A Survey on the Use and Effects of Goal Hierarchies in Digitalization Efforts

Sinan S. Tanilkan, Leif Z. Knutsen, J. David Patón-Romero, Jo E. Hannay

Center for Effective Digitalization of the Public Sector (EDOS), Simula Metropolitan Center for Digital Engineering (SimulaMet), Oslo, Norway

Abstract—**Digitalization has become a primary goal for organizations. Successfully adopting the digital context both in daily operations and in business management and strategy entails great benefits at different levels (organizational, economic, social, environmental…). Thus, it is very important that practitioners have clear conceptions of the goals in this regard and that those goals are "alive" in organizations.**

For this reason, in this study we present a survey that we performed among practitioners related to the management of Information Technology (IT) from both the private and public sectors in Norway. Through this survey we have tried to find out how organizations understand and translate the current context of digitalization from different goal levels. For that, we asked respondents to relate to one of three goal hierarchies: A) a classical governance approach; B) an organizational tier approach; and C) an effects-based approach.

Among the results obtained we found that the first two are the most used and the goal achievement is slightly higher for the classical governance approach than for the organizational tier approach. Likewise, we identified that while top level management has a good understanding of the goals, this understanding deteriorates as one moves down the organizational hierarchy.

I. Introduction

In recent years, both private and public organizations around the world have incorporated digitalization as a main objective in their roadmaps [1]. This concept refers to the use of digital technologies to change a business model and provide new revenue and opportunities, i.e., it is the process of moving (partially or completely) to a digital business [2] [3].

Although the concept of digitalization may seem simple to understand in principle, its application in practice is challenging [4], which may explain why many organizations struggle to adequately identify what digitalization means to them and how to approach it. Digitalization as such is a very high-level strategic goal that directly entails and affects numerous other related goals, subgoals, and goals at various levels of abstraction and levels of organization. This calls for alignment between business and Information Technology (IT) goals so their attainment serves the same purpose.

Since the practice of "management by objectives" was articulated by Peter Drucker in 1954 [5], numerous approaches have been suggested for maintaining the connection between high-level goals that are meaningful and salient to senior executives, board members, shareholders, etc., on the one hand, and those who implement these goals through specific actions and decisions on the ground on the other hand, typically through what we may term a "goal hierarchy" [6], in which goals at the highest and lowest levels

of aggregation provide context and support through each other as implemented in a management system.

Goal hierarchies imply a structuring of goals on different levels of aggregation, corresponding to different levels of management scope. Although structuring also implies that there should be a connection between goals at various levels, there is often a disconnect between levels in both the formulation of goals and the activities that should lead to achieving goals. Various architectural design frameworks, such as *The Open Group Architecture Framework* (TOGAF)[1], *Capability Driven Design* (CDD) [7], and the *NATO Architecture Framework* (NAF)[2], have been proposed to solve this problem in a general form. These frameworks structure a workflow through the abstraction layers suggesting diagram types that are suitable at various levels for describing enterprise architectures, business processes, system architectures, etc. Further, to support practitioners to develop content in such diagrams, a user story-based approach with explicit goal statements has been suggested [8] [9] [10] [11], as well as other methodological support [12] [13].

Despite the existence of such methodological support, our informal observations from the field suggest that these kinds of methods are not used unless they are integrated into commercial frameworks, popularized in mainstream literature, or imposed by public governance. The three goal hierarchies investigated in the present study are integrated in frameworks that are either popularized or imposed. However, as is typically the case, the frameworks do not include methodological support to define actual goals at the different levels or to define explicit links between goals at different levels. This may be further complicated by the increasing use of goals tied to corporate social responsibility, e.g., sustainability and "green" goals [14] [15] [16].

There is an abundance of practitioner literature and case studies on goal hierarchies (e.g., [17] [18]), but we have found little empirical evidence on how these hierarchies serve their intended purpose. While it may seem important that organizations identify their digitalization goals at all relevant levels of abstraction and organization to keep them aligned and consistent, it is unclear whether this is possible or even always desirable. The purpose of the present study is to gain an initial understanding of how goal hierarchies are perceived and used among practitioners, and, particularly, how different approaches for these hierarchies are used (with a particular emphasis on digitalization efforts). Specifically, we investigate the awareness of goals at various levels and what awareness and experience practitioners have of the linking of goals at different levels.

To this end, we conducted a survey among IT practitioners from both the public and private sectors in Norway to gauge their engagement in and awareness of different goal hierarchy systems.

This document is organized as follows: Section II contains the background on digitalization and goals, motivating the research questions in Section III. Section IV presents the application of the main aspects from the research methodology used. Section V shows in a general manner the results obtained from the survey performed. Section VI discusses the findings, as well as the implications for research and practice and threats to validity. And Section VII concludes the present study. In the same way, Appendix A includes the questions used in the survey.

II. BACKGROUND

A. Digitization vs. Digitalization vs. Digital Transformation

The terms "digitization", "digitalization", and "digital transformation" are often used interchangeably [19]. Schallmo and Williams [20] propose the following descriptions:

- **Digitization** – making an analog or physical artifact digital.

- **Digitalization** – making fundamental changes to organizations based on knowledge gained via digitization initiatives (often focused on more efficient or quicker).

- **Digital transformation** – differs from digitization and digitalization in how new understanding is utilized. In digital transformation, processes are reevaluated and new ones are invented.

When using the term *digitalization* in this study, we included all the above meanings and allowed respondents to interpret the term how they prefer. We will also use the term "IT" interchangeably with "digitalization" in this paper.

B. Goals

The purpose of using goals in organizations includes improving performance (at individual [21] and group [22] [23] levels), establishing alignment (among people [24] [25] and between objectives and daily work [26]), setting priorities [24], providing focus [27], reducing the needed coordination and management effort [28], and making measurable contributions [27]. Research suggests that a collection of goals is most beneficial when they are conceptually and economically coherent [29] [30], and when there is congruence among them across organizational hierarchies [18] [31].

Goals have been studied from several angles. The theory of task motivation and incentives [32] explores goals for individuals and suggests approaches to goal setting with the aim to improve task performance. Results suggests that *"[…] hard goals produce a higher level of performance (output) than easy goals"* [32] and that goals should be specific. A recent survey, primarily of senior managers, shows that strategic planning, which is based on achieving specific goals, remain commonplace and is considered useful among Norwegian government agencies, highlighting the importance of understanding the effectiveness of the frameworks used to that end [33].

At the organizational level, goal hierarchies are suggested as a part of a full set of management control systems that articulate, measure, and improve performance [34] [35]. The theory of co-operation and competition [36] suggests that goal hierarchies can promote situations to be co-operative, competitive, or individualistic. In the cooperative goal hierarchy, individuals can only achieve their goals if the people they are working with also achieve their goals. Here the individual's rewards are directly proportional to the quality of the work in the group [37]. The competitive goal hierarchy is opposite to the co-operative in that there is a negative relationship between the individual's goal attainment and their peers' goal attainment, much like a zero-sum game. The worse one person does, the better the results of others are [38]. In the individualistic goal hierarchy, *"[…] there is no interrelation between the goal attainments of the people involved"* [38]. One person's success is independent of others'. In this situation *"[…] a person seeks an outcome that is personally beneficial, ignoring as irrelevant the goal achievement efforts of other participants in the situation"* [39]. It is clearly the case, however, that it is the co-operative mode which is expressed in the goals frameworks commonly used today, although anecdotal evidence suggests that the competitive mode may well be in play informally.

The "classical" notion of alignment builds on a vertical structure in which superordinate goals are disaggregated into subordinate goals, the attainment of which aggregate to contribute significantly to the superordinate goals. However, alignment in scaled agile emphasizes horizontal alignment between groups at the same level [40]. As an integral part of agile practices, team autonomy promotes a "loose" connection between superordinate and subordinate goals in which teams tend to prioritize their efforts based on a shared understanding of value, rather than specific higher-level goals [41].

Several case studies of agile practices at scale have highlighted the need for alignment between the strategic goals of the organization, or indeed the ecosystem in which the organization takes part, and the objectives that guide the work of agile teams. A recent study highlighted the challenges in implementing one such hierarchy – Objectives and Key Results (OKR) – in an organization, where specifically, the identification and specification of coherent goals at various levels was perceived as hard [42].

C. The Role of IT in Organizational Goal Setting

Despite continuing debate on the IT investment's effects on firm productivity ("Solow Paradox") [43], IT governance has proven to be an increasingly important part of overall corporate governance, affecting several aspects of overall performance [43]. This has led to an interest in improving alignment between business and IT strategy [44].

The extent to which the entire goal hierarchy is coherent, and that IT managers perceive congruence between the goals they are responsible for achieving and the overall goals of the organization is therefore likely to improve both their goal attainment and contribute to the overall organization goals.

III. RESEARCH QUESTIONS

As a first step to understanding goals application in practice, we study alignment of goals through vertical connections. This is based on what frameworks are used in our sampling space and on the fact that vertical goal hierarchies are, perhaps, easier to conceptualize than horizontal alignment frameworks. It may, however, be the case that practitioners rather use informal mechanisms to achieve horizontal alignment between goals, but that is left for future study.

Different goal hierarchy approaches are used to vertically align work in organizations. 1) A "classical governance" approach is promoted in [45] [46] [47], where goals are organized as operational, tactical, and strategic. 2) Recently frameworks such as Objectives and Key Results (OKR) [27] have gained in popularity. These frameworks use an "organizational tier" approach, such as individual, team, and organization goals. 3) When relating goals to products or projects, goals can be organized according to an "effects-based" approach, such as in impact and benefit estimation methods [48] [49] and reflected somewhat in governmental recommendations [50] [51]. In the effects-based approach, goals are organized as result/solution, effect/process, and societal/business [51]. These are the three types of hierarchy we are investigating at present, summarized in Table I.

TABLE I. OVERVIEW OF GOAL HIERARCHIES

	Classical Governance	Organizational Tier	Effects-based
Upper Level	Strategic	Organization	Societal/business
Middle Level	Tactical	Team	Effect/process
Lower Level	Operational	Individual	Result/solution

We shall relate to those types of hierarchy and investigate practitioners' familiarity with them and their perceptions of impact and use. We pose the following research questions (RQs):

- **RQ1.** To what extent are goal hierarchies used in industry?

- **RQ2.** How successful are the different goal hierarchies in connecting goals at different levels?

- **RQ3.** Are there differences in realization of goals among those using the different goal hierarchies?

- **RQ4.** Do the methods and frameworks for connecting and managing goals at different levels influence the realization of goals?

- **RQ5.** What types of goals drive digitalization work in organizations?

- **RQ6.** To what extent do people in organizations understand and contribute to top management goals?

IV. RESEARCH METHODOLOGY

To answer the RQs in the present study, we designed and conducted a survey following the characteristics of a survey identified by Groves et al. [52] for the collection and generation of data.

A. Survey Design

In designing the survey, we decided to first identify a series of relevant questions to address the RQs and subsequently to perform a pilot test [53] [54] to validate the defined scope and questions.

During the first phase we conducted a meeting to define the aspects in the survey scope, identifying the key objectives, the target audience, and a series of possible questions.

On the one hand, the context of the survey was based on the field of digitalization. We took advantage of the holding of a seminar whose main theme was on how organizations implement methods and frameworks regarding goals on digitalization.

It was also clear to us that our target audience would be made up of IT practitioners with varying levels of responsibility for IT (both at the corporate and project level) from the public and private sectors in Norway, since the seminar was organized exclusively for this type of audience.

On the other hand, we also developed a first draft of relevant questions within the context of the study. These questions were refined during a series of iterations/meetings over two weeks, in which we modified, added, and removed some aspects and questions to obtain a survey that is understandable and concise/direct, that they were aligned with the established RQs, to obtain relevant and reliable results. These questions were organized into three blocks or sections:

- **First Section (Goal Hierarchies).** In this first section, each respondent was asked to select one of the three goal hierarchies (shown in Table I), according to which hierarchy was used in the respondent's current organization, or alternatively in case none of the three were in use, which hierarchy the respondent was most familiar with. The ensuing questions were then oriented to the chosen hierarchy.

- **Second Section (Goal Levels).** This was the main part of the survey, through which our intention was to identify the relationship between goals at different levels and how these goals were achieved. To do this, we asked respondents to write examples of goals (max. five) that they had experienced or could come up with at each of the three levels of their chosen hierarchy. After this, we established a series of questions to find out the extent to which the respondents perceived that goals at different levels were connected in their organizations, as well as the degree of achievement of these goals and how the achievement was assessed. Lastly, we asked respondents for their perception of the actual and desired impact on digitalization work of various types of goals (quantitative, qualitative, sustainability-related goals, etc.), also asking about their awareness with top management goals.

- **Third Section (Demographic and Organizational-related Data).** Finally, with the aim of being able to identify groups both at the level of the respondents and their organizations, we included a series of questions on demographic and organizational-related data. These questions are intended to identify, among others, years of experience, role, type and size of the organization…

The survey was issued using *Qualtrics* (https://www.qualtrics.com/), due to its ability to branch according to respondent choices and due to its cross-platform compatibility.

In the second phase of the design work, we performed a pilot test with three experts from the field of IT management. We first sent the link to the survey to each of these experts, explaining to them what the objective of our study was and what data we intended to collect. After this, the experts performed the survey in a normal way and gave us a series of comments and feedback that allowed us to validate that the questions we had defined were oriented towards the context that we intended to investigate and were understandable to the target audience. From this test, we refined some words and expressions to make the survey more suitable for respondents.

We finalized a survey instrument made up of 22 questions, for which we estimated a response duration of 10–15 minutes. Appendix A of this document includes the questions defined in the survey, as well as the response type and the possible responses for fixed-answer questions.

B. Survey Execution

The survey was administered at a seminar on the theme of how organizations implement methods and frameworks to better integrate strategic goals with actual initiatives, in which IT practitioners from the public and private sectors in Norway participated. This seminar had a hybrid modality, in which between 50–60 people attended in person and around 60 more people attended online.

The survey was conducted right after the first keynote on a study that highlighted the challenges in implementing OKR as a management system [42]. First, we gave a brief introduction to the survey, stating that our aim was to understand more about the goals and the connection between them at the different levels of organizations (from a digitalization point of view). Subsequently, we indicated that the first question was for selecting the appropriate goal hierarchy as mentioned above, after which three free-text questions would follow in which they should include some examples of goals at each level. We remarked that they should not spend more than one minute per question on these three questions. After this, we commented that a series of scale-type questions would follow on different aspects of the goal levels. We ended the introduction by indicating that, in total, the survey should take between 10-15 minutes and that in case of any doubt or concern, we would be available for questions.

At the end of the seminar, we presented a preliminary analysis of the collected data with graphs (automatically generated through *Qualtrics*) and some preliminary findings that served as a point of reflection for the attendees. We also indicated that the survey link was going to remain active, in case anyone had not been able to attend or complete the survey or wanted to share it with a colleague. We decided to end the data collection one week after the seminar and considered the dataset (made up of 85 respondents) as definitive. This dataset is available at https://tinyurl.com/goalsstudy.

C. Survey Data Analysis

For the reader that does not enjoy considerations of statistical methods, Table II provides an overview of the statistical symbols used in this study. The remainder of this section describes the statistical analysis of the survey data.

TABLE II. OVERVIEW OF STATISTICAL SYMBOLS USED

Symbol	Name	Description
p	Probability (p) value	Probability of the sample exhibiting the observed difference under the assumption that there is, in fact, no difference in the population
p_{adj}	Adjusted p value	Adjusted p value to compensate for the increased probability of false positives when conducting multiple tests
p_{norm}	p value for normality	Probability of the sample exhibiting a normal distribution, when the population is, in fact, not normal
E_R^2	Epsilon-squared	Measure of effect size for parametric models

Symbol	Name	Description
W	Kendall's W	Measure of effect size for non-parametric models
r	Correlation coefficient	Measure of effect size for models with two variables

For the analysis of the data collected through the survey, we used the functionality in the *Qualtrics* tool for a first representation and export of the data (in this case, in a file with .csv or "comma-separated values" format). This data file was later imported into the *IBM SPSS Statistics* tool (https://www.ibm.com/products/spss-statistics), in order to conduct a statistical analysis and more detailed representation of the results obtained.

The analysis was initiated with a test of normality on the collected data. For this, we used the *Kolmogorov-Smirnov Test of Normality*, which tests the probability that the sample is reported to be normally distributed, when it is in fact not normal. When evaluating if samples were normal, we used the least normal of each sample for each test. This resulted in p_{norm} values ranging from 0.000 to 0.039, which fails the normality test.

Subsequent analysis of our data was conducted using non-parametric tests of statistical significance. Non-parametric tests are used because our data is likely not normally distributed. Also, our sample size is not large enough to compensate for non-normal data (which would be necessary to use parametric tests). Table III provides an overview of the tests and what data the tests are used on.

TABLE III. OVERVIEW OF TESTS OF SIGNIFICANCE USED

Test	Data Compared
Kruskal-Wallis	• Degree of connection between goal levels **&** Goal hierarchies with their levels • Degree of goal realization **&** Goal hierarchies with their levels • Degree of goal realization **&** Number of methods used for connecting goals • Degree of goal realization **&** Whether organizations use specific frameworks for connecting goals
Friedman's	• Reported effect goals *actually* have on digitalization work **&** Types of goals • Reported effect goals *should* have on digitalization work **&** Types of goals
Wilcoxon	• Reported effect goals *actually* have on digitalization work **&** Reported effect goals *should* have on digitalization work
Jonckheere-Terpstra	• Respondents' understanding of top managements' goals **&** Respondents position in organization • Respondents' contribution in daily work to top managements' goals **&** Respondents position in organization

When using the *Related-Samples **Friedman's** Two-Way Analysis of Variance Test*, we reported both the results from the omnibus test and pairwise comparisons. For pairwise comparisons, there will be multiple significance tests, leading to an increased probability of observing significant results only by chance [55]. To compensate for this, we reported the Bonferroni-adjusted probability (p_{adj}).

The ***Jonckheere-Terpstra** Test* is used because we wanted to test if there is a decrease in understanding of and

contribution to top managements' goals when moving down in the organizational hierarchy.

When testing for statistical significance, we accepted a 5 % probability of rejecting the null hypothesis, when it is in fact true (p <= 0.05).

Calculating effect sizes for non-parametric tests is not straightforward. Table IV provides an overview of the methods used to calculate effect sizes for the different significance tests. Selection of methods for calculating effect sizes are based on the study of Tomczak and Tomczak [56].

TABLE IV. OVERVIEW OF METHODS USED TO CALCULATE EFFECT SIZES

Test	Effect Size Method	Ranges
Kruskal-Wallis	Epsilon-squared	0: no relationship 1: perfect relationship
Friedman's	Kendall's W	0: no relationship 1: perfect relationship
Wilcoxon	Correlation coefficient	0: no relationship 1: perfect relationship
Jonckheere-Terpstra	No method for calculating omnibus effect size found	

It is important to highlight that results from different methods of calculating effect size are not necessarily comparable. We still believe that reporting effect sizes are useful, because 1) it allows for consideration of the effect size for each test, and 2) it allows others to compare their results with those reported here.

V. RESULTS

The following subsections show an overview of the results obtained through the survey. To do this, we have decided to organize them according to the three blocks or sections that comprise the survey.

A. Goal Hierarchies

In this first section (questions 01 and 02; cf. Appendix A), our objective was to determine the number of practitioners who identify with each goal hierarchy. Thus, Fig. 1 shows the categorization of the 85 respondents based on these goal hierarchies. The lower section of each column (purple) represents the number of responses where the respondent's organization uses the indicated hierarchy, while the upper section (blue) represents the number of responses where the respondent's organization did not use the hierarchy, but where the respondent was otherwise familiar with the hierarchy.
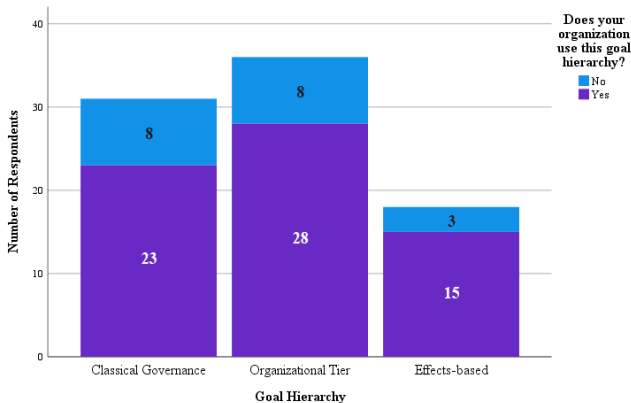

Fig. 1. Number of respondents selecting each goal hierarchy

B. Goal Levels

In the main part of the survey, we focused on identifying different characteristics of the goals at each level in the goal hierarchies included.

We asked respondents about how strong they perceived the connections to be between the different goal levels in their chosen hierarchy (question 06). Fig. 2 shows the descriptive statistics in terms of quartile boxplots, where, for each hierarchy, one can see the degree of perceived connection between the lower and middle levels (purple), middle and upper levels (blue), and lower and upper levels (green).
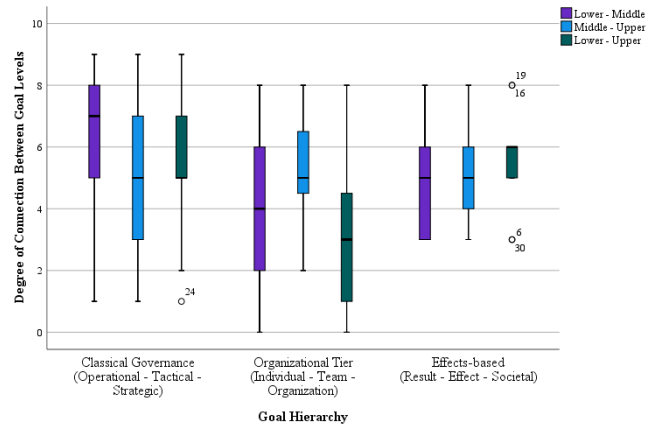

Fig. 2. Connection between goal levels

To see if there are any differences between the hierarchies in how strong the perceived connections are, we ran comparison tests across hierarchies for each of the three relationships between levels (purple, blue, and green). For significance testing, we used the *Independent-Samples Kruskal-Wallis Test*, comparing the degree of connection between levels across the three goal hierarchies. Table V shows the p and E_R^2 values for the omnibus test of the null hypothesis of the degree of connection being equal across all three hierarchies.

TABLE V. RESULTS OF COMPARING CONNECTION BETWEEN GOAL LEVELS ACROSS GOAL HIERARCHIES

Levels	Comparison (cf. Fig. 2)	p	E_R^2
Lower – Middle	Purple boxplots	0.083	0.111
Middle – Upper	Blue boxplots	0.873	0.006
Lower – Upper	Green boxplots	0.009*	0.209*

Significant results highlighted in the text

As can be seen from the p values, there is a significant difference across hierarchies (i.e., the null hypothesis of there not being any difference can be rejected) when it comes to the degree of connection between the lower and upper goal levels. To find out between which hierarchies the differences are, we ran pairwise comparisons. Visual inspection of Fig. 2 indicates that upper and lower goal levels are less connected in the "organizational tier" hierarchy (i.e., individual and organization levels) than in the other models. This is supported by the pairwise comparisons, which shows a significant difference between "classical governance" versus "organizational tier" (p_{adj} = 0.026) and between "effects-based" and "organizational tier" (p_{adj} = 0.035).

Next, to see if there are differences in the perceived realization of goals per level across goal hierarchies, we used responses from questions 01 and 08. Fig. 3 shows the reported degree of goal realization for each goal level organized by goal hierarchy.
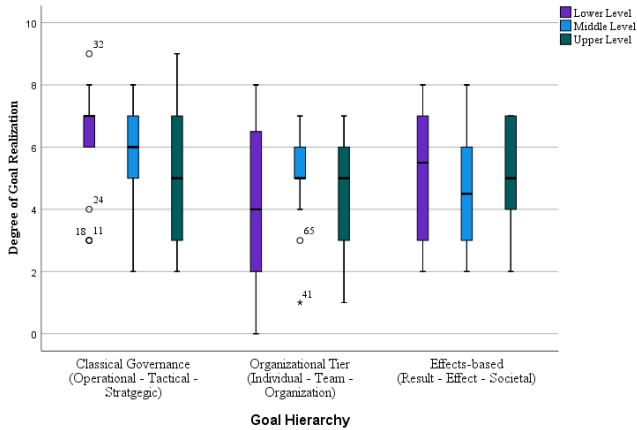

Fig. 3. Goal realization for the different goal levels

We used the *Independent-Samples Kruskal-Wallis Test* to test for differences across hierarchies for goal realization at the lower level (purple boxplots), middle level (blue boxplots), and upper level (green boxplots). Table VI shows the p and E_R^2 values for the omnibus test.

TABLE VI. RESULTS OF COMPARING REALIZATION OF GOALS ACROSS GOAL HIERARCHIES

Level	Comparison (cf. Fig. 3)	p	E_R^2
Lower Level	Purple boxplots	0.023*	0.168*
Middle Level	Blue boxplots	0.353	0.046
Upper Level	Green boxplots	0.593	0.023

Significant results highlighted in the text

We found no significant differences between goal realization at the upper levels nor at the middle levels. At the lower levels goal realization is observed to differ significantly across hierarchies. From Fig. 3, it seems that those selecting the "organizational tier" hierarchy have a lower performance in realizing goals at the lower level, compared to the other goal hierarchies. Running pairwise tests, it turns out that this relationship is significant only between the "classical governance" and the "organizational tier" hierarchies ($p_{adj} = 0.018$).

To compare the realization of goals with the number of methods used for connecting goals[3], we used responses from questions 07 and 08. We combined the results on realization of goals at each level across hierarchies. In Fig. 4, all goals at the lower level are represented by purple boxplots, the middle level by blue boxplots, and the upper level by green boxplots.
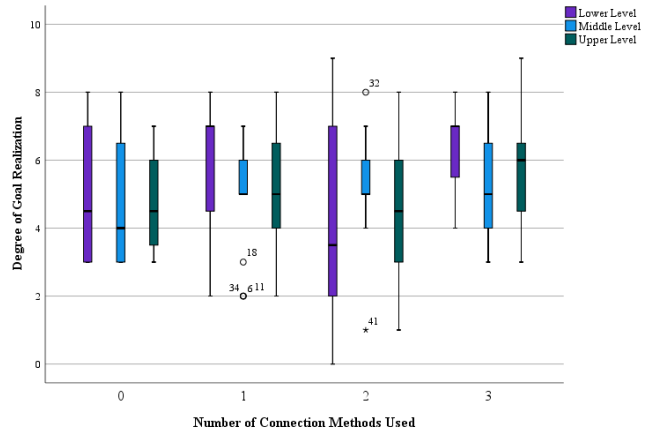

Fig. 4. Goal realization compared to the number of connection methods used

Visual inspection of Fig. 4 indicates no effect of the number of connection methods used on goal realization. This is supported by significance testing, using the *Independent-Samples Kruskal-Wallis Test*, which also indicates no significant difference (Table VII).

TABLE VII. RESULTS OF COMPARING REALIZATION OF GOALS BETWEEN NUMBER OF METHODS USED TO CONNECT GOALS

Level	Comparison (cf. Fig. 4)	p	E_R^2
Lower Level	Purple boxplots	0.212	0.107
Middle Level	Blue boxplots	0.931	0.010
Upper Level	Green boxplots	0.664	0.038

To compare the realization of goals with the use of concrete frameworks for handling them (e.g., OKR, Lean Value Tree, or similar), we used responses to questions 08 and 14. We used the *Independent-Samples Kruskal-Wallis Test* to compare realization of goals across the goal levels, when organizations report to use or not use frameworks for handling goals.

Visual inspection of Fig. 5 and p and E_R^2 values from Table VIII indicate no difference in realization of goals between those using and those not using concrete frameworks for handling goals.
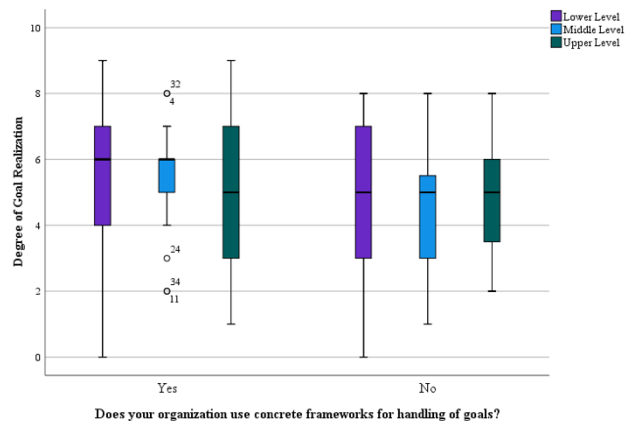

Fig. 5. Goal realization regarding the use or not of frameworks

---

[3] The included methods for connecting goals are *concrete frameworks (OKR, Lean Value Tree, or similar), formal communication (presentations, events, or similar), informal communication/leadership (through "fans", informal leaders, or similar)* and *other*.

TABLE VIII. RESULTS OF COMPARING REALIZATION OF GOALS BETWEEN USING OR NOT CONCRETE FRAMEWORKS FOR HANDLING GOALS

Level	Comparison (cf. Fig. 5)	p	E_R^2
Lower Level	Purple boxplots	0.715	0.003
Middle Level	Blue boxplots	0.183	0.042
Upper Level	Green boxplots	0.598	0.007

To explore the influence different types of goals *actually* have and should *ideally* have on digitalization work, we used responses to questions 10 and 11. Here we asked respondents to what degree the different types of goals *actually* influence digitalization work, and to what degree they think that the same types of goals should *ideally* influence digitalization work. The degree to which goals *actually* influence digitalization is displayed in Fig. 6 and the degree to which practitioners think goals should *ideally* drive digitalization is presented in Fig. 7.
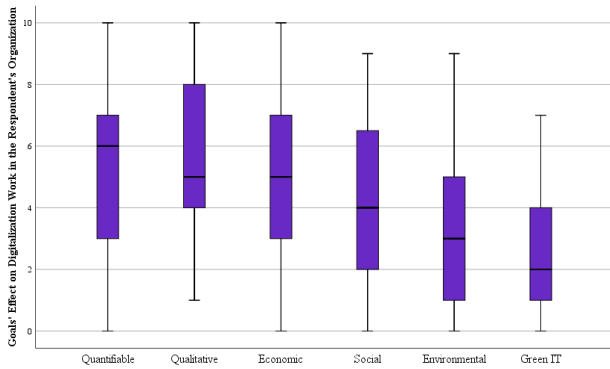

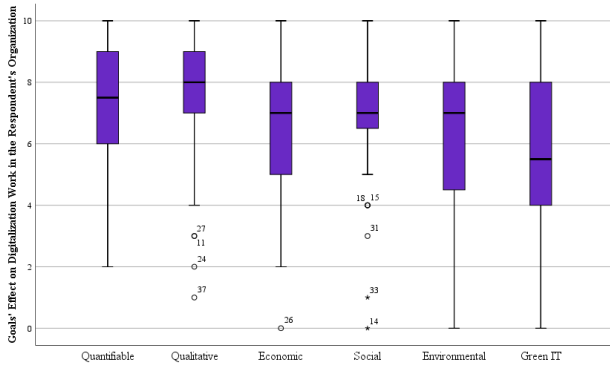Fig. 6. *Actual* types of goals driving the digitalization work in organizations

Fig. 7. *Ideal* types of goals driving the digitalization work in organizations

To compare the influence the different types of goals are reported to *actually* have, and the influence respondents report that the different types of goals should *ideally* have on digitalization work, we used the *Related-Samples Friedman's Two-Way Analysis of Variance Test*. For both tests, we got significant differences, indicating that there is a difference between types of goals in both the influence they are reported to *actually* have and should *ideally* have. Comparing the influence goals are reported to *actually* have, we got $p = 0.000$ and $W = 0.294$, and comparing the influence respondents report that goals should *ideally* have, we got $p = 0.000$ and $W = 0.125$.

Visual inspection of Fig. 6 indicates that there is an ordinal relationship between types of goals when it comes to the goals *actual* influence on driving digitalization work. Pairwise comparisons support this observation only for *Environmental*

and *Green IT* goals. Results of pairwise comparisons can be found in Table IX, where p_{adj} values over the diagonal are for comparisons on the influence goals are reported to *actually* have, while p_{adj} values under the diagonal represent the influence practitioners report that goals should *ideally* have on digitalization work. From the p_{adj} values under the diagonal, we observed that the only goal type that practitioners report that should *ideally* have less influence than the others is *Green IT* (significant when comparing with *Quantifiable*, *Quantitative*, and *Social* goals).

TABLE IX. RESULTS ON PAIRWISE TESTS ON *ACTUAL* INFLUENCE OVER THE DIAGONAL AND *IDEAL* INFLUENCE UNDER THE DIAGONAL

p_{adj}	Quantifiable	Qualitative	Economic	Social	Environmental	Green IT
Quantifiable		1.000	1.000	0.604	0.001*	0.000*
Qualitative	1.000		1.000	0.232	0.000*	0.000*
Economic	1.000	1.000		0.347	0.038*	0.000*
Social	1.000	1.000	1.000		0.563	0.004*
Environmental	1.000	0.525	1.000	1.000		1.000
Green IT	0.031*	0.001*	0.168	0.004*	0.692	

Significant results highlighted in the text

Comparing Fig. 6 and Fig. 7, it seems that practitioners believe that all the types of goals should *ideally* have more influence on digitalization work than they *actually* have. We used *Wilcoxon Signed Ranks Test* to compare each goal type on the influence it is reported to *actually* have vs. should *ideally* have. The results are shown in Table X, which shows that there is a significant difference between the influence goals are reported to *actually* have versus the influence respondents report that goals should *ideally* have.

TABLE X. RESULTS ON PAIRWISE TESTS ON *ACTUAL* INFLUENCE OVER THE DIAGONAL AND *IDEAL* INFLUENCE UNDER THE DIAGONAL

Actual vs *Ideal*	p	r
Quantifiable	0.000*	-0.440
Qualitative	0.000*	-0.417
Economic	0.000*	-0.379
Social	0.000*	-0.514
Environmental	0.000*	-0.443
Green IT	0.000*	-0.492

Significant results highlighted in the text

Another interesting characteristic is the influence of internal and external requirements on organizational goals. Fig. 8 shows to what degree organizational goals are driven by internal versus external requirements (based on the responses to question 12). The results in Fig. 8 show clearly that the largest portion of respondents report their goals to be more driven by external than internal requirements.
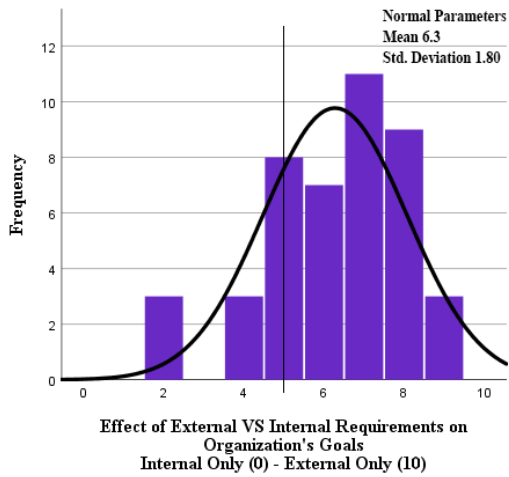
Fig. 8. Internal vs external requirements driving goals in organizations

With the aim to evaluate to what degree people at different levels in the organization *understand* and *contribute* to top management goals, we used responses to questions 13 and 20.

Visual inspection of Fig. 9 and Fig. 10 indicates that *understanding* of and *contribution* to top management goals degrades as one moves down in the organizational hierarchy. To test this, we used the *Independent-Samples Jonckheere-Terpstra Test*. The *p* values obtained are 0.024 (for *understanding*) and 0.071 (for *contribution*), which supports the observation made above regarding the *understanding* of top management goals. However, the test does not support that observation when comparing *contribution* to top management goals. One particularly interesting observation from Fig. 10 is that team leaders is the group that reports to contribute the least to top management goals.
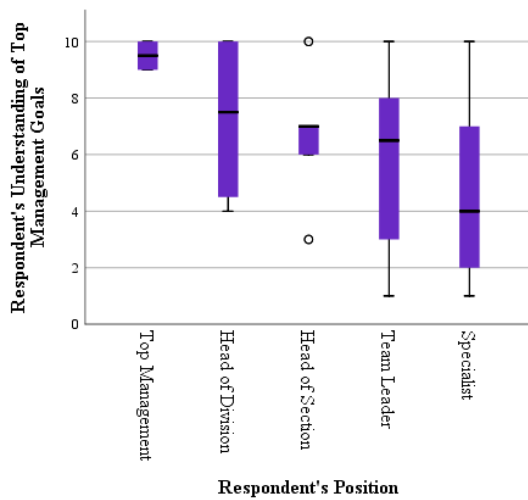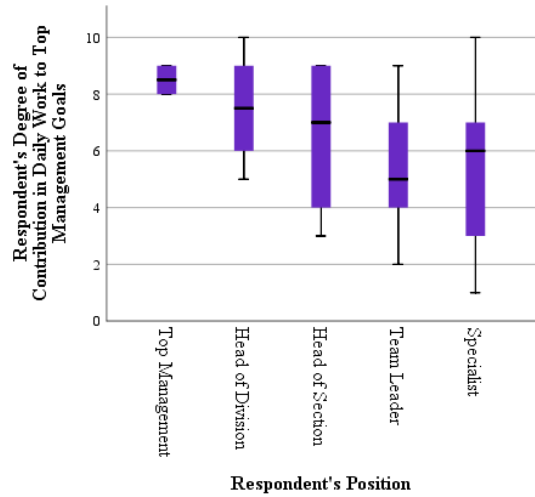

Fig. 9. Understanding of top management goals

Fig. 10. Contribution of daily work to top management goals

C. Demographic and Organizational-related Data

We collected the demographic data at the end of the survey (questions from 15 to 22), and so we only have this data for those who finished the entire survey. The respondents reported having between 0.5 and 30 years of experience developing digital solutions, with a mean value of 13.9 years. Those that had worked as leaders for development of digital solutions had between 0.5 and 25 years of experience in leadership, with a mean value of 10.3 years. 40.9 % reported working as consultants, while 59.1 % were employees. The respondents' roles included software developers, agile coaches, team leaders, product managers, project managers, digital advisors, business developers, and leaders at different levels. Table XI gives an overview of the number of respondents at each organizational level.

TABLE XI. RESPONDENTS IN EACH ORGANIZATIONAL LEVEL

Organizational Level	Number of Respondents	Percentage
Top Management	2	4.55 %
Head of Division	4	9.09 %
Head of Section	9	20.45 %
Team Leader	12	27.27 %
Specialist	17	38.64 %

VI. DISCUSSION

The obtained results indicate several relevant findings: 1) the "classical governance" and "organizational tier" hierarchy approaches are more used than the "effects-based"; 2) there is great difficulty in identifying goals at different levels; 3) the levels within goal hierarchies are perceived as moderately connected; 4) goal achievement/realization is slightly higher for the "classical governance" approach than for the "organizational tier" approach; 5) there are no significant differences in reported goal realization between organizations using goal hierarchies and those that do not; 6) sustainability as a goal is hardly considered in the digitalization work at organizations; 7) gap between the *ideal* and *actual* goals that drive the digitalization work in the organizations; and 8) managers at lower levels of the organization believe they have a lower understanding of the goals and their achievement than do senior management.

A. Principal Findings

The principal findings we reached after analyzing the results from the survey performed are shown below, organized according to the research questions (RQs) established, showing first a summary and then the main statements with a more detailed description.

1) RQ1. To What Extent Are Goal Hierarchies Used in Industry?

Our data suggests that organizations do use goal hierarchies (cf. Fig. 1). The most used goal hierarchy is the "organizational tier", which has almost double the use of the "effects-based" hierarchy.

A focus on "classical governance" and "organizational tier" goal hierarchies. On the one hand, leading-edge companies such as *Google*, *Amazon*, and *Netflix* use OKR, which is an instance of the "organizational tier" approach. This may also reflect the traditional Norwegian public sector organization structure and career paths, which emphasize tier structures [4] [57]. On the other hand, the "effects-based" hierarchy is the one used in the Norwegian public-sector acquisition and quality assurance programs imposed on large development efforts, which practitioners tend to describe as burdensome [58] and bureaucratic [59] [60]. This could explain why our data show that the "organizational tier" hierarchy is more common than the "effects-based" hierarchy. Our data suggest a difference between the use of the "classical governance" and "organizational tier" goal hierarchies with respect to the "effects-based" (cf. Fig. 1). The latter is a hierarchy recommended and typically implemented by government institutions that follow a bureaucratic model that often result in very long acquisition processes [59] [60]. Our results may support anecdotal evidence that today this is perceived as obsolete, and that organizations opt for the use of hierarchies that are popularized as better in line with modern management and development practices. It is of concern, though, that the possible aptness and effectiveness of the "effects-based" hierarchy are overshadowed by the fact that it is integrated in an unpopular framework. Organizations should be aware of the various elements that goal frameworks contain and adapt hierarchies to their needs, as well as establishing periodic reviews to keep up to date in this regard in the future. Indeed, one organization at the seminar presented a scheme in which an "effects-based" hierarchy figured within a Lean Value Tree framework.

A lack of familiarity with the different goal levels and goal specification. Of the 85 respondents who started the survey, only 44 (i.e., 52 %) completed it; the rest abandoned the survey at the questions that prompted for examples of goals at the different levels (questions 03 and 05; cf. Appendix A). This may have been due to the difficulty of supplying free text answers on mobile devices, but may also be due to an unfamiliarity with using goal hierarchies or with stating goals. A few respondents told us that they did not know how to define goals at those levels, since, although they do have certain notions about these levels, in practice they do not apply them (although they should) and, therefore, they do not have the knowledge or experience in this regard. This could be a matter of concern, in light of the research mentioned introductorily on the importance of clear, congruent, and coherent goals. The intention behind goal hierarchies is that if

organizations properly apply these levels and have well-defined goals in each of them, it should be easier to manage, evaluate/assess, and control the progress of programs and projects. All this should make it possible to obtain more reliable results, reducing risks associated with the programs and projects and helping to realize benefits, among others.

2) RQ2. How Successful Are the Different Goal Hierarchies in Connecting Goals at Different Levels?

As we observed from the results in the second section of the survey (cf. Section V.B), all the hierarchies are reported to be close to mediocre or worse in connecting goals at different levels. We identified a significant difference in connecting lower to upper goals, where the "classical governance" hierarchy performed better than the "organizational tier", but this is only the case because the latter is reported to perform especially poorly in connecting lower and upper goals.

Levels within goal hierarchies are perceived as moderately connected at best. The connections between the goal levels in the different hierarchies are mostly in the medium range (cf. Fig. 2), which may indicate that practitioners fail to identify and establish the relationship between goals adequately or, in other words, treat the goals in isolation at each of the levels so that they do not directly support each other. It is noteworthy that those respondents who chose the "organizational tier" (OKR) hierarchy reported a lower connection between the different levels. This can help explain some of the problems/challenges encountered by those applying OKR [27] [26] [24]. In fact, one of the challenges of OKR is failing to keep the big picture in mind [26]. This could be because the goals at the individual level are not aligned properly, or they lack consideration of goals at the organization level. Therefore, it is important to implement proper communication between the managers and stakeholders of the different goal levels to, first, identify and establish goals that support and contribute to the achievement of each other, and second, help all involved stakeholders to understand and contribute to the scope and purposes of the different levels and goals (keeping the big picture of the whole context in mind).

3) RQ3. Are There Differences in Realization of Goals Among Those Using the Different Goal Hierarchies?

The realization of goals is mostly mediocre, except for lower-level goals in the "classical governance" hierarchy. Realization of lower-level goals in the "classical governance" approach is reported to be higher (significantly) than in the "organizational tier" hierarchy. For the middle and upper levels of goals, we found no significant differences in realization of goals.

Goal realization is considered higher in the "classical governance" hierarchy. Although there is a slight difference in goal realization between the "classical governance" hierarchy and the "organizational tier" approach (cf. Fig. 3), we speculate that practitioners feel more familiar with the operational, tactical, and strategic levels, and, largely because of this familiarity, find it easier to achieve or realize the established goals (especially at the operational level). This may be due to the extensive use of these classical governance frameworks [61] [62] [63], making them widely recognized frameworks that are easy to understand and apply by IT professionals.

---

4) RQ4. Do the Methods and Frameworks for Connecting and Managing Goals at Different Levels Influence the Realization of Goals?

We observed no difference in realization of goals between those using frameworks and those not using frameworks for handling goals. Likewise, the number of methods used to connect goals did not seem to make a difference on realization of goals.

Goal realization is very similar between those who use specific frameworks and those who do not. An interesting finding is that goal realization remains at similar levels whether respondents use frameworks or models for goals definition and management or not (cf. Fig. 5). Supposedly, the frameworks are guides that help the whole process of identifying, managing, and achieving goals, but here, it seems that they do not make much of a difference. This is an unexpected finding we would like to investigate further, as the data in the survey does not suggest an explanation.

5) RQ5. What Types of Goals Drive Digitalization Work in Organizations?

From Fig. 6 and Table IX, we saw that *Quantifiable*, *Qualitative*, *Economic* and *Social* goals have more influence than *Environmental* and *Green IT* goals. Still, only *Quantifiable* goals have barely more than medium effect on digitalization work, which makes us wonder if work is driven by goals at all. An interesting observation is that practitioners reported that all the types of goals should have a higher effect (significantly) on work than they do have. Although practitioners reported that *Green IT* should have a higher effect on work than it does, they also reported that *Green IT* should have less influence than most other types of goals (significantly).

A lack of focus on sustainability in goals that drive digitalization. Digitalization is inherently a practice aimed at achieving sustainable development [64] [65] [66] [67]. However, we observed that, currently, the goals that drive/guide the digitalization work in organizations only consider the three perspectives of sustainability (environmental, social, and economic) [68] [69] and what is known as Green IT [15] [70] [71] to a low extent (cf. Fig. 6). A very relevant finding is that organizations that do not pursue sustainability goals are motivated by other purposes, while, far from being wrong, should not be the main focus or should also be analyzed from the point of view of sustainability. Although it is true that organizations do not consider these types of goals nowadays, there is a consensus among the respondents (with a large increase in the degree of relevance in their responses) that sustainability and all its perspectives should be a focus in the digitalization work of organizations (cf. Fig. 7).

Pervasive gap between desired and actual goals being pursued. For all the types of goals included about digitalization work there was a significant difference between what goals the respondents felt were important and those that were actually pursued.

6) RQ6. To What Extent Do People in Organizations Understand and Contribute to Top Management Goals?

Fig. 9 shows that top management clearly understands their own goals, and that the understanding decreases when moving down the organizational hierarchy. This relationship seems similar for contribution to goals, where top management contributes largely to their own goals, and the contribution seems to decrease when moving down the organizational hierarchy (note that the decrease is not significant). Still, it is interesting to highlight that team leaders seem to be those perceived to contribute the least to top management goals.

Sense of understanding of goals deteriorates as one moves down the organizational hierarchy. Analyzing the demographic data collected against the answers to the questions in the second section of the survey, we realized that those with roles closest to top management report having a better understanding of the goals than roles such as specialists or team leaders (cf. Fig. 9). Although organizations are increasingly trying to involve and raise awareness at all levels of roles regarding goals, efforts to harmonize understanding of goals are not perceived to be effectful by practitioners. We argue that other mechanisms than goal hierarchies are needed to help people in organizations collaborate towards the same goals. For this reason, it is very important to establish, for example, some transversal communication mechanism between the different levels of roles and goals.

B. Implications for Practice and Research

For practitioners, we hope that these findings raise awareness that the goal hierarchies need work to be effective, and that a lack of alignment is a common shortcoming. While this work does not offer remedies for these shortcomings, it should provide the basis for discussions among practitioners, particularly "vertically" across organizational layers.

In organizations that employ agile practices, there may be an inherent contradiction between the need for alignment based on horizontal coordination with priority-setting based on a shared understanding of external value, and hierarchical alignment based on superordinate manager goal requirements. This may be particularly relevant where goal hierarchies rely on stringent traceability with attendant accountability.

From the point of view of the research, as described above, several issues call for further research, and it is our hope that the findings presented here contribute to such efforts.

More study is needed to ascertain specific causes for the lacking connection between the levels in goal hierarchies. These may include that the goals lack conceptual coherence, e.g., that lower-level goals do not contribute to higher-level goals, that higher-level goals are mutually incompatible, etc. It may also be that lower-level goals are not actionable, because they are not specific, measurable, or achievable. There is a need for further critical analysis of the effects of hierarchies in multiple cases.

The effectiveness of alternatives to the "classical governance" hierarchies needs further study as these are developed and allowed to mature in organizations that adopt them. This may be particularly useful in organizations that pursue agile practices to meet strategic goals, because the idea of "management control" in hierarchical goal structures may run counter to externally oriented team autonomy typically found in agile practices.

Much could also be learned by studying the process of developing the actual goals at the hierarchical levels to identify points in that process at which the goals lose salience for those responsible for them, or contribution to the superordinate goals, etc. This approach could also be applied to the process of pursuing these goals, particularly as events unfold that call for revisions at all hierarchical levels.

The need for congruence between personal and organizational goals across hierarchical levels would benefit from further in-depth study. To the extent that goal hierarchies reflect organizational hierarchies, understanding congruence or lack thereof may help inform our understanding of leadership in these organizations.

Finally, and most importantly in the field of digital transformation, further research work should be done to identify specific issues that apply to IT work, i.e., whether digitalization goals and goal hierarchies require specific frameworks, tools, or approaches. This may be especially relevant in environments where technology is perceived as an innovation driver, i.e., where new technologies enable business innovation rather than planned business innovation calling for technology support.

C. Threats to Validity

To ensure that the results obtained in the survey through the collection and analysis of the data are reliable, it is necessary to consider certain threats that may have affected them. To this end, the following subsections analyze the threats to validity applied to the present study, following the example defined by Runeson et al. [72].

1) Construct Validity

Construct validity is related to the achievement of the objective of the study, that is, the extent to which the study evaluates/assesses what it has been designed for. In particular, this pertains to how well the survey questions operationalize the concepts in the RQs.

In this regard, the main threat in the survey was that the respondents would interpret the scope or context of the questions in a different way than we had intended. Therefore, to mitigate this threat (since it cannot be completely avoided or eliminated), before conducting the survey itself, we decided to perform a pilot test, through which we were able to analyze the impressions and feedback of three experts. Thanks to this, we were able to verify that the scope of the survey was understandable and that the different aspects and terms of the questions were familiar and easy to identify for the target audience. In the same way, during the survey we indicated to the respondents that in the event of any doubt in this regard, we were available to clarify any issues that may arise.

2) Internal Validity

Internal validity refers to unstudied factors or causes that may affect the results.

In this type of survey-based study, internal validity is mainly related to the characteristics of the respondents in relation to their background, training, experience, age, among others. These factors affect the experiences and opinions of the respondents and, therefore, the answers to the different questions. However, this diversity is a positive thing, since it helps to obtain a representative data set. That is why, with the aim to identify possible differences and analyze and categorize the data according to different groups, we included a series of questions on demographic data. In this way, we managed to mitigate the risk of obtaining a great divergence in the answers due to issues such as those described above.

3) External Validity

External validity is about the extent to which the findings can be generalized or applied in different contexts, as well as the relevance of these.

In this regard, the respondents in the present survey consisted of IT practitioners from the public and private sectors in Norway, who were present in a seminar on methods and frameworks for digitalization goals. It is likely that limiting our respondents, both to practitioners in Norway and to those practitioners being participants in a seminar, affect generalizability of the results. We preferred to start with a small target audience to verify the suitability and consistency of the survey (as if it were a first proof of concept) and thus be able to refine it to conduct it in a broader context. That is why, to mitigate the risks in this type of validity and obtain more data to feed the results and findings, we are preparing the survey to be conducted in new cases internationally.

In the same way, this document includes the entire process followed (design, execution, and report) with all the aspects defined, as well as the survey performed. This allows other researchers and professionals to conduct said survey (or a similar one), being able to compare the results they obtain with those presented in this document and reach their own findings and conclusions.

Finally, thanks to the results and feedback obtained from the respondents, we observed that the topic is of interest and that it is necessary to create more awareness and training on the goals and different levels that exist to achieve the digitalization requirements that organizations establish.

VII. CONCLUSIONS

This study shows that organizations often employ goal hierarchies in support of their management models, but that practitioners perceive relatively little congruence and alignment between the goals they are responsible for and the higher-level goals of the organization, and that the disconnect increases with distance from the formulation of the high-level goals. This raises several issues.

First, whether there are characteristics of IT-related goals that make them less suitable for goal hierarchy structures. Research on business IT alignment indicates that consistency between business and IT goals improves the performance of the business and the contribution of IT, but that such alignment is difficult to achieve [44].

Second, whether the notion of "digital transformation" engenders a new paradigm for goal hierarchies, in which IT enables business goals rather than merely supporting them, as illustrated in, inter alia, "Industry 4.0", i.e., business innovations that are entirely predicated on previously unavailable technology [73].

Third, the effects of this disconnect on the management layers in each organization, in particular the role of middle managers in "translating" high-level goals effectively both to ensure understanding and lower-level goals that lead to the desired results [74]. The literature on middle manager roles and responsibilities suggests that middle managers are subject to pressure both from above and below, which requires specific types of skills, activities, and sensibilities [75].

Fourth, the fact that "classical governance" seemed to do find more alignment than the two other approaches leave unresolved whether these newer approaches fail to deliver on promised superior results or need more time and effort to mature. A key theme of the seminar was precisely that such structures took time and effort to implement.

Fifth, the gap between aspirations and practice in formulating, pursuing, and realizing sustainability and Green IT goals need further study. If organizations hope to achieve sustainability but reward other goals more, they are likely to be both disappointed and disillusioned [76].

We did not ask for, nor did the respondents offer, views on how alignment and congruence between higher- and lower-level goals affected performance. However, if goal hierarchies make little difference to performance, they are at best an unnecessary practice; and if they do make a difference but are implemented ineffectively, the lack of alignment causes significant opportunity costs. Best practices done poorly not only fail to deliver on potential promises but may also hurt organizational support for doing the right thing.

REFERENCES

[1] C. Legner, T. Eymann, T. Hess, C. Matt, T. Böhmann, P. Drews, A. Mädche, N. Urbach, and F. Ahlemann, "Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community," *Business & Information Systems Engineering*, vol. 59, no. 4, pp. 301–308, July 2017. https://dx.doi.org/10.1007/s12599-017-0484-2

[2] J. S. Brennen and D. Kreiss, "Digitalization," in *The International Encyclopedia of Communication Theory and Philosophy*, K. B. Jensen, E. W. Rothenbuhler, J. D. Pooley, and R. T. Craig, Eds. Chichester, UK: John Wiley & Sons, 2016, pp. 556–566. https://dx.doi.org/10.1002/9781118766804.wbiect111

[3] V. Parida, "Digitalization," in *Addressing Societal Changes*, J. Frishammar and Å. Ericson, Eds. Luleå, Sweden: Luleå University of Technology, 2018, pp. 23–38.

[4] P. Parviainen, M. Tihinen, J. Kääriäinen, and S. Teppola, "Tackling the digitalization challenge: how to benefit from digitalization in practice," *International Journal of Information Systems and Project Management*, vol. 5, no. 1, pp. 63–77, March 2017. https://dx.doi.org/10.12821/ijispm050104

[5] R. G. Greenwood, "Management by Objectives: As Developed by Peter Drucker, Assisted by Harold Smiddy," *Academy of Management Review*, vol. 6, no. 2, pp. 225–230, April 1981. https://dx.doi.org/10.5465/amr.1981.4287793

[6] T. S. Bateman, H. O'Neill, and A. Kenworthy-U'Ren, "A Hierarchical Taxonomy of Top Managers' Goals," *Journal of Applied Psychology*, vol. 87, no. 6, pp. 1134–1148, December 2002. https://dx.doi.org/10.1037/0021-9010.87.6.1134

[7] K. Sandkuhl, "Investigating the Potential of Capability-Driven Design and Delivery in an SME Case Study," in Proc. *27th International Conference on Advanced Information Systems Engineering (CAiSE 2015)*, Jun. 2015, pp. 3–14.

[8] J. E. Hannay and E. Gjørven, "Leveraging network-centric strategic goals in capabilities," *Journal of Military Studies*, vol. 10, no. 1, pp. 90–104, April 2021. https://dx.doi.org/10.2478/jms-2021-0001

[9] J. E. Hannay, K. Brathen, and O. M. Mevassvik, "Agile requirements handling in a service-oriented taxonomy of capabilities," *Requirements Engineering*, vol. 22, no. 2, pp. 289–314, January 2016. https://dx.doi.org/10.1007/s00766-016-0244-8

[10] J. E. Hannay, H. C. Benestad, and K. Strand, "Earned Business Value: See That You Deliver Value to Your Customer," *IEEE Software*, vol. 34, no. 4, pp. 58–70, July 2017. https://dx.doi.org/10.1109/MS.2017.105

[11] J. E. Hannay, "Architectural work for modeling and simulation combining the NATO Architecture Framework and C3 Taxonomy," *The Journal of Defense Modeling and Simulation*, vol. 14, no. 2, pp. 139–158, November 2016. https://dx.doi.org/10.1177/1548512916670785

[12] M. H. Danesh and E. Yu, "Analyzing IT Flexibility to Enable Dynamic Capabilities," in Proc. *27th International Conference on Advanced Information Systems Engineering (CAiSE 2015)*, Jun. 2015, pp. 53–65. https://dx.doi.org/10.1007/978-3-319-19243-7_5

[13] K. Sandkuhl and H. Koc, "On the Applicability of Concepts from Variability Modelling in Capability Modelling: Experiences from a Case in Business Process Outsourcing," in Proc. *26th International Conference on Advanced Information Systems Engineering (CAiSE 2014)*, Jun. 2014, pp. 65–76. https://dx.doi.org/10.1007/978-3-319-07869-4_6

[14] M. J. Epstein and A. R. Buhovac, *Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental and Economic Impacts*, 2nd ed. San Francisco, CA, USA: Berrett-Koehler Publishers, 2014.

[15] J. D. Patón-Romero, M. T. Baldassarre, M. Rodríguez, and M. Piattini, "Governance and Management of Green IT," in *Software Sustainability*, C. Calero, M. A. Moraga, and M. Piattini, Eds. Cham, Switzerland: Springer Nature Switzerland AG, 2021, pp. 243–267. https://dx.doi.org/10.1007/978-3-030-69970-3_10

[16] Q. Deng and S. Ji, "Organizational Green IT Adoption: Concept and Evidence," *Sustainability*, vol. 7, no. 12, pp. 16737–16755, December 2015. https://dx.doi.org/10.3390/su71215843

[17] C. Mio, A. Costantini, and S. Panfilo, "Performance measurement tools for sustainable business: A systematic literature review on the sustainability balanced scorecard use," *Corporate Social Responsibility and Environmental Management*, vol. 29, no. 2, pp. 367–384, March 2022. https://dx.doi.org/10.1002/csr.2206

[18] L. A. Witt, "Enhancing organizational goal congruence: A solution to organizational politics," *Journal of Applied Psychology*, vol. 83, no. 4, pp. 666–674, August 1998. https://dx.doi.org/10.1037/0021-9010.83.4.666

[19] I. Mergel, N. Edelmann, and N. Haug, "Defining digital transformation: Results from expert interviews," *Government Information Quarterly*, vol. 36, no. 4, pp. 101385, October 2019. https://dx.doi.org/10.1016/j.giq.2019.06.002

[20] D. R. A. Schallmo and C. A. Williams, "History of Digital Transformation," in *Digital Transformation Now!*. Cham, Switzerland: Springer, 2018, pp. 3–8. https://dx.doi.org/10.1007/978-3-319-72844-5_2

[21] M. Erez and I. Zidon, "Effect of Goal Acceptance on the Relationship of Goal Difficulty to Performance," *Journal of Applied Psychology*, vol. 69, no.1, pp. 69–78, February 1984. https://dx.doi.org/10.1037/0021-9010.69.1.69

[22] A. Kleingeld, H. van Mierlo, and L. Arends, "The Effect of Goal Setting on Group Performance: A Meta-Analysis," *Journal of Applied Psychology*, vol. 96, no. 6, pp. 1289–1304, November 2011. https://dx.doi.org/10.1037/a0024315

[23] A. M. O'Leary-Kelly, J. J. Martocchio, and D. D. Frink, "A Review of the Influence of Group Goals on Group Performance," *Academy of Management Journal*, vol. 37, no. 5, pp. 1285–1301, October 1994. https://dx.doi.org/10.5465/256673

[24] V. Stray, N. B. Moe, H. Vedal, and M. N. Berntzen, "Using Objectives and Key Results (OKRs) and Slack: A Case Study of Coordination in Large-Scale Distributed Agile," in Proc. *55th Hawaii International Conference on System Sciences (HICSS 2022)*, Jan. 2022, pp. 7360–7369.

[25] V. Stray, J. H. Gundelsby, R. Ulfsnes, and N. B. Moe, "How agile teams make Objectives and Key Results (OKRs) work," in Proc. *16th International Conference on Software and Systems Process (ICSSP 2022)*, May 2022, pp. 104–109. https://dx.doi.org/10.1145/3529320.3529332

[26] B. Trinkenreich, G. Santos, M. P. Barcellos, and T. Conte, "Combining GQM+Strategies and OKR - Preliminary Results from a Participative Case Study in Industry," in Proc. *20th International Conference on Product-Focused Software Process Improvement (PROFES 2019)*, Nov. 2019, pp. 103–111.

[27] P. R. Niven and B. Lamorte, *Objectives and Key Results: Driving Focus, Alignment, and Engagement with OKRs*. Hoboken, NJ, USA: John Wiley & Sons, 2016. https://dx.doi.org/10.1002/9781119255543

[28] K. Petersen and C. Wohlin, "The effect of moving from a plan-driven to an incremental software development approach with agile practices," *Empirical Software Engineering*, vol. 15, no. 6, pp. 654–693, December 2010. https://dx.doi.org/10.1007/s10664-010-9136-6

[29] M. De Haas, J. Algera, H. Van Tuijl, and J. Meulman, "Macro and Micro Goal Setting: In Search of Coherence," *Applied Psychology*, vol. 49, no. 3, pp. 579–595, July 2000. https://dx.doi.org/10.1111/1464-0597.00033

[30] S. Linder and N. J. Foss, "Microfoundations of Organizational Goals: A Review and New Directions for Future Research," *International Journal of Management Reviews*, vol. 20, pp. S39–S62, January 2018. https://dx.doi.org/10.1111/ijmr.12154

[31] M. L. Bouillon, G. D. Ferrier, M. T. Stuebs Jr, and T. D. West, "The economic benefit of goal congruence and implications for management control systems," *Journal of Accounting and Public Policy*, vol. 25, no. 3, pp. 265–298, June 2006. https://dx.doi.org/10.1016/j.jaccpubpol.2006.03.003

[32] E. A. Locke, "Toward a Theory of Task Motivation and Incentives," *Organizational Behavior and Human Performance*, vol. 3, no. 2, pp. 157–189, May 1968. https://dx.doi.org/10.1016/0030-5073(68)90004-4

[33] Å. Johnsen, "Strategic planning in turbulent times: Still useful?," *Public Policy and Administration*, vol. 0, no. 0, pp. 1–21, April 2022. https://dx.doi.org/10.1177/09520767221080668

[34] T. Malmi and D. A. Brown, "Management control systems as a package—Opportunities, challenges and research directions," *Management Accounting Research*, vol. 19, no. 4, pp. 287–300, December 2008. https://dx.doi.org/10.1016/j.mar.2008.09.003

[35] E. Strauß and C. Zecher, "Management control systems: a review," *Journal of Management Control*, vol. 23, no. 4, pp. 233–268, February 2013. https://dx.doi.org/10.1007/s00187-012-0158-7

[36] M. Deutsch, "A Theory of Co-operation and Competition," *Human Relations*, vol. 2, no. 2, pp. 129–152, April 1949. https://dx.doi.org/10.1177/001872674900200204

[37] G. E. Lindzey and E. E. Aronson, *The Handbook of Social Psychology*, 2nd Edition. Massachusetts, MA, USA: Addison-Wesley, 1968.

[38] G. Jacobs, "Co-operative goal structure: a way to improve group activities," *ELT Journal*, vol. 42, no. 2, pp. 97–101, April 1988. https://dx.doi.org/10.1093/elt/42.2.97

[39] D. W. Johnson, G. Maruyama, R. Johnson, D. Nelson, and L. Skon, "Effects of Cooperative, Competitive, and Individualistic Goal Structures on Achievement: A Meta-Analysis," *Psychological Bulletin*, vol. 89, no. 1, pp. 47–62, January 1981. https://dx.doi.org/10.1037/0033-2909.89.1.47

[40] T. Dingsøyr, F. O. Bjørnson, J. Schrof, and T. Sporsem, "A longitudinal explanatory case study of coordination in a very large development programme: the impact of transitioning from a first-to a second-generation large-scale agile development method," *Empirical Software Engineering*, vol. 28, no. 1, pp. 1–49, January 2023. https://dx.doi.org/10.1007/s10664-022-10230-6

[41] N. B. Moe and V. Stray, "A Decade of Research on Autonomous Agile Teams: A Summary of the Third International Workshop," *Lecture Notes in Business Information Processing*, pp. 212–218, September 2020. http://dx.doi.org/10.1007/978-3-030-58858-8

[42] V. Stray, J. H. Gundelsby, R. Ulfsnes, and N. Brede Moe, "How agile teams make Objectives and Key Results (OKRs) work," in Proc. *16th International Conference on Software and Systems Process (ICSSP 2022)*, May 2022, pp. 104–109. https://dx.doi.org/10.1145/3529320.3529332

[43] S. Schweikl and R. Obermaier, "Lessons from three decades of IT productivity research: towards a better understanding of IT-induced productivity effects," *Management Review Quarterly*, vol. 70, no. 4, pp. 461–507, November 2020. https://dx.doi.org/10.1007/s11301-019-00173-6

[44] G. M. Jonathan, L. Rusu, and W. Van Grembergen, "Business-IT Alignment and Digital Transformation: Setting A Research Agenda," in Proc. *29th International Conference on Information Systems Development (ISD2021)*, Sep. 2021.

[45] ISACA, *COBIT 2019 Framework: Introduction & Methodology*. Rolling Meadows, IL, USA: Information Systems Audit and Control Association, 2018.

[46] ISACA, *COBIT 2019 Framework: Governance and Management Objectives*. Rolling Meadows, IL, USA: Information Systems Audit and Control Association, 2018.

[47] J. C. Zapata, V. A. Varma, and G. V. Reklaitis, "Impact of tactical and operational policies in the selection of a new product portfolio," *Computers & Chemical Engineering*, vol. 32, no. 1–2, pp. 307–319, January 2008. https://dx.doi.org/10.1016/j.compchemeng.2007.03.024

[48] T. Gilb, *Competitive Engineering: A Handbook for Systems Engineering, Requirements Engineering, and Software Engineering Using Planguage*. Oxford, UK: Elsevier Butterworth-Heinemann, 2005.

[49] J. E. Hannay, *Benefit/Cost-Driven Software Development: With Benefit Points and Size Points*. Cham, Switzerland: Springer Nature Switzerland AG, 2021. https://dx.doi.org/10.1007/978-3-030-74218-8

[50] UK Government (Infrastructure and Projects Authority), *Guide for Effective Benefits Management in Major Projects: Key benefits management principles and activities for major projects*. London, UK: Crown, 2017.

[51] K. F. Samset, G. H. Volden, N. Olsson, and E. V. Kvalheim, *Governance Schemes for Major Public Investment Projects: A comparative study of principles and practices in six countries*. Trondheim, Norway: The Concept research program, Concept report no. 47, 2016.

[52] R. M. Groves, F. J. Fowler Jr, M. P. Couper, J. M. Lepkowski, E. Singer, and R. Tourangeau, *Survey Methodology*, 2nd Edition. Hoboken, NJ, USA: John Wiley & Sons, 2009.

[53] L. M. Connelly, "Pilot Studies," *MEDSURG Nursing*, vol. 17, no. 6, pp. 411–412, December 2008.

[54] E. Van Teijlingen and V. Hundley, "The importance of pilot studies," *Nursing Standard*, vol. 16, no. 40, pp. 33–36, June 2002.

[55] J. M. Bland and D. G. Altman, "Multiple significance tests: the Bonferroni method," *BMJ*, vol. 310, pp. 170, January 1995. https://dx.doi.org/10.1136/bmj.310.6973.170

[56] M. Tomczak and E. Tomczak, "The need to report effect size estimates revisited. An overview of some recommended measures of effect size," *Trends in Sport Sciences*, vol. 1, no. 21, pp. 19–25, February 2014.

[57] S. Brattli, M. Molvær, and T. Nesheim, "Flexible structure in two state agencies in Norway: Challenges for middle managers and employees," *Norsk Statsvitenskapelig Tidsskrift*, vol. 37, no. 1, pp. 50–68, April 2021. https://dx.doi.org/10.18261/issn.1504-2936-2021-01-03

[58] K. Samset and G. H., "Volden, Prinsipp, praksis og ringvirkninger," *Stat & Styring*, vol. 23, no. 3, pp. 23–26, September 2013. https://dx.doi.org/10.18261/ISSN0809-750X-2013-03-12

[59] M. Egeberg, "The Impact of Bureaucratic Structure on Policy Making," *Public Administration*, vol. 77, no. 1, pp. 155–170, January 1999. https://dx.doi.org/10.1111/1467-9299.00148

[60] M. Egeberg and I. M. Stigen, "Explaining government bureaucrats' behaviour: On the relative importance of organizational position, demographic background, and political attitudes," *Public Policy and Administration*, vol. 36, no. 1, pp. 3–18, January 2021. https://dx.doi.org/10.1177/0952076718814901

[61] G. Ridley, J. Young, and P. Carroll, "COBIT and its Utilization: A framework from the literature," in Proc. *37th Annual Hawaii International Conference on System Sciences (HICSS 2004)*, Jan. 2004. https://dx.doi.org/10.1109/HICSS.2004.1265566

[62] ISACA, *COBIT Global Regulatory and Legislative Recognition*. Rolling Meadows, IL, USA: Information Systems Audit and Control Association, 2014.

[63] Y. S. Jo, J. H. Lee, and J. M. Kim, "Influential Factors for COBIT Adoption Intention: An Empirical Analysis," *International Journal of Contents*, vol. 6, no. 4, pp. 79–89, December 2010. https://dx.doi.org/10.5392/IJoC.2010.6.4.079

[64] B. Brenner and B. Hartl, "The perceived relationship between digitalization and ecological, economic, and social sustainability," *Journal of Cleaner Production*, vol. 315, pp. 128128, September 2021. https://dx.doi.org/10.1016/j.jclepro.2021.128128

[65] U. Lichtenthaler, "Digitainability: The Combined Effects of the Megatrends Digitalization and Sustainability," *Journal of Innovation Management*, vol. 9, no. 2, pp. 64–80, August 2021. https://dx.doi.org/10.24840/2183-0606_009.002_0006

[66] T. Osburg and C. Lohrmann, Eds., *Sustainability in a Digital World: New Opportunities Through New Technologies*. New York, NJ, USA: Springer International Publishing AG, 2017. https://dx.doi.org/10.1007/978-3-319-54603-2

[67] P. Seele and I. Lock, The game-changing potential of digitalization for sustainability: possibilities, perils, and pathways. *Sustainability Science*, vol. 12, no. 2, pp. 183–185, February 2017. https://dx.doi.org/10.1007/s11625-017-0426-4

[68] B. Purvis, Y. Mao, and D. Robinson, "Three pillars of sustainability: in search of conceptual origins," *Sustainability Science*, vol. 14, no. 3, pp. 681–695, May 2019. https://dx.doi.org/10.1007/s11625-018-0627-5

[69] United Nations, "Transforming Our World: The 2030 Agenda for Sustainable Development," in *Seventieth Session of the United Nations General Assembly*, Sep. 2015, Resolution A/RES/70/1.

[70] C. Calero and M. Piattini, Eds., *Green in Software Engineering*. Cham, Switzerland: Springer International Publishing AG, 2015. https://dx.doi.org/10.1007/978-3-319-08581-4

[71] J. D. Patón-Romero, M. T. Baldassarre, M. Rodriguez, and M. Piattini, "A Revised Framework for the Governance and Management of Green IT," *Journal of Universal Computer Science*, vol. 25, no. 13, pp. 1736–1760, December 2019. https://dx.doi.org/10.3217/jucs-025-13-1736

[72] P. Runeson, M. Höst, A. Rainer, and B. Regnell, *Case Study Research in Software Engineering: Guidelines and Examples*. Hoboken, NJ, USA: John Wiley & Sons, 2012. https://dx.doi.org/10.1002/9781118181034

[73] D. Ibarra, J. Ganzarain, and J. I. Igartua, "Business model innovation through Industry 4.0: A review," *Procedia Manufacturing*, vol. 22, pp. 4–10, April 2018. https://dx.doi.org/10.1016/j.promfg.2018.03.002

[74] M. J. Van Rensburg, A. Davis, and P. Venter, "Making strategy work: The role of the middle manager," *Journal of Management & Organization*, vol. 20, no. 2, pp. 165–186, August 2014. https://dx.doi.org/10.1017/jmo.2014.33

[75] S. Gjerde and M. Alvesson, "Sandwiched: Exploring role and identity of middle managers in the genuine middle," *Human Relations*, vol. 73, no. 1, pp. 124–151, January 2020. https://dx.doi.org/10.1177/0018726718823243

[76] S. Kerr, "On the Folly of Rewarding A, While Hoping for B," *Academy of Management Journal*, vol. 18, no. 4, pp. 769–783, December 1975. https://dx.doi.org/10.5465/255378

APPENDIX A. SURVEY QUESTIONS

The questions defined for the survey presented in this study are shown in Table XII, organized according to the three blocks or sections established and showing the type of question and the possible answers that have been defined for each of them. These survey questions and responses are also available at https://tinyurl.com/goalsstudy.

TABLE XII. SURVEY QUESTIONS

ID	Question	Type	Possible Responses
First Section (Goal Hierarchies)			
01	Which of these goal hierarchies are closest to what is used in your organization? *(If none, choose the one that is most natural to you)*	*Single choice*	• Operational goals – Tactical goals – Strategic goals (used in classical governance frameworks) • Individual goals – Team goals – Organization goals (e.g., in OKR) • Result/solution goals – Effect/process goals – Societal/business goals
02	Does your organization use the goal hierarchy you selected?	*Single choice*	• Yes • No
Second Section (Goal Levels)			
03	Provide examples of *[operational goals]/[individual goals]/[result/solution goals]* you have been conscious about in the digitalization work you have been involved in.	*Free text*	
04	Provide examples of *[tactical goals]/[team goals]/[effect/process goals]* you have been conscious about in the digitalization work you have been involved in.	*Free text*	
05	Provide examples of *[strategic goals]/[organization goals]/[societal/business goals]* you have been conscious about in the digitalization work you have been involved in.	*Free text*	
06	How well are the different goal levels in the organization connected? • *[Operational goals]/[Individual goals]/[Result/solution goals]* • *[Tactical goals]/[Team goals]/[Effect/process goals]* • *[Strategic goals]/[Organization goals]/[Societal/business goals]*	*11-point ordinal (for each option)*	From 0 (No connection) to 10 (Strong connection)
07	How are the connections between the levels implemented?	*Multiple choices*	• Concrete frameworks (OKR, Lean Value Tree, or similar) • Formal communication (presentations, events, or similar) • Informal communication/leadership (through "fans", informal leaders, or similar) • We do not connect the goals at the different levels • Other *<free text>*
08	To what degree do you think that goals are achieved in the organization? • *[Operational goals]/[Individual goals]/[Result/solution goals]* • *[Tactical goals]/[Team goals]/[Effect/process goals]* • *[Strategic goals]/[Organization goals]/[Societal/business goals]*	*11-point ordinal (for each option)*	From 0 (No achievement of goals) to 10 (To very large extent)

ID	Question	Type	Possible Responses
09	How do you assess if goals have been achieved?	*Multiple choices*	• Concrete frameworks (OKR, Lean Value Tree, or similar) • Formal communication (presentations, reports, or similar) • Informal communication/leadership • We do not assess if goals are achieved • Other *<free text>*
10	To what degree has the following types of goals been driving in the digitalization work in the organization: • Quantifiable goals • Qualitative (soft) goals • Economical sustainability • Social sustainability • Environmental sustainability • Green IT specifically	*11-point ordinal (for each option)*	From 0 (To no extent) to 10 (To very large extent)
11	To what degree should the following types of goals be driving in the digitalization work in the organization: • Quantifiable goals • Qualitative (soft) goals • Economical sustainability • Social sustainability • Environmental sustainability • Green IT specifically	*11-point ordinal (for each option)*	From 0 (To no extent) to 10 (To very large extent)
12	To what degree are your organization goals driven by internal versus external requirements?	*11-point ordinal*	From 0 (Internal only) to 10 (External only)
13	The goals of top management in your organization: • If you were to write down the three most important goals of top management in your organization, how certain are you that you would get them right? • To what degree do you feel that your daily work contributes to these goals?	*11-point ordinal (for each option)*	From 0 (To no extent) to 10 (To very large extent)
14	Does your organization use concrete frameworks (OKR, Lean Value Tree, or similar) for handling of goals?	*Single choice*	• Yes – Name them *<free text>* • No
Third Section (Demographic and Organizational-related Data)			
15	For how many years have you worked with development of digital solutions?	*Free text (number)*	
16	For how many years have you worked as a leader of development of digital solutions? *(Choose 0 if you have not worked as a leader)*	*Free text (number)*	
17	Choose the option that fits best:	*Single choice*	• I am a consultant • I am an employee
18	What is your current role? *(If consultant, provide the role that you are filling in the organization where your work is done)*	*Free text*	
19	For how many years have you had this role (regardless of the organization)?	*Free text (number)*	
20	At what level of the organization do you work?	*Single choice*	• Top management • Division management • Section management • Team leader • Specialist
21	Do you work for private or public sector?	*Single choice*	• Private sector • Public sector
22	How large is the organization you work for?	*Single choice*	• Small (smaller than 50 persons) • Medium (50-250 persons) • Large (more than 250 persons)