new information that warrants those actions (illustrated in Fig. 9 by the arrows pointing from *Unaware that changes has occurred*). In order to make educated choices, those responsible for benefits-related decisions, are dependent on others to notify them when new understanding is available. Also, those who experience a change in understanding of benefits need to understand when this understanding should be forwarded to the decision makers (illustrated in Fig. 9 by the arrows pointing from *Unclear when decision makers should be notified of change*). The arrows from the impediments to *theory-in-use* and *actions* signify that the unawareness of changes is a result of missing updates to the theory-in-use or goals, which again impedes the actions of the organization. Similarly, the lack of clarity of when decision makers should be notified about change, is a result of the individuals' theory-in-use, which impedes the actions of the individual who have experienced changed understanding of benefits.

The participants' suggestion of moving decision-making authority close to where new understanding is obtained (2) is supported by principal–agent theory, where it is suggested that tasks should be delegated to practitioners who have better information (Waterman and Meier, 1998). Still, as we saw in Section 5.2.3, it is not always clear where new understandings of benefits will be obtained or come from. As such, it is difficult to know in advance where to place decision authority.

Also, changes to benefits are naturally business decisions, and those making investment decisions are responsible for ensuring that the right benefits are invested in. Although decision-making authority can be delegated also for business decisions, we wonder what happens with responsibility when business decisions are delegated. Is the business manager still responsible if a bad business decision is done when delegated? Looking to principal–agent theory again, Itoh (1994) describes that organizations might allocate responsibility for unpopular decisions to interim managers, freeing the organization's managers from blame. In an organization where avoiding blame is key, delegating decisions related to benefits should be safe. Still, if the primary objective of the organization is to realize benefits, having someone to blame for bad decisions is not sufficient. This leaves business managers in a situation where delegation might be necessary, but potentially risky, unless they have means for ensuring that sound decisions are made.

When moving benefits-related decision authority into the teams that do the day-to-day work, it seems relevant to discuss whether people are able to make tough decisions regarding their own working situation and prioritize benefits in these decisions. A recent study, indicates that benefit does not have much influence on project termination decisions (Tanilkan and Hannay, 2022a). This could be explained by barriers to termination. Royer (2001) suggests that people who are vested in the project are often opposed to termination, and that ambiguity makes some people continue to support projects, that in fact should be terminated. While it is may be the case that people rarely terminate projects that they are involved in, there are examples of teams that choose to dismantle itself: During a retrospective meeting, a software product development team discussed the benefits versus the costs of continuing their work. In particular they had observed that there was not a pressing need for the services they were developing and that the solution they were creating did also not fulfil all the needs. In addition, the low number of users, did not justify the large amount of resources needed to finish their work. Based on these reflections inside the team, the team was dismantled and the individuals received new tasks (Bergwitz-Larsen, 2022).

In the following we will discuss two approaches to placing decision authority in organizations. We denote them the *elevator* approach and the *shrinking of distance* approach.

In the *elevator* approach, the positioning of decision authority can be moved up or down in the organization, depending on the desired effects (leftmost frame in Fig. 9). It is reasonable to assume that by moving decision authority closer to top management, the decision makers will have a better contextual understanding. When moving decision authority further down in an organzational hierarchy, it is possible that decision authority is moved closer to where changes in understanding of benefits are experienced, at the expense of contextual understanding. It seems reasonable that organizations who choose to place decision authority at a higher level must put extra emphasis on obtaining and moving changed understanding to decision makers (i and ii from Fig. 9). Similarly organizations that place decision authority at lower levels are likely to benefit from more emphasis on sharing contextual information in the organization.

An interesting aspect relating to the sharing of contextual information versus sharing change information, is the observation that since it seems unpredictable where in organizations changes in understanding will occur and that contextual information (frame 2 in Fig. 9) is important for deciding whether to escalate changed understanding (i and ii in Fig. 9), it seems likely that organizations should ensure that sufficient contextual information is held by all relevant parts of the organization. Under this condition, the cost and challenge of context sharing is likely to be close to constant regardless of where decision authority is placed. The remaining factor is then the challenge of escalating changed understanding. The rational choice in that case is to reduce the challenge of escalating changed understanding (by moving decision authority close to where changes are anticipated).

While the elevator approach assumes a balancing act between sharing of contextual information versus sharing information on change, the *shrinking of distance* approach is concerned with reducing the distance between those holding contextual information and those experiencing change. By incorporating people who can make benefits-related decisions into the teams where changed understanding of benefits are likely to be experienced (change observers in leftmost frame (2) in Fig. 9), the cost and challenges of sharing both contextual information and change information can be reduced. This approach fits nicely with cross-functional autonomous teams that seem to be popular among practitioners at present, and has also been suggested to promote double-loop learning (Basten and Haamann, 2018).

Although the placement of decision authority can reduce the need for movement of information on changed understanding of benefits, it remains uncertain where change in understanding will occur. Thus it seems relevant to discuss (3) how new understanding of benefits can migrate to decision makers. When the communication of changes to benefits understanding is intended to change an organization's current

view of the benefits and, ultimately, goals, there is likely to be similarities with what other research has found on the communication of dissent in organizations. Kassing (2002) summarizes factors that heighten peoples' likelihood of escalating possibly dissenting information. These are people who: (a) have higher levels of argumentativeness, (b) possess an internal locus of control, (c) perceive their relationships with supervisors to have high quality, (d) have high organizational status, (e) perceive that they have high level of personal influence in the organization, and (f) have high levels of self-reported satisfaction. While factors (a) and (b) are characteristics of each person, factors (c–f) are likely to be affectable by the organization. Thus, it seems reasonable that organizations can increase the likelihood of people escalating new understanding of benefits by improving employees perceived quality of relationships with managers (c), organizational status (d), personal influence (e), and job satisfaction (f).

If an organization is successful in getting employees to escalate new understandings of benefit, that information also needs to move from the escalating party to the decision makers. This move of information can be impeded by managers who delay handling or do not handle the issues raised to them (Kassing, 2009). As a result, using the line organization to communicate changes to understanding of benefits might not be effective. One particular difference between the communication of changes to understanding of benefits and communication of dissenting information, is that in dissent, the message is often not wanted, or might be perceived as a problem. Although some might perceive changes to understanding of benefits to be a problem, it also represents a possibility to obtain information that helps the organization utilize possibilities or avoid unsatisfactory results. Such potentially positive information might still be unwanted, because of the perceived side effects people think might arise (Argyris and Schön, 1996).

In summary for (3), double-loop learning depends on (i) people understanding when changes to understanding of benefits should be pushed to decision makers, (ii) that people actually push information to the decision makers, and (iii) that the decision makers understand when available changes to understanding of benefits should affect goals and assumptions in the organization. It is likely that by moving benefits-related decision authority to different parts of the organization, the probability of relevant information (both contextual understanding and changed understanding of benefits) reaching the decision makers are influenced, thus affecting the soundness of benefits-related decisions.

7. Discussion

In each of the four studies, we summarized and placed the results in a double-loop learning model for benefits management inspired by Argyris and Schön (1996). The purpose of this is to create a reference for practitioners to which they can relate changes to understanding of benefits into their organization's learning process, enabling them to manage better such changes which are often faced in software investments.

To exemplify this, we look at how changes to understanding of benefits were managed in two projects from the data material for Study 1, and relate what happened in these projects to our benefits management double-loop learning model. We look at one project that successfully managed the changing understanding of benefits, and one that did not.

In the first project, which successfully managed changing understanding of benefits, the project goals consisted of internal benefits exclusively. However, for these benefits to be realized, data needed to be provided by other organizations. These other organizations had previously provided data using paper forms, which would in the future be provided using the new digital solution. During a meeting between the project manager and a manager in one of these organization that would need to change the way they provided data, it became evident that the new solution would provide previously unknown benefits for the external organization (Fig. 4): They identified *new benefits* and new information about *known user groups*. During further discussions it turned out that by making changes to the planned solution (resulting from *changed understanding of what was needed*), other organizations would also benefit from the new solution (introducing *new user groups*). Although the meeting was intended to inform the external organization about a need to change the interaction between the two organizations (due to the introduction of the new solution) – which can be considered inner loop learning, in the end, the meeting resulted in a change in goals for both organizations (outer loop learning). This was allowed to happen probably because the meeting participants were willing, and able, to *change the solution* and *reprioritize work* (Fig. 6, lowermost frame). Together, the project manager and the external manager toured organizations that could be affected by the new solution, identifying new benefits and possibilities of the new solution. The choice to tour organizations affected by the new solution and deliberately seeking new understanding can be considered as *organizing differently* than planned (the collaboration between the project manager and external manager was not part of the initial organization) and *improving their analysis* – both part of *promoting learning* in Fig. 6.

Although improved analysis is, in the normative models, expected to be performed prior to project initiation, the touring of organizations as a data collection mechanism (in addition to information sharing), is a remarkably proactive way of collecting data for analysis of benefits. By deliberately communicating with stakeholders in organizations affected by the new solution, they gathered information from known actors, but also identified and collected data from *unknown actors* (Fig. 7) – increasing the probability of identifying all relevant changes to the understanding of benefits.

Prior to project initiation, the understanding of the benefits had been different, compared to the updated understanding of the benefits arising from the interaction between the project manager and the external manager. This change happened even after the project organization had conducted a thorough analysis process (Fig. 8) prior to project initiation. Also, due to the funding program that the project was part of, the project had inflexible scope (Fig. 8). This was also the case for the external organization, which, in addition, was overloaded with work. Still, both the project and the external organization were able to overcome the lack of flexibility by convincing their managers that making the proposed changes was the right decision.

One likely reason that both the project manager and the external manager were able to ensure effective benefits-related decisions, may be due to their positions in the organization. They were close enough to where change in understanding happened, to effectively understand the change. Also, they were sufficiently close to top management, providing them with sufficient contextual information and access to obtain approval for the desired changes (Fig. 9 leftmost frame). As the project manager and the external manager were the ones who acquired new understanding of benefits, they did not have to go through the steps (i) and (ii) in Fig. 9 for forwarding the changed understanding, and due to sufficient contextual information, they were able to utilize that changed understanding to change the project goals (iii). In the end, they realized benefits that far exceeded the expectations.

Next, we will look at a project that failed to collect on changed understanding of benefits. In this project, a part of the benefits were planned to be realized in the municipal sector. After finishing the creation of the solution, the municipalities were informed by e-mail about the new solution. However, none of the municipalities responded. This would signal that, somewhere and somehow, some sort of changed understanding of benefits has arisen; both at the municipalities who do not care to respond and at the providing organization who should question if they have delivered the intended value. At the end of Section 3.2.6, we see an extract from the interview of the providing organization, where the interviewee explains that it is uncertain if the e-mail will be read by the recipients, and that it is unlikely that it will be acted upon. The interviewee indicated that sending the e-mail was not sufficient and that *more work should be done in order to*

realize the benefits (Fig. 4). It is not clear from the interviews if the lack of response from the municipalities was anticipated or not. Assuming that the project was honest about their planned benefits, it seems reasonable that the lack of response from the municipalities was not anticipated, which indicates that this experience resulted in a change in understanding of the benefits (*what was needed in order to realize the benefits*). Interestingly, the interviewee explained that they did not plan to take further action to realize the planned benefits. While there can be many reason for choosing not to pursue part of the planned benefits, it is plausible that this lack of action fits into Argyris and Schön (1996)'s inhibitory theory-in-use. That is people have expectations about other people, which guide their actions in an inhibitory way. In the current example, the interviewee thinks that the municipalities will not read my emails or act upon them 6, so further actions are futile – resulting in a lack of escalation of the possibilities for the municipalities.

Assuming that the new solution would actually provide relevant benefits for the municipalities, it seems likely that if the persons receiving the e-mails in the municipalities had (2) sufficient *contextual information*, they would be able to (i) *understand that the changed understanding should be pushed to decision makers* or *use the changed understanding to affect their actions* (Fig. 9). One approach, that could help those delivering the solution in making the municipalities receive the solution, could be to actively influence the recipients' contextual information, for example by providing information on how the proposed benefits fits into the municipality.

Relating more closely to the work of Argyris and Schön (1996) and Argyris (1993), a central problem that emerges from the results and the project examples above, is that managing the changed understanding of benefits does not seem like something that can be solved by suggesting a new process. Rather, peoples' underlying theories-in-use and their belief systems are instrumental to managing changed understanding of benefits. Argyris and Schön (1996) describe two models of organizational theories-in-use – Model 1 and Model 2. In Model 1, individuals are concerned with winning in the situation they are in and optimizing the inner loop, making a display of rational behaviour and limiting the display of potential dissent. In Model 2, individuals' foci shift towards obtaining valid information, making informed choices and developing commitment to those choices. For organizations to successfully manage changing understanding of benefits, those involved need to follow Model 2-based values. This, in turn, poses challenges for the management of changing understanding. First, because (Argyris and Schön, 1996) argue that promoting Model 2-values is challenging in an organization where Model 1 has found root. Second, because it seems unpredictable which parts of the organization will be involved in handling the changed understanding of benefits (either experiencing the change, helping forward it, or make decisions based on the change). Third, because in many situations, a multitude of people can be involved in the process of changing understanding. Thus there is a large number of people who need to adopt Model 2 values for the effective management of changing understanding of benefits to occur.

Nevertheless, simply being aware of what is going on is a first step to improvement. The conceptual model that we have started building through the four studies in this article is intended as an aid to such awareness. If organizations are able to map their situation to concepts in the model (as we did for the two cases above), this might lay the grounds for verbalizing and bringing out into the open otherwise tacit presumptions that fuel inhibitory Model 1 behaviour.

8. Limitations

The limitations of the studies presented above are discussed in terms of threats to construct validity and to external validity. Both types pertain to generalizability. The former also concerns the validity of concept construction, which is central in the types of study in this article.

8.1. Construct validity

Construct validity is concerned with the relationship between results at the operational level and claims at the conceptual level (Trochim, 2001). Although construct validity is often used in quantitative research, to consider how well a set of indicators represents a concept (such as in factor analysis and latent variable modelling), construct validity is central to the building of conceptual models through content analysis (Krippendorff, 2004) and in devising questionnaire items (Trochim, 2001). The type of threats to construct validity relevant to our work is *inadequate explication of constructs* (Shadish et al., 2002).

Inadequate explication of constructs is relevant for all the studies reported here. For the first study (Section 3), the adequacy of the construct definition relates to our ability to build adequate constructs based on the interviewees' statements. One threat to this validity is the use of only one researcher to code the data. We mitigated this problem by applying the coding tests described in Section 3.1.3. Code grouping and concept development is also relevant to the adequacy of the construct definition. If our understanding of the collected data is based on misinterpretations, the code groups and suggested concept will be invalid. Observing that the phenomena represented in the code groups are reported in other studies (as discussed in Section 3.3), gives some affirmation to the adequacy of these groups. Only a single concept from Study 1 is used in further developments in this article, namely, *w*ith its six change types (A–F). This reduces the relevant adequacy threat to this concept only. When collecting data about the concept in the latter studies (Sections 4, 5 and 6), we relied on the pilot tests described in Section 4.1.3, to validate that the construct made sense to the respondents. The adequacy of the concept is strengthened by its (adequate) use in multiple studies (Yin, 2003).

Building the construct only on data from a specific type of projects (public sector digitalization projects in Norway), with low variation in size and duration, we are concerned that there might be parts of the concept (codes or code groups) that we have not identified. Still, from our experience as practitioners in the software industry, we cannot point to any missing elements.

In the second study (Section 4), we conducted a ten-minute long survey without explaining the relevant terminology to the respondents. Although the pilot tests of the survey indicated no challenges for respondents in understanding the different parts of the concept (identification of new benefits etc.), there is a possibility that other terminology is understood differently. We believe this is especially relevant for the response alternatives of SQ1 through SQ3.

In SQ1 we ask for the presence in change of understanding of the different characteristics of benefits, but we do not know if the change in understanding is large or small. As a result, the high occurrence of changes to understanding of benefits reported here, might be due to small changes. Still, seeing that respondents chose to act on the reported changes in understanding, indicate that the changes are important.

In SQ2, we do not know if the respondents' reported need for *better analysis* and *organizing differently* requires a large or small change. Also, we do not know the amount of analysis done previously or how they were organized prior to suggesting a need for organizing differently. Similar observations are relevant for SQ3, where we have no information of size or implications of the reported changes.

Although threats like these are common for questionnaires, we think it is pertinent to draw attention to possible ambiguities, which can be clarified in further studies of other types.

8.2. External validity

The most important threat to external validity of the above studies lies in the sampling strategies. Respondents to the first study were limited by availability (some people who had held key roles were not with the organization anymore), were selected only from the public

sector, had little variation in project size, and had positive incentives to use benefits management. It is likely that these factors affect how organizations work and hence how their understanding of benefits change. We have attempted to mitigate this problem by evaluating the concept of changing understanding of benefits in a survey (Section 4), but the survey sample is also a convenience sample, with practitioners only from Norway. Similar observations can be made for the focus groups, where participants had either volunteered or were invited. Still, there are two properties of the respondents that we consider to be useful. First, in order to improve the field of benefits management, collecting data from the use of benefits management in practise is useful. This classifies our samples as critical samples, where one can argue that challenges and difficulties in benefits management observed in incentivized cases are even more likely to occur in non-incentivized cases (Hannay and Jørgensen, 2008). Second, the focus groups were dependent on participants with experience. Randomly selecting participants for these studies, would probably lead to data with low degree of information on the topics to be studied.

9. Conclusion and further work

While working on the first two studies of this paper, it became evident that guides and literature on benefits management did not provide guidance to practitioners on how to manage the changing understanding of benefits below the portfolio level. After conducting the last two studies, we see that providing guidance on how to manage changing understanding of benefits is not straightforward. It seems unlikely that cookbook-recipes for practitioners will help. Rather, it seems that organizations need to be conscious about embracing changes to understanding of benefits, and evolve the organization into being able to escalate and utilize that changed understanding. Building on that, we think there are two areas of research that could be particularly useful for practitioners. First, we think it would be advantageous to understand more about the factors that promote changes to understanding of benefits to arise in individuals. Second, it would be useful to better understand people's escalation and organizations' reception of changes to understanding of benefits. Furthering our understanding of these two topics is likely to help improve the realization of benefits in the dynamic environment that software investments are.

CRediT authorship contribution statement

Sinan Sigurd Tanilkan: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Writing – review & editing, Visualization, Project administration. **Jo Erskine Hannay:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Only data that is not limited by GDPR is provided through url's included in the paper.

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