

Understanding Organizations through Systems Oriented Design: Mapping Critical Intervention Points for Universal Design

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Abstract. This paper discusses how organisations pro-actively can ensure compliance with disciplinary best practice and regulations on universal design (UD) of ICT. We apply system-oriented design to analyse and engineer organisational compliance. The focus is on how best practice – disclosed in theory on how to design for UD, as well as coming regulatory updates – relate to current practices and systems theory on where in a system to intervene in order to change systems most effectively. The aim is a blueprint for a compliant, stable and improved organizational system. The case for the study is the Norwegian Labour and Welfare Administration (NAV). The work presented is part of ongoing strategic work on UD for NAV. Two contributions are made; 1) a discussion on the success of the utilized approach to inform strategic work on intervention points, and 2) recommended system mechanisms for NAV and similar organizations in order to meet the intention of the UD legislation and current quality benchmarks.

Keywords: Universal Design, System Thinking, Systems Oriented Design, GIGA mapping, Leverage Points, Critical Success Criteria, Strategic Design.

1 Introduction

Universal design (UD) is a dimension in the design of products, services, environments and solutions, so that these are usable for as many people as possible, regardless of the capabilities of users and their context of use [1]. This includes technical accessibility. In Norway, a basic level of UD has been a legal requirement for new websites and self-service machines since July 2014 [2]. These regulations are being updated and extended, and additional demands will come into force from 2021. As the legislation changes, organisations must continuously work to ensure UD of ICT in daily work and strategically meet new demands. One such organisation is the Norwegian Labour and Welfare Administration (NAV), whose increasing amount of web-based services are covered by the UD regulations.

There is no unified approach to analyse organisations in order to create internal systems that ensure a desired outcome. However, Systems Oriented Design (SOD) in the field of systemic design, offers a guide for businesses and organisations to create holistic understandings of their system mechanisms, rules and structures [3, 4]. Further, system thinking theory on leverage points shows us which mechanisms, rules and structures offer the strongest organisational impacts – and how they work together to create system stability over time [5, 6]. Such insights provide an opportunity to make informed decisions on any necessary changes, understanding the effects of interventions on system mechanisms, and deliver concrete plans for strategic alignment.

Research shows compliance to regulations is not sufficient to ensure usability for all, as these focus on technical accessibility. A distinction between technical and usable accessibility is recommended [7-12]. According to Fuglerud and Sloan [13] there is a heavy focus on adhering to the regulations and standards set forth by the legislations, and a lack of emphasis on the development process. Disciplinary best practice has thus been identified to complement regulations and bridge gaps between the legislative intent of UD and real-life results. A recently defined set of such guidelines are the Critical Success Criteria (CSC) for achieving universal design of IT-solutions [14, 15]. To inform strategic work on UD in NAV, we consider adherence to both disciplinary best practice and routines to ensure compliance with regulations. We ask: *How can NAV as an organizational system be improved and stabilized to reach its aims on delivering digital solutions to all inhabitants and comply with legal demands? In extension, what is needed to comply in time, and what is needed to comply over time?*

2 Background

NAV administers a third of the Norwegian national budget and a large proportion of social security schemes in Norway, such as unemployment benefits, work assessment allowances, assistive technologies, sickness benefits, disability and retirement pensions, child benefits and a range of other services related to life events. NAV provides services targeting diverse user groups, and has worked steadily to launch digitalized services to its users over the last decade [16-18]. The service digitalization has affected the internal organization of NAV. During the time-period 2013-2018, the NAV IT department has transformed. Development is shifting from being plan-based and outsourced, to agile in-house cross-disciplinary teams.

In the era of big, waterfall IT projects, UD and accessibility were set as requirement to consultants delivering a service. NAV specified these requirements and tested for accessibility – combining accessibility inspections and user testing. These tests were mostly carried out by the UD expert team at NAV, consisting of 4-5 people. Considering the small size of the team, this meant only a small number of services could be tested thoroughly at once.

Since the transformation of NAV IT, this approach is no longer sustainable. Currently there are about 40 agile teams in NAV. More autonomic, cross-functional teams are continuously formed. Instead of publishing large-scale IT solutions up to four times a year, new services can be published several times a day. The change rate is

increased. As a consequence, the NAV UD team changed their approach, concentrating on how to scale UD efforts and empower agile teams to build inclusive solutions. The agile development teams themselves are responsible for UD requirements, just as they are responsible for aspects such as security and privacy. The UD team focuses on educating NAV teams on the importance of UD and its relevance for the users, as well as how to assure UD. As of late, this has been developed into a service called “UD coaching”; teaching methods and tools and giving practical advice. The UD coaching stresses the importance of including users with special needs and those using assistive technologies and arrange user testing with such edge-case users.

The UD team also helps assure the quality of the components in NAV’s Design System and promotes its use. As accessibility is an important part of the procurement requirements, the UD team further assists with educating the procurement staff and evaluating the accessibility of software that is considered. The UD team also contributes to building a new solution for forms used for applications for benefits, which at the time mostly consists of non-accessible PDFs.

Additionally, the UD team explores future methods and tools, such as the possibilities of automated testing and artificial intelligence in UD testing. They work together with other state agencies to allow for reuse of measures and tools that have proven to be useful. Finally, they provide input to management on strategic plans. Current strategic work on UD of IT in NAV span two dimensions; 1) ensuring compliance to the coming *regulations*, and 2) promoting and incentivizing *best practice* for UD of IT in the agile development settings.

Related to regulations, NAV has announced compliancy since the introduction of 2013 regulations on UD of ICT [19]. NAV stipulate Web Content Accessibility Guidelines (WCAG) 2.0 AA-level compliance (with a few criteria exceptions) for web-based solutions [20]. From 2021, legacy systems will be covered by these regulations – not just new developments. This includes legacy documents, as documents as part of a web-based service are defined as web-content.

Concurrently, the Norwegian legislation on UD of ICT is updated in accordance with the European Web Accessibility Directive (WAD) [21]. This will introduce the following additional extensions on existing Norwegian legislation: a) new requirements from WCAG 2.1, b) provision and regularly update of an accessibility statement per webservice/mobile application, c) a user feedback feature on unsatisfactory accessibility, and d) UD requirements related to intranet and extranet.

Related to the second point on best practice, previous research articulated 15 Critical Success Criteria (CSC) for universal design (UD) in ICT-projects [14, 15]. These were identified through an interview study investigating the practices of IT-projects that had produced solutions of “high UD quality”. The inclusion criteria were based on industry awards and assessment ratings, resulting in a sample 34 interviews across 23 IT-projects. A thematic content analysis pointed to a best practice for ensuring UD quality, both on a procedural level and related to organizational, personal and societal characteristics. The 15 most frequently mentioned characteristics were labeled CSC.

The assumption that these 15 CSC (see Table 1) represent success conditions was tested through a design-based research approach [22]. A tool predicting success based on CSC compliance was collaboratively developed through iterative expert analysis,

user testing, focus group and phone interviews [23]. Though not perfect, the tool indicates likely successes and failure based on compliance. This strengthened our belief that CSC are indeed success conditions for IT projects and can be viewed as facilitating legal compliance (prior to 2021) and current “high quality” UD benchmarks.

Table 1. Summary of the 15 Critical Success Criteria (CSC)

CSC	Type	Category
1. Legislation	Societal	N/A
2. Awareness	Organizational	UD Anchoring
3. Priority		UD Strategy
4. Competence building		Early & Clear Focus (on UD)
5. Requirements Specification		UD/UX Integration
6. Needs Integration	Procedural	Process Qualities
7. Continuous Focus		Quality Control
8. Team Collaboration		(Lack of) Resources
9. User Testing		(Lack of) Competence
10. Internal (evaluation)		Personal
11. Time & Budget		
12. Equipment & Human Resources		
13. Design for All (DfA) Mindset		
14. Interested		
15. Enthusiastic		

3 Research Approach

The research approach outlined in this paper is a case study – an in-depth and contextual investigations of NAV. The work is qualitative and adhere to interpretive epistemology; focusing not on an objective and constant truth, but on reflexive analysis on shared perspectives. In other words, one tries to carefully interpret.

Hanington and Martin [24] present methods of design, and categorize their contributions as either exploring, evaluating or generating. Exploratory research approaches are typically used to investigate little-understood phenomena [25]. In contrast, generative research denotes the phase between exploratory and evaluating research where one generates concepts or early prototypes [24]. Generative research can be participatory, e.g. through workshops, which is descriptive for our research process [24]. In this paper we apply theory in the analysis of an empirical case, to create abstract insights and create strategizing concrete plans for change. We are thus both exploratory and generative. In terms of case study classification, we do a single case study, which is mainly an explaining case study (focusing on modeling and making visible), with traits from exploratory (focusing on novel insights) case studies [26].

The difference between a case study and other qualitative studies is the investigation is “bounded”; you can express (theoretically) a finite set of cases – e.g. number of people to be interviewed or observed [27]. In this case, we define the case and system of “NAV”, more specifically NAV IT, as the internal organizational structures. A system is a set of interrelated elements organized to serve any particular function or goal (see Fig. 1). The system function or goal is sometimes not at all what the system or people in it would say it is, but rather the result that is clearly being produced by that system. Note, however, that this “system goal” may not always be in line with the goals of the people *in* the system, or the actors in the systems *environment*. Nonetheless, a system is scaffolded to support this overall “system goal”. The system is organized towards it and is always trying to produce outcomes which are in line with it.

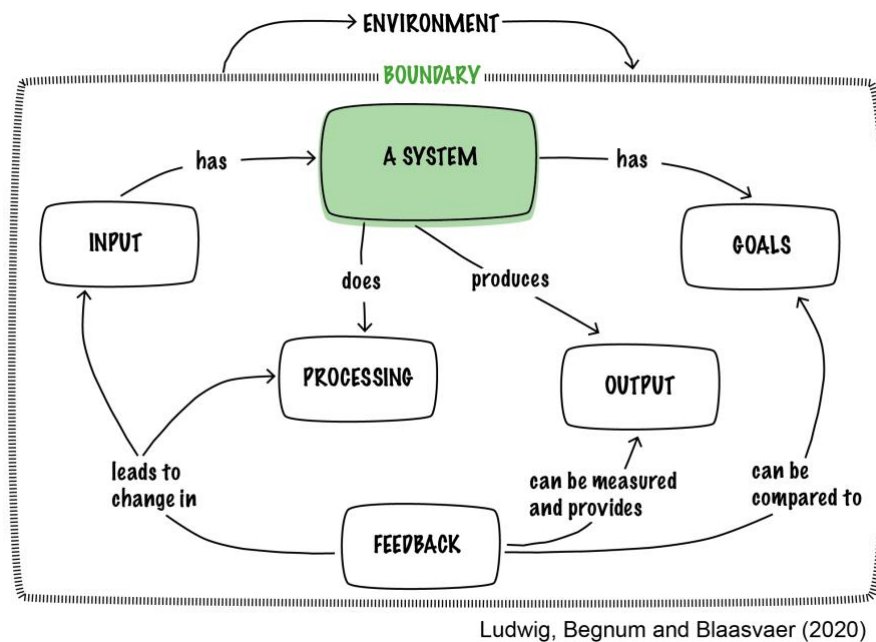


Fig. 1. Concept model of a system

In order to analyse whether NAV has system mechanism in place facilitating legal compliance and success conditions for UD of ICT, we apply methods from SOD. Parts of the analysis was done by GIGA-mapping, a method that involves the visualization of exceedingly complex and rich data followed by the disclosure of patterns, couplings, functioning systems, nodes, flow, and so forth (in this paper referred to as *system mechanisms*) [28]. Extending the GIGA mapping of system mechanisms is a theoretical analysis of CSC in light of Meadow’s 12 leverage points (see Fig. 2.) [5, 6]. Leverage points are mechanisms in which small shifts can produce big changes on complex systems [6]. This enables prioritizing interventions according to their effectiveness as leverage points for systems change. To answer our research questions, we investigated

the following for the NAV system: A) Which mechanisms does the organization have to support CSC and legal requirements? B) Is there is a need to add, change, or remove mechanisms in order to comply? and C) Looking at the resulting system as a whole: Is there is a need to add, change, or remove mechanisms in order to stabilize the system?

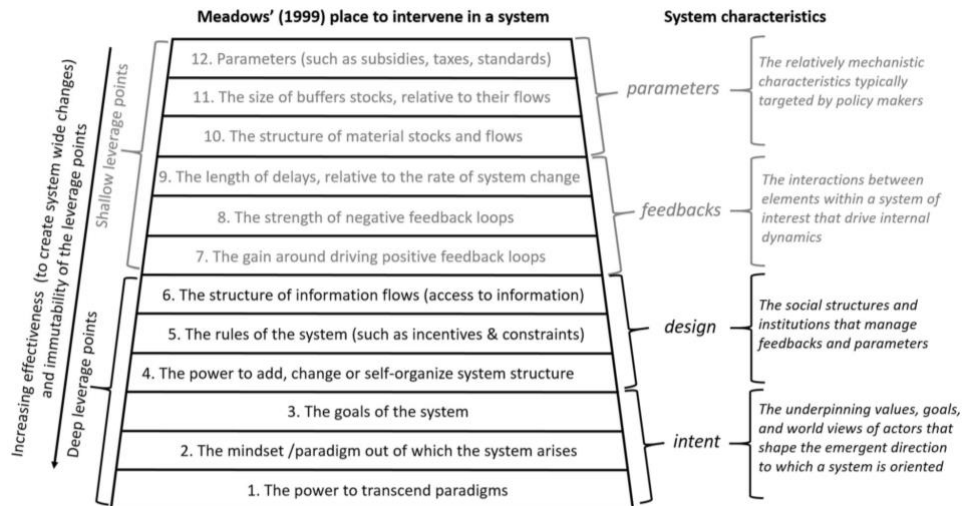


Fig. 2. System Leverage Points (in increasing order of effectiveness) [29]

4 Findings

4.1 Which mechanisms support CSC and legal requirements?

Table 2 summarizes identified mechanisms supporting best practice and legal requirements are summarized, the leverage point of the mechanisms and key challenges.

Meadow's top 3 leverage points are related to values and intent, which form the culture of an organization: system goals, paradigms and the ability to transcend paradigms. On these points, NAV emphasizes values and goals related to among other things user-centered development and inclusion. Nevertheless, UD is not a clear priority and requirement in high-level plans or strategies. UD mindsets on Personal (individuals) and Organizational levels (culture and management) appear partly present (CSC 2 Awareness and CSC 13 UD mindset). However, critical design competencies from the Design Department seem underutilized in strategic value-based work. There are no clear aims for UD in the national political strategy on digitalization either [18], which would have trickled down into NAV's internal plans and goals.

The next 3 leverage points cover the social structures and institutions: the power of self-organization, system rules and information flows. In the current NAV structure,

we identify few formalized requirements and rules to ensure legislative compliance (CSC 1 Legislation) or to ensure a necessary level of UD focus, priority, and quality. The system seems to depend on informal mechanisms in this regard; the development teams are responsible for WCAG-compliance, but NAV lacks clear top-down requirements and consequences if solutions are not compliant. We suspect most teams reflect too little on the UD quality of the service they build (CSC 10 Internal evaluation) even though many do user testing (CSC 9 User testing). Competence-building on UD appears mostly ad-hoc, driven by personal enthusiasm (CSC 15 Enthusiasm), apart from information during onboarding. The UD-team offers coaching, but teams (mostly) have to put in requests for that. On procedural level, however, NAV has high-quality settings with self-organizing development teams, which checks some of the best practice CSC, as NAV teams are agile and user-focused with cross-disciplinary collaboration (CSC 8 Team collaboration).

Table 2. Mapping leverage points and Critical Success Criteria (CSC) for UD in NAV

Leverage Point	Present mechanism supporting CSC/requirements	Challenge
1. Transcendence	<i>No CSC or legal requirements related to this.</i>	
2. Paradigm – system mindset	CSC 2: Organizational Awareness – partly anchored. CSC 13: Personal UD mindsets – partly present.	Negative UD mindsets & views also present.
3. Goals of the system	<i>No CSC or legal requirements related to this.</i>	Lacking formalized UD goals.
4. Self-organization power	CSC 8: Team Collaboration – high procedural quality.	Unknown UD focus.
5. Rules of the system	CSC 1: Legislation	Lacking UD-quality standards & competence assurance.
6. Information flows	Procedural QA through CSC 9: User Testing & 10: Internal (expert) evaluation. Competence building through CSC 15: Personal Enthusiasm & UD coaching.	Ad-hoc.
7. Driving loops	CSC 1: Legislation & CSC15: Personal Enthusiasm	Ad-hoc.
8. Balancing loops	UD coaching & CSC 14: Personal Interest. CSC 3: Priority	Ad-hoc.
9. Delays relative to changes	Too long – thus reducing UD quality.	Overlong.
10. Stock-and-flow Structure	CSC 12: Equipment (test labs, licenses, platforms etc.)	Some strain.
11. Buffers	Very few; mostly on CSC 12: Human resources.	Severe strain.
12. Numbers	CSC 1: Legislation, CSC 11: Time & Budget, and CSC 12: Human resources are present, but not adequate.	Insufficient

Leverage points 7 to 9 regard feedback, that is to say the interactions between elements within a system that drive internal dynamics: the driving loops, balancing loops (relative to the impacts they are trying to correct) and length of delays (relative to the rate of system change). Again, we find leverage points operate with ad-hoc mechanisms. The system currently lacks mechanisms for meeting (balancing) any triggered (driving) demands on UD. For example, there is no way for the UD team to know when requests for support will come, or a set time for answering such team requests – this relies on the availability at the time. Therefore, increasing demand for UD support, for example as a result of possible mandatory reporting on UD status (CSC 1 Legislation and partly CSC 15 Enthusiasm) is hypothesized to trigger more constraints on the time available for the UD team, which thus had less opportunity to invest time into measures that could prevent UD errors and to educate development teams. This again would likely increase the demand for support from the UD team and so forth. Without any balancing loops, this driving loop would soon crash the capacity of the UD team, leading to a collapse of this part of the system. It could partly be balanced through people skilled in UD outside the UD team (CSC 14 Interest and CSC 15 Enthusiasm). Therefore, teams (especially team leaders) need to prioritize UD; team members must be given time to build their UD competence and team leaders must encourage and demand UD efforts to build better solutions – even if this could lead to slight delays in the release of a service.

The final 3 leverage points are linear parameters, including the structure of material stocks and flows and buffers. NAV has few measurable parameters for UD as of yet, but WCAG can be seen as a parameter that enable teams to see if their solution is in accordance with the law (CSC 1 Legislation). We find NAV does not have an abundance of resources, nor any clear buffers, to rescue the system if/when unbalanced. Indeed, the limit on human and time resources is a constant challenge to ensure UD even under the present semi-structured system. This relates to CSC 11 Time and Budget, CSC 12 Equipment and human resources. How then can teams find the resources to meet new demands, and new goals?

4.2 Is there a need to intervene and change system mechanisms?

A strategy for UD, anchored in high-level organizational strategies. We conclude that NAV stresses, among other things, inclusion and user-centered development. But the existing goals and ambitions are vague on UD. A strategy addressing the goals and paradigms in the system, focusing on diversity perspectives and societal responsibility to design for all NAV's users, should have a profound effect on the organization [6]. Cynically looking at compliance to the regulation on UD of ICT, the minimum necessitated change is to add organizational awareness on the legal demands. We propose establishing a strategy which expresses the desired UD aims for NAV, regardless of the scope of these aims. We believe a strategy for UD would fulfill CSC 2 (Awareness) on anchoring UD as part of organizational values and CSC 3 (Priority) on emphasize UD priority. Next, there is a need for mechanisms that ensure the desired UD aims and priority levels are being implemented.

Specify a UD standard. The UD strategy could be translated to a UD quality standard for NAV, along with consequences or incentives for compliance. Specifically, NAV lacks system mechanisms to implement any CSC 5: requirements for UD. Today, there are no consequences if not complying to the legislation. This relates to the rules of the system: How absolute are requirements? What happens if teams de-prioritize UD? Who is responsible for ensuring legal compliance? Here, we recommend rules related to the end-result, but not rules related to a specific method or process for the teams. This would protect the agency of the teams, while promoting UD and ensuring compliance. The UD standard could also be part of or influence voluntary standards for several competence groups in NAV, such as Design standards or standards for Code Quality. However, we do recommend a structured and specified information flow and creating scalable best practice examples in the stock-and-flow structures (including the coming mandated accessibility declaration). The relevant staff and departments must be made aware of the new UD strategy and aims, and the new rules of the system.

Strategic Competence Building. NAV does not have a strategy for UD competence building (CSC 4). If a development team experiences time constraints and is unsure how to test for and fix UD errors, there is an increased risk that the team only tests very little or skips the testing altogether. Relevant individuals must be offered UD training in order to be able to implement the strategy as desired. NAV wants agile teams to have true agency, and this is in fact itself a quality indicator for UD [15]. In addition, there are several procedural CSC that appears present and should continue be encouraged, for example 8: Cross-disciplinary collaboration, 6: Viewing UD as part of user needs and UX, and 7: integrating UD/UX focus in work processes. This would support both information flow and self-organizing power.

4.3 Is there a need for additional mechanisms to stabilize the system?

If rules are to be introduced to ensure legal compliance and disciplinary best-practice, NAV must also ensure that there are buffers, balancing loops and delay mechanisms in place that can stabilize the system – so as to not break down but be sustainable over time. Today, the lack of priority given to UD creates ad-hoc driving loops for competence building and quality control, which is met by ad-hoc training and solutions.

Key driving feedback loops for UD are as such not systematized. Let us first look at the driving versus balancing feedback loops on UD in NAV. We find there are no clear system rules providing guidance on the degree to which teams need to do CSC 10: internal evaluations (expert inspections) of the UD quality of code, designs or service journeys, or CSC 9: testing with users. Procedures for checking compliance with regulations are not demanded. UD training is not required.

With the proposed changes outlined in Section 5.2, the system will look very different. Now, we will have a minimum of driving UD feedback loops, relative to the organizational goals (the standard) and rules (quality assurance). What is likely to happen when the teams start following these?

With strategic changes, we foresee there will be an immediate need for CSC 11: Time. First, teams need to find the time to educate themselves on UD. Teams are often hard pressured on the time at hand to increase their UD competence. Second, teams are pressured on the time to do QA work – user testing, for example, takes time to plan, conduct and evaluate. According to our analysis, UD fixes appears to frequently be postponed due to time constraints, lacking human resources within teams or lack of knowledge on how to find and fix such errors. Additionally, UD testing and error fixing in itself can lead to delays in publishing new parts or features of a service. Third, the UD expert team is not able to buffer the time constraint the teams are under. Delays will continue and grow under the suggested change unless resources are increased. An alternative to adding time is finding more people with the necessary competence to get more done in the same amount of time. Let us then look at CSC 12: Equipment and human resources. We have two choices; either pulling resources from the organization or buying external competence.

Internal UD resources. There is a strain on human resources related to UD: NAV only has a handful of UD experts who offer UD coaching (training) on demand to NAV's 40+ teams, in addition to strategic work, research, legal consultation, public sector collaboration and communication work. Though team support is prioritized by these experts, strategic work to reach legal compliance (such as piloting an accessibility statement and a feedback feature) and scalable efforts (such as supporting the Design System team) are expedited over timely response to single teams. Unfortunately, internal structures make it difficult for the UD team to get access to other resources like developers skilled in UD, which would be very beneficial for building and strengthening measures that prevent UD errors. Today, the UD team in NAV is not able to provide the necessary support in time to agile teams, which hinders UD quality and competence building. The UD team could either restrict the number of agile teams receiving support, or the amount of support given to each agile team. As such, the organization does not have that many internal UD resources to pull.

External UD Resources. The second alternative then, is buying external competence. We do not have first-hand knowledge of NAV team budgets. Still, we believe there are as tight budgets for NAV as for public sector in general. We do not believe NAV has the budget to hire external experts to aid them on UD compliance in time.

Strategic Competence Building. There is, however a third option. By building UD competence in NAV IT over time (as outlined in 4.2), the delay in UD support – though continued – will be less critical. After all, a delay in a feedback process is only critical relative to what the feedback loop is trying to control. The necessary stabilizing mechanism is thus increasing the competence to independently secure UD in agile teams – thus over time diminishing the importance of the UD team. In addition to the strategic competence building for all of NAV IT, we find that NAV needs to utilize employees with interest in UD more. We suggest building a network of interested individuals, “UD ambassadors”, that can discuss UD challenges and come up with improvements. This would support the leverage point of self-organization and could

speed up innovation. We assume that this also would strengthen the will and ability of individuals to take responsibility for UD in their team.

Support Mechanisms. Further, NAV could strengthen additional mechanisms to support agile teams on UD, thereby adding more balancing mechanisms to the likely increased requests on UD. NAV's *Design system* – including the frontend framework – provides a sound foundation for preventing common UD errors. A simple analysis of UD errors in older projects indicate that up to 70 % of UD errors would not have occurred if the projects had used a Design system with “built-in UD”. To comply with the coming legal requirements, the Design System needs to be updated. We recommend its broader use in NAV.

Another way to support teams would be to *improve automatization of UD testing*. At the time of writing few UD criteria can be tested using automated tools; mostly technical WCAG criteria. If a higher percentage of UD errors can be detected using automated tools, this would reduce the stress on the development teams and the UD expert team. We recommend strengthened efforts to research and increase the coverage of automated testing.

5 Discussion

Looking at the time at hand, we have about 1 year left. Plainly put; strategic competence building is urgent for NAV to reach compliance in time! Since legal deadlines are finite, NAV will have to *apply for a (time-limited) exemption* from the requirements. To be granted an exemption, authorities demand NAV submits a *realistic plan on when and how to comply to the law*.

5.1 Towards a UD Strategy for NAV

Based on the possible leverage points, which measures will likely have the most profound positive effects on NAV's UD work? We first discuss intervention points both in the light of Meadows's [6] leverage points (LP) and the Critical Success Criteria (CSC) identified by Begnum [14].

Triggering Change. Meadows states that the higher-level the leverage point, the higher the intervention effect. Looking the relationship between leverage points and critical success criteria, a CSC may correspond to several LPs – and a LP may include several success criteria. As such, the relationship is a bit messy. Nevertheless, as shown in Table 2, most LPs and CSC match very well, even regarding their priority. We find NAV is currently lacking system rules for ensuring legal compliance and that interventions to correct this corresponds to high-level leverage points; 2, 3 and 5. Meadows [6] and Begnum [14] are in alignment that a strategy and clear goals on an organizational level will likely trigger major changes in the organization fairly quickly.

Even so, it may be that these measures cannot lead to the necessary change in time, NAV may still have to apply for a time-limited exemption from at least some of the legal requirements.

Grassroot vs. top-down approach. According to Begnum [14] boosting CSC 13-14-15: UD mindset, UD interest and enthusiasm can create grassroots movements. Unfortunately, given the time left before the new regulations go into force, we do not believe a grassroots level movement would have the necessary effect *in time*. That being said, building competence is viewed as a bottom-up way to create the mindset and culture needed for organizational change, and therefore encouraged as part of the UD strategy in NAV. In addition, it would also be a way for NAV IT to protect the agency of teams, an aspect that is threatened by a top-down approach to building system rules. A standard that works as a set of best practices to be educated on, instead of a rigid set of to-dos, could support the teams in prioritizing and conducting their own UD work as they see fit.

Sustaining Change. Meadows [6] warns of ensuring system stability. Similarly, Begnum finds that in order for triggers to succeed, there must also be sufficient possibilities in place in the organization [14]. Based on Fogg's Behavior Model for Persuasive Design, she hypothesizes this is A) related to enough time, money, equipment and human resources, and B) related to the cultural values of both the individual, the team and the organization. For a trigger to succeed, enabling factors - called "abilitators" - are needed. We hypothesize that the identified strain on enabling factors in NAV, has been hindering a grassroots movement.

Our analysis shows resource factors are under strain in NAV. Any strategy must as such consider how these can be better aligned with the stated goals and rules. As such, the outlined top-down "strategy & rules approach" in NAV should consider resources and other system mechanisms as balancing factors (or abilitators) to be sustainable over time. Building up buffers in UD competence (by strategic competence building and an ambassador network) and measures that prevent UD errors to begin with (as the Design system and frontend framework) is thus considered critical for sustainability over time, even though they are on a lower level in Meadows' hierarchy of leverage points.

In conclusion, NAV will have to work on both short-time and stabilizing measures. The analysis highlights how adding *UD strategy, goals and rules* are the most powerful points to intervene in the NAV system to ensure expedient legal compliance to UD regulations. This is the argument focused on compliance *in* time. In order for the outlined top-down "strategy & rules approach" to be successful, the strategy must trigger additional change in the system - such as the constants, flows, loops and buffers necessitated to follow and measure the rules. These are the foundation for all change to be sustainable over time.

In particular, NAV has to focus on scaling UD in a way that teams can ensure UD quality of their solutions on their own, without extensive help of an expert team on a day-to-day basis. To ensure best practice and compliance *over* time, the analysis

indicate that the most important thing NAV can do is boost abilitators. If not, Begnum and Meadows point to the same end – using terms such as “trigger failure” and “system collapse”.

Key interventions to answer the research questions *How can NAV as an organizational system be improved and stabilized to reach its aims on delivering digital solutions to all inhabitants and comply with legal demands?* and *In extension, what is needed to comply in time, and what is needed to comply over time?* is summarized in Table 3, while Fig. 3 provides a visualized overview of our empirical case.

Table 3. Summary of Needed Changes to NAV

Leverage Point	To ensure legal compliance, we need:	To ensure system stability, we need:
1. Transcendence		Use critical design in strategic work.
2. Paradigm – system mindset	Create a Strategy for UD.	Strengthen UD- and integration-related paradigms; include NAV’s societal responsibilities into its strategies.
3. Goals of the system	Create a Strategy for UD; express UD goals for NAV.	Follow up goals.
4. Self-organization power	Strategic UD competence building.	Ambassador network, increased distributed UD competence in NAV IT.
5. Rules of the system	Specify UD standard, set consequences for not meeting the standard (for development teams and in procurement).	Apply consequences and incentives.
6. Information flows	Communicate goals & system rules. User testing/feedback channel for UD. Create accessibility statements based on self-evaluations.	Secure regular updates of accessibility statements.
7. Driving loops	Increased UD expertise needed, both in development teams and procurement.	Manage change rate.
8. Balancing loops	Distributed UD expertise (to decrease strain on UD team and provide buffers).	Manage change rate.
9. Delays relative to changes	Shorter delays in how long it takes to assist team that need UD support.	Manage change rate.
10. Stock-and-flow Structure	Update the Design System to be compliant with WCAG 2.1. Improved automatization of UD testing.	Assure technical frameworks used in NAV support accessibility
11. Buffers	Access to internal resources skilled at UD that can support the UD team, both developers, designers and others. Budget for needed software and for hiring external competence.	Time! Ambassador network

	Apply for (time-limited) exemption from legal requirements.	
12. Numbers	Apt UD measurements.	Measure UD goals/rules.

Towards a sustainable system for complying with legal UD demands on digital solutions in NAV.
 Current, transitional and future state of UD expert team supporting agile teams.

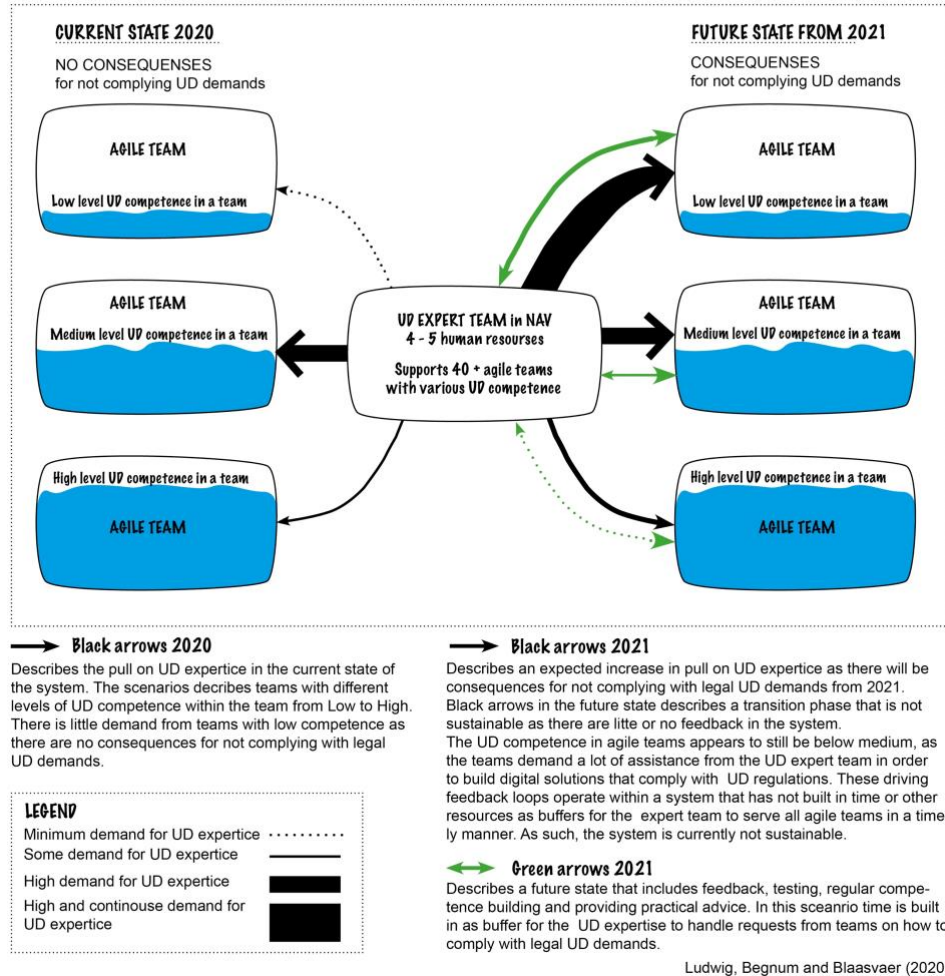


Fig. 3. A graph derived from the rich data GIGA mapping. Bold black arrows indicate expected increased pull on UD expertise with new legal demands on UD in 2021 for agile teams.

5.1 Towards a UD Strategy for NAV

Without a shared organization-wide framework, it will be difficult to set and follow up priorities in NAV. UD needs a clear and stated mandate, just as privacy and security. NAV should therefore define a framework that ensures at least a minimum of quality

in the solutions built. To achieve this, NAV has to stop viewing UD as technical requirements (the legally required minimum of technical accessibility) and start defining UD as a part of product and service development.

Historically speaking, NAV has had a tendency to build big and inflexible frameworks to compensate for areas where NAV itself lacked expertise, in order to prevent errors. These static frameworks were supervised by strong control mechanisms and a project model with little room for flexibility or autonomy. This led to a very low change, while opening for more thorough testing and quality assurance (of very few solutions), since things did not change as fast. We do not see this as a fitting solution for UD work in NAV and propose an alternative. Instead of a large framework, UD should be integrated into the NAV system in a manner that is quickly scalable in a fast-paced agile environment. We propose scaffolding consistent with CSC best practice. To succeed on UD, the teams is hypothesized to need help detecting their UD blind spots. We propose support structures such as a template for an accessibility statement, the Design system and automated testing should be one aspect of the scaffolding. Further, we propose strategic competence building (including possible help by the UD expert team) to support development teams and distributed cross-team UD assistance.

With the above aspects in mind, we suggest the following priorities for NAV:

1. **A UD strategy**, as part of an overall strategy at NAV, including a clear mandate for UD and the UD team, as well as consequences and incentives for meeting UD requirements (system rules). Both Meadows and Begnum indicate that such an intervention will likely have a high change effect. Further, we argue that it will be necessary and critical for prioritizing UD in NAV and to provide agile teams with the flexibility to build in time as a buffer (meaning that teams prioritize to use time both for UD testing and building UD competence). The strategy could also cover how to utilize internal employees using assistive technologies in development processes.
2. **A plan for strategic competence building** (based on today's UD coaching), which also should include the startup of an ambassador network. This has to be an ongoing process which will overlap with other measures. As argued above, this will be needed to achieve compliance over time and an essential measure to prevent a system collapse regarding strain on the UD expert team.
3. **A UD standard**, which outlines recommended best practice and required outcomes.
4. **A template for an accessibility statement** A UD quality assessment of all of NAV's services to achieve a more realistic picture of the status quo and to more easily be able to predict which teams will need how much and what kind of support.
5. **A UD quality assessment (QA) of all of NAV's digital services**, or at least all services that target end users and thus have to meet new regulations from 2021. This QA should use the accessibility statement template, and statements from different solutions should be able to generate statistic data that informs the UD team and NAV's leadership on the status quo. This data will be important to develop a realistic plan for UD fixes, and also be needed to apply for a time-limited legal exemption.

6. **Updating the Design system and frontend framework.** This will enable development teams to prevent UD errors and to improve the design quality of their solution with relatively little effort.
7. **Strengthen the efforts on automated UD testing.** This is also a measure to reduce the time and effort teams need to comply with UD requirements.

5.2 Reflections on our research approach

In the previous section, we answered our research questions; This section represents a discussion on the success of the utilized approach to inform strategic work on intervention points. We also discuss whether we believe the recommended system mechanisms for NAV can be extended to similar organizations in order to meet the intention of the UD legislation and current quality benchmarks

Leverage points and Critical Success Criteria as indicators of intervention points.

Both Meadows and Begnum point to similar areas that should be prioritized to leverage UD quality in an organisation. This indicates high-level LPs and CSCs are good starting points to guide strategic work on how to initiate change in the system. In order to balance the system, we identify additional interventions that are hypothesized to have a large effect on stabilizing the system. As NAV aims to create a strategy that both reaches timely compliance and is sustainable, both the identified high leverage points and the insights into balancing factors inform the future strategy work on UD in NAV.

Value for other organizations. In-depth case based qualitative insights cannot scientifically be generalized to other cases. This article is not considering the external validity of our data. In this case-study we have utilized our knowledge of NAV as an organization and of its UD efforts to search for leverage points that could guide our future efforts to secure UD quality. It is likely that similar leverage points exist in similar organizations. However, we assume the greatest value for other organizations is the in showing how to apply systemic thinking to both consider effective measures to improve UD in their systems and consider mechanisms to balance their systems. We theorize that if time is not an issue, the balancing mechanisms could be prioritized over high-level interventions, as they would work as abilitators to enable trigger success in a more sustainable environment. This approach could better facilitate grassroot movements.

System Oriented Design (SOD) and GIGA mapping. The case analysis revealed the current system do not support UD goals. However, rather than simply stating that goals to reach mandated legal requirements should be developed (as a solution to the lack of UD goals), system thinking also informs on the sustainability of change. By applying SOD to the case at NAV, the issue of implementing best practice for UD could be analyzed in a broader manner. The visual GIGA map made it possible for us see more holistic pictures of the problems at hand. Applying system thinking to the GIGA maps,

it became evident that the whole system should be restructured on the issue of UD best practice, in order to align with new UD goals. These insights were valuable, and not only will we continue to apply SOD in future studies at NAV, we also recommend other organizations utilize SOD in strategic planning.

In addition to holistic problem analysis, the GIGA map visualizations were also utilized for reflecting together. The technique aided us in seeing interrelated functions and discussing content from which new questions emerged. Hence, in addition to contributing to our case research methodology, GIGA mapping served as a medium for a reflexive practice. The reflections concerning our own use of GIGA-mapping contributes to showcasing the design research process within systemic design. GIGA mapping is much more than a visual communication tool. Based on our experiences in this case study, we recommend GIGA mapping to other organizations – both as part of researching a SOD project, as a reflection tool and as a communication.

6 Conclusion

All over Europe, regulations on UD of IT is being updated and extended. These changes will come into force in Norway in 2021. The Norwegian Labour and Welfare Administration (NAV) is responsible for major social security schemes in Norway, and NAV IT has been transformed to support the rapid speed of service digitalization. In this paper we have analyzed the emerged organizational system in NAV, and the degree to which current structures 1) facilitate best practice and 2) ensure legal compliance.

We find that NAV is lacking sufficient system mechanisms for ensuring legal compliance in the current system. Based on the findings, we discuss the prioritized places to intervene in the system to change this. We conclude that a strategic plan that clearly express UD values and outline goals, clarify requirements and system rules is needed to assure timely compliance. Based on theory this is considered the most important intervention, and the only strategy to achieve UD compliance in a short window of time.

However, we do not only want to facilitate compliance with best practice and regulations *in time*, we also want to identify mechanisms necessary to stabilize the system *over time*. To do so, we advise NAV to prioritize balancing mechanisms and enabling factors. In particular, we would advise NAV to focus on strategic competence building, to empower teams and make it possible to scale UD work to the desired speed of digitalization. In addition, we propose supporting structures for agile teams that facilitates both UD and team agency; in particular an accessibility statement template, and a quality standard on UD outlining required outcomes and recommending best practice. We also recommend the support of measures that prevent UD errors or reduce time and effort needed for UD testing, such as NAV's Design system and automatization of UD testing where possible. Finally, in order to plan for reaching new UD regulations, we propose a benchmarking of UD quality in NAV's current solutions.

We believe the methodological approach applied in this paper showcases how theoretical and empirical knowledge can be merged using system thinking, in order to

aid organisations in their strategic work to build up systems that are sustainable over time.

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