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Catalogue of Digital Work Environment Aspects in Public Procurement

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1 About this Catalogue

The purpose of this catalogue is to provide a structured and detailed overview of how digital work environment considerations are expressed in procurement practice. It is intended both as a standalone reference document and as supplementary material to the research publications derived from this study.

Digital systems are a central part of modern health and social care work. The requirements specified during procurement influence not only system functionality, but also the digital work environment of the professionals who will use the systems in their daily work. We use the term *digital work environment* to refer to how digital technologies influence employees' ability to perform their work effectively, efficiently, safely, and with appropriate cognitive and organisational support. It encompasses traditional usability concerns as well as broader socio-technical factors such as workflow integration, training, interoperability, safety, and organisational adaptation.

This catalogue presents fifteen digital work environment aspects identified through an analysis of procurement documentation from 20 procurements of larger IT systems within Swedish municipal home health care. The fifteen aspects represent broader dimensions of the digital work environment. For each aspect, we identified one or more recurring themes that describe how the aspect was operationalised through procurement requirements.

For each aspect, the catalogue presents the identified themes, illustrative examples of requirements, and information about the prevalence and extent of the aspect across the analysed procurements. The catalogue can be used as:

- a reference when developing procurement requirements,
- a source of inspiration for strengthening digital work environment considerations in procurement processes,
- a basis for discussion between procuring organisations, suppliers, users, and researchers, and
- a resource for understanding the breadth of aspects that influence the digital work environment.

The catalogue reflects how digital work environment requirements are currently expressed in procurement documentation. It should therefore be viewed as a descriptive overview of existing practice rather than a normative framework prescribing how requirements should be formulated. The focus is on documenting and organising the empirical findings in a form that can support both research and practice.

The fifteen aspects identified in the study are shown in Figure 1 and described in detail in the following sections. An overview of the 20 procurement cases and the document types included in the analysis (Request for Quotation, Requirements specification, and User Evaluation) is provided in Figure 2.

This catalogue is designed as a standalone supplementary resource that provides a detailed account of the digital work environment factors identified in the analysed procurement documentation. To support reuse by practitioners and researchers, the catalogue provides detailed descriptions of the identified aspects, themes, prevalence data, and illustrative requirement examples that could not be reported in full in the associated publications. Further discussion of the findings, theoretical implications, practical recommendations, methodological limitations, and overall conclusions can be found in the journal and conference publications arising from this research project.

Awareness and understandability - Patient/client details - Current work and tasks - Updates and changes Documentation - User manuals - Training and learning support materials - System and technical documentation - Scope and quality of documentation including accessibility Ease of learning - Process and navigation guidance - Intuitive and self-explanatory interaction - Consistency and language clarity Ease of remembering - Recognition through guidance and constraints - Support for infrequent or occasional users - Overview and contextual cues - Easy access to standardised and frequently used functions Efficiency - Work task support and coordination - Interaction efficiency - Automation and reduction of manual work - Performance and system responsiveness Interface design - Interface standardisation and localisation - Input efficiency and flexible interaction techniques - Feedback and visibility of system state - Responsive and adaptive design Overall usability and ergonomics - Accessibility and inclusiveness - Simplicity and intuitive use - Cognitive support - Consistency across platforms and contexts of use - User-centred design and experience orientation Robustness - Performance stability and scalability - High availability and continuous operation - Fault tolerance and resilience to failures - Robust operation during system updates and maintenance	Safety and error prevention - Workflow control and input validation - Alerts and situation awareness - Communication safety and reducing misunderstandings Security - Authentication and access control - Logging and monitoring - Encryption and secure communication - Legal compliance and governance - Operational security and continuity - Organizational and physical security Subjective satisfaction - Effective goal fulfilment - Cognitive simplicity across user groups - Emotional response System interplay - Ecosystem integration across organisations - Data synchronisation and real-time integration - Openness and interoperability infrastructure - Integration with digital devices and external technologies Training and support - Role-based and work-oriented training - Continuous and life-cycle oriented training - Embedded learning and contextual user support - Training and support infrastructures Utility and adaptability - Configurability and local adaptations - Flexibility in data handling, reporting, and operational logic - Legal adaptability and regulatory compliance Work interplay - Process-integrated workflow carriers - Seamless information flow - Coordination across roles and organisational boundaries - End to end visibility and traceability - Integration of documentation into work execution
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Figure 1. *An overview of digital work environment aspects identified in the material.*

Case	Procurement procedure	Year	Procured system	Per document type, total number of words			Overall, total number of words
				RFQ	RS	UE	
P1	Open	2023	Cambio Welfare	7 315	6 319		13 634
P2	Open	2015	Tieto LifeCare	7 248	7 517		14 765
P3	Open	2017	Tieto LifeCare	6 779	5 157		11 936
P4	Open	2018	Tieto LifeCare	16 513	13 143		29 656
P5	Open	2021	Selfpoint	30 544	4 081	349	34 974
P6	Open	2019	CGI	4 350	22 617	1 137	28 104
P7	Open	2020	Tieto LifeCare	5 888	11 695		17 583
P8	Open	2017	Tieto LifeCare	10 112	12 770	211	23 093
P9	Open	2019	Unassigned	11 817	5 154	371	17 342
P10	Open	2021	Pulsen Omsorg	16 065	13 952	488	30 505
P11	Open	2020	Tieto LifeCare	19 533	8 145		27 678
P12	Open	2021	Pulsen Omsorg	32 944	9 191		42 135
P13	Open	2021	Alfa eCare	4 140	3 369		7 509
P14	Open	2022	Cambio Welfare	8 734	21 319		30 053
P15	Negotiated	2021	Pulsen Omsorg	26 144	9 731		35 875
P16	Negotiated	2013	Tieto LifeCare	3 469	8 068		11 537
P17	Negotiated	2022	Pulsen Omsorg	4 673	12 886	4 908	22 467
P18	Negotiated	2018	Tieto LifeCare	8 185	3 122		11 307
P19	Negotiated	2020	Unknown	11 850	2 661		14 511
P20	Negotiated	2022	CGI	2 519	14 777	249	17 545

Figure 2. Overview of the analysed procurement cases (P1-P20) including the type and size of documents for each; RFQ request for quote, RS requirements specification, UE usability evaluation.

2 Digital Work Environment Requirements

The analysis identified fifteen recurring digital work environment aspects in the procurement documentation. Together, these aspects describe how municipalities articulate expectations regarding how a digital system should support users, work processes, collaboration, learning, safety, usability, and organisational adaptation. The aspects were identified across the analysed procurement cases, with prevalence varying substantially: some aspects, such as *work interplay*, *system interplay*, and *utility and adaptability*, appeared in nearly all cases (19 of 20), whereas others, such as *subjective satisfaction*, were found in only four cases.

Table 1 summarises the average extent to which each aspect is represented per case, overall and by document type (request for quote, requirements specification, and usability evaluation). Table 2 provides a more detailed overview of the extent of each aspect across the individual procurement cases. Extent refers to the amount of procurement text coded to each aspect, measured as number of words.

Overall, the results suggest that procurement requirements primarily focus on supporting work processes, interoperability, utility, adaptability, and organisational coordination. In contrast, subjective user experience, memorability, and learnability receive substantially less attention. This indicates that procuring organisations largely frame digital work environment concerns in operational and organisational terms rather than in terms of individual user experience.

Table 1. Overview of extent of documentation is measured as the number of words for each digital work environment aspect. The extent is given on average per case (where it is included) and per document type (request for quote, requirements specification, usability evaluation) over all cases.

	Nr of cases included	Extent rating	Average per case (included)	Average per case		
				RFQ	RS	UE
Total number of words			22 110	12 097	9 628	386
Work-related Health			3 413	208	3 174	30
Awareness	19	6	242	5	226	
Documentation	16	10	90	21	52	
Ease of learning	8	12	48		19	
Ease of remembering	8	15	32	2	10	
Efficiency	16	7	214	14	154	3
Interface design	15	11	78		59	
Overall usability, erg.	9	9	143	15	26	22
Robustness	11	14	45	3	22	
Safety, proh user error	18	8	153	7	130	
Security	12	4	298		179	
Subjective satisfaction	4	12	48	2	5	3
System interplay	19	3	493	20	448	
Training & support	16	5	272	57	161	
Utility & adaptability	19	2	609	11	564	3
Work interplay	19	1	1 232	49	1 121	

Table 2. Overview of extent of documentation (number of words) for each digital work environment aspects and per case.

	Total	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
Awareness	4 763	31	346	103	523	144	78	94	197	241	276	244	586	225	402	484	129	312	0	215	133
Documentation	1 475	0	40	7	257	59	0	45	24	158	19	285	79	30	227	76	90	62	0	0	17
Ease of learning	443	0	19	0	0	0	0	31	214	0	19	0	0	0	33	61	20	0	0	0	46
Ease of remembering	252	0	0	0	0	18	0	31	57	65	36	0	0	0	16	0	0	15	0	0	14
Efficiency	3 589	0	202	8	150	0	0	53	606	69	250	491	302	86	233	215	194	582	0	0	148
Interface design	1 401	68	181	39	63	18	0	0	0	101	19	0	233	139	86	170	72	102	61	0	49
Overall usability	1 136	0	0	0	0	9	0	0	0	95	0	0	0	134	33	0	163	351	337	0	14
Robustness	465	0	31	13	8	85	133	0	0	32	0	0	52	39	0	0	11	42	0	0	19
Safety	2 788	0	155	52	884	102	58	18	57	138	125	267	96	125	158	111	49	246	0	82	65
Security	3 714	0	472	0	0	636	0	136	0	62	0	90	951	270	0	391	91	202	413	0	0
Subjective satisfaction	142	0	0	0	0	0	0	0	0	47	0	0	35	0	0	0	60	0	0	0	0
System interplay	8 957	0	420	114	1 171	189	743	1 161	468	406	224	846	337	220	322	432	708	418	300	114	364
Training and support	4 001	288	337	0	0	278	140	1 146	49	33	319	0	483	42	13	182	183	18	295	195	0
Utility and adaptability	11 843	21	2 540	17	818	324	182	13	243	260	333	374	2 307	631	100	2 728	322	169	0	421	40
Work interplay	23 994	66	117	0	1 412	643	16 288	59	256	566	292	989	459	67	353	689	659	413	76	427	163

2.1 Awareness and Understandability

Awareness refers to informing users about what is happening in the digital system, in line with the usability heuristic *visibility of system status* [1], while understandability concerns how clearly system functionality and possible user actions are communicated [2]. This aspect is included in almost all procurement cases (19 of 20). However, its relative extent, measured as the number of words used to express these requirements in the documentation, is moderate, ranking sixth among all 15 aspects.

We identify three main types of awareness-related requirements in the material, each reflecting the need to make a specific aspect of the system state visible to the user through requirements on making critical patient/client information visible, supporting understanding of work context, and alerting users about changes and events in the system. First, **awareness of patient/client details** concerns the clear presentation of critical attributes of the individual patient or client, often related to safety or confidentiality. For example, requirements state that *“it shall be clearly visible ... that a person has a confidentiality marking”* (P15), that the system must *“clearly indicate and show important information about a patient such as infection and allergies”* (P10), and that *“the case contains protected information”* (P9). Second, **awareness of current work and tasks** focuses on giving users an overview of their tasks and responsibilities, typically through dashboards or workspace views. Illustrative examples include requirements that *“at login, there is an overview of the user’s workspace, such as ongoing cases, incoming messages”* (P17), that the system should *“display what is current information for each user, such as active cases ... assignments”* (P10), and that it should be *“clear to the user where they are in the process ... and what the next step is”* (P17). Third, **awareness of updates and changes** captures the need to actively inform users about updates, deviations, or time-sensitive events. This is reflected in requirements such as providing *“a reminder when they have assignments that have not been signed”* (P12), issuing warnings when *“an issue has been inactive a certain amount of time”* (P9), or notifying users *“when a patient has started or completed home health care”* (P14).

Since the studied procurements concern health care related systems, they may also include aspects of patient safety in relation to awareness, such as requirements on system design that increases situational awareness [3] and ensures the ability to monitor processes that are important in order to ensure the safety of the patients [4].

2.2 Documentation

Documentation refers to the provision of accessible, clear, and understandable information that support users in learning and performing their work, including manuals, training resources, and technical descriptions [1]. As such, it constitutes an important aspect for ensuring a well-functioning digital work environment [5]. Requirements related to documentation are present in most procurement cases (16 of 20), often specifying both the expected scope and quality of these materials. However, the extent of this aspect in the analysed procurement cases is limited, ranking tenth among all aspects.

The documentation-related requirements can be organised into four recurring themes: user manuals, training and learning support materials, system and technical documentation, and requirements concerning the scope, quality, and accessibility of documentation. First, **user manuals** concern formal descriptions of system use, such as *“an electronic user manual in Swedish”* (P3), *“complete Swedish user instructions ... shall accompany the delivered system”* (P4), and *“user manual describing all modules and associated functions”* (P14). Second, **training and learning support materials** extend documentation into organisational learning, illustrated by requirements that *“training material should be editable ...”* (P4), that *“eLearning ... [and] training environment ... should be included in the delivery”* (P11), and that *“complete role-specific training materials”* should be provided (P12). Third, **system and technical documentation** captures the need for operational and technical understanding, for example *“systems och operational documentation should contain a system overview ...”* (P14), *“documentation and instructions for technical and systems operations”* (P9), and *“descriptions of... logs... information flow to/from other systems”* (P16). Finally, **scope and quality of documentation including accessibility** emphasises completeness, usability, and continuous updating, including that *“delivery shall not be considered complete until all documentation has been delivered”* (P4), that documentation should be *“in electronic format... without access or print restrictions”* (P4) and *“in electronic and editable format ... in Swedish”* (P9), and that suppliers must *“continuously update the documentation ... for additions and changes”* (P15).

Together, these themes show that documentation is treated not merely as a contractual deliverable, but as an integrated, accessible, and evolving resource intended to support system use, organisational learning, operation, and long-term management.

2.3 Ease of Learning

Ease of learning, or learnability, refers to how easily users can become proficient in using a system, for example through intuitive interaction, clear guidance, and supportive feedback environments [5], [6]. It is an established usability factor and has been identified as particularly important in digital work environments [8]. In the examined procurement cases, requirements related to ease of learning are comparatively rare, appearing in fewer than half of the cases (8 of 20). Moreover, their relative extent, measured as the number of words devoted to these requirements is very limited, ranking twelfth among the fifteen aspects.

The analysed requirements on ease of learning reveal three recurring themes describing how systems are expected to support users in becoming proficient with minimal effort through process navigation guidance, self-explanatory interaction, and consistency and language clarity. First, **process and navigation guidance** reflects expectations that the system should guide users through workflows and help them understand structure and progression. For example, systems should be “*process supporting ... [with] clear signals of what is expected to do in the work process*” (P2), “*guide the user in the processes supported by the system*” (P14), and provide support for correct actions through mechanisms such as validation and shortcuts, including “*how can a user see that information is missing ... to complete the task*” and “*smart short-cuts ... direct connections between ... a TODO list ... and a client’s medical records*” (P8). Second, **intuitive and self-explanatory interaction** captures the strong emphasis on systems being easy to understand without extensive training, expressed in requirements that the system should be “*intuitive, self-learning*” (P7), “*to a high degree ... self-instructive and intuitive*” (P8), and “*easy to use... intuitive and easy to understand*” (P20), with the expectation that this results in “*minimal need for training and onboarding*” (P16). Third, **consistency and language clarity** highlights the role of clear and familiar language in reducing learning barriers, illustrated by requirements that the interface should “*use Swedish exclusively for menus, buttons, labels, help information, input fields, and user interaction*” (P10).

Together, these themes show that ease of learning is addressed both through structured, guided interaction and through intuitive, clearly communicated system design.

2.4 Ease of Remembering

Ease of remembering refers to how easily users can re-establish proficiency after periods of non-use, for example through interfaces that minimise reliance on memory and support recognition and re-orientation [34]. This is an established usability factor (memorability) and has been identified as important in digital work environments environments [8]. Despite this, requirements related to ease of remembering are relatively rare in the analysed procurement cases, appearing in only eight cases. The aspect is among the least frequently specified overall and has the lowest relative extent of all aspects, ranking fifteenth out of fifteen based on the proportion of words devoted to it in the documentation. Thus ease of remembering receives comparatively little attention in procurements.

Despite this, the requirements in our material reveal four recurring themes related to ease of remembering: recognition through guidance and constraints, support for infrequent users, overview and contextual cues, and easy access to standardised and frequently used functions. Together, these themes focus on reducing users’ reliance on memory and supporting re-orientation after periods of non-use. First, **recognition through guidance and constraints** emphasises that systems should externalise knowledge and make correct actions visible, for example by “*providing guides and restrict input or modification options*” (P5) and by helping users understand “*how ... a user [notices] that information is missing to complete the task and proceed*” (P8). Second, **support for infrequent or occasional users** is explicitly highlighted, as usability is considered particularly important for “so called ‘*infrequent users*’” and that the system should be “*easy to use when logging in, navigating menus, and retrieving information*” (P9), reflecting the need to enable effective re-use without relying on memory. Third, **overview and contextual cues** support users in re-orienting themselves, for instance through requirements that “*a customised overview screen ... show what is current ... current cases, ongoing investigations ...*” (P10), making the current system state visible and helping users recall their work context. Fourth, **easy access to standardised and frequently used functions** reduces the need to remember navigation paths or procedures, as seen in requirements that “*functions ... that enable easy access for the most frequently used functions*” (P14), that links should be “*grouped together and easily accessible*” (P9), and that the system should provide “*pre-defined options*” for common tasks (P17).

Together, these themes show that memorability is primarily addressed by shifting cognitive effort from the user to the system through guidance, visibility, and structured, easily recognisable interaction patterns.

2.5 Efficiency

Efficiency refers to the degree to which a system supports users in carrying out their tasks with minimal effort, for example by reducing unnecessary steps, supporting smooth workflows, and enabling timely system responses [6]. As an established usability factor, efficiency is particularly important in digital work environments, where system use is closely tied to task performance and productivity. In the analysed procurement cases, requirements related to efficiency are common, appearing in 15 of 20 cases. The relative extent of this aspect, measured as the proportion of words devoted to describing the needs for such support, is moderate, ranking seventh among the fifteen aspects.

The efficiency-related requirements in our material reveal four interrelated themes concerning the efficient completion of work tasks: support for work coordination, efficient interaction, automation of routine activities, and rapid system response. Together, these themes reflect an emphasis on reducing unnecessary effort and enabling users to complete their work quickly and effectively. First, **work task support and coordination** emphasise helping users manage, organise, and progress through work efficiently by providing overviews, planning support, and smooth navigation. For example, the system should support planning through *“TO-DO list-functionality ... [with] real-time updates”* (P8), enable direct access such as *“open a case directly from an overview screen”* (P9), and allow users to *“work in several views simultaneously”* (P17) or *“navigate between”* multiple windows (P4), thereby reducing fragmentation and enabling parallel work. Second, **interaction efficiency** reflects the importance of minimising effort in everyday interaction, particularly through search, reuse, and standardisation. Requirements include enabling users to *“perform free-text searches”* (P2), ensuring that information can be *“easy to ... reach ... through searches and filtering”* (P8), and supporting reuse such as *“copy/connect previous information ...”* (P7) or *“reuse/revise”* (P12), thereby reducing typing effort and the need to recreate information. In addition, several requirements explicitly emphasise the use of predefined and reusable text elements, or *phrases*, for example the ability to *“create text phrases as support in the system”* (P2) and that *“a user should be able to use... pre-defined text phrases”* (P12), thereby further reducing typing effort and the need to recreate information. Third, **automation and reduction of manual work** captures how systems are expected to take over repetitive or low-value tasks, for instance through *“forms that automatically collect data”* (P2), *“free text is saved automatically”* (P14), or that *“actions are automatically completed”* (P10), as well as automated notifications such as *“automatically create monitoring flags/notifications”* (P17). Finally, **performance and system responsiveness** highlights the importance of speed and smooth interaction as a prerequisite for efficiency, with requirements specifying *“fast response times ... minimise loading times”* (P17), *“response time ... max two (2) seconds”* (P13), and that systems should be *“fast to work with, with short response times”* (P16).

Together, these themes show that efficiency is addressed not only by reducing the effort required for individual interactions, but also by supporting coordinated work processes, automating routine tasks, and ensuring responsive system behaviour that enables uninterrupted work.

2.6 Interface Design

Interface design refers to specific design-level requirements concerning how the user interface should be structured and presented, including aspects such as layout consistency, interaction mechanisms, feedback, and accessibility. As a key component of usability, interface design shapes how users perceive, understand, and interact with the system. In the analysed procurement cases, requirements related to interface design are common, appearing in 15 of 20 cases. However, their relative extent is limited, ranking eleventh among the fifteen aspects.

The analysed requirements reveal several recurring themes in user interface design: interface standardisation and accessibility, input efficiency and flexible interaction techniques, feedback and visibility of system state, and responsive and adaptive design. Together, these themes emphasise consistency, efficiency, visibility, and flexibility in the design of procurement systems. First, a dominant theme is the need for **interface standardisation and localisation** of the user interface, regarding language and visual coherence. Multiple sources emphasise that *“the systems user interface shall exclusively use Swedish language...”* (P1, P4, P9, P10, P14) highlighting the importance of linguistic consistency for usability. This is complemented by requirements that interfaces should maintain uniformity, e.g. *“the interface shall have the same visual appearance throughout”* (P13). Closely related to this are requirements for adherence to established standards and accessibility guidelines such as is the aim of aligning with standards and conventions for interface design, such as *“the interface of the service... shall be designed inline with the accessibility standard WCAG 2.1”* (P15) and *“the system shall adhere to Law (2018:1937) on accessibility to digital public service”* (P12). Practical accessibility features are also specified, for example *“it shall be possible to enlarge text when needed”* (P12). A second theme concerns **input efficiency and flexible interaction techniques**, where requirements stress support for established interaction patterns and efficient workflows. For example, systems should enable alternative shortcut interaction modes through

“keyboard entry as an alternative to using the mouse” (P16), that “all functions in the system shall be accessible directly from keyboard commands” (P4), and that it should be possible to “‘copy’, ‘cut’ and ‘paste’ ... via keyboard shortcuts.” (P14). A third theme highlights **feedback and visibility of system state** to ensure that users can easily interpret information and system activity. This is evident in requirements for overview dashboards, e.g. “at system login an overview screen shall show the user’s workspace...” (P2), and visual cues such as “fields that are locked for editing should differ in appearance from the ones who can be edited” (P4), as well as status differentiation through colour: “client visits have different colours depending on status” (P20). Finally, the requirements also emphasise **responsive and adaptive design**, reflecting the need for flexibility across devices and contexts of use. For instance, “the system shall adapt and be responsive to different screens” (P12), which illustrates expectations of mobility and continuity of work, while adaptation to user roles is reflected in “the systems layout shall be adaptable to individual users or roles” (P16).

Together, these themes demonstrate a strong emphasis on usability grounded in standardisation, efficient interaction, transparency of system state, contextual adaptability, and inclusive access. However, while generic design-level requirements, provide guidance when designing and developing a system, more detailed requirements at this level that specify envisioned solutions pose a risk of restricting designers and software engineers in creating novel and sound solutions to user problems [7].

2.7 Overall Usability and Ergonomics

Overall usability and ergonomics refer to high-level qualities of system use, capturing the extent to which a system supports effective, efficient, and satisfying user interaction in a broad, holistic sense. Unlike other more specific usability aspects (covered by other digital work environment aspects), this aspect reflects overarching design principles and general expectations of system quality, including accessibility, simplicity, and user experience. In the analysed procurement cases, explicit requirements addressing overall usability and ergonomics are relatively limited, appearing in 8 of 20 cases. Their relative extent, measured as the proportion of words devoted to such requirements, is moderate, ranking ninth among the fifteen aspects.

The analysed requirements reveal five interrelated themes concerning overall usability and ergonomics: accessibility and inclusiveness, simplicity and intuitive use, cognitive support, cross-platform consistency, and user-centred design. Together, these themes highlight a holistic view of usability that extends beyond functionality to include accessibility, ease of use, work support, and user experience. First, **accessibility and inclusiveness** are emphasised through explicit references to formal guidelines and legislation, ensuring broad usability across diverse user groups. For example, requirements state that “Layout should adhere to WCAG 2.1” and that “all parts... shall adhere to... the Web Accessibility Directive (EU 2016/2102)” (P13), while also calling for compliance with European standards such as “EN 301 549 V2.1.2” (P14). Second, **simplicity and intuitive use** emerge as a central concern, highlighting that systems should be easy to understand and require minimal effort to use. This is reflected in statements such as “The technology should be easy to use. It should be intuitive and easy to understand” (P20) and the expectation of a “business system that is easy for staff to use” (P9). At the same time, usability must accommodate both novice and experienced users, as seen in the requirement that systems be “easy to use...” while also being “functional and logical to those who register [entries] daily” (P9). Third, the theme of **cognitive support** focuses on reducing users’ cognitive load by helping them maintain orientation and situational awareness. Requirements emphasise that “the system shall be clear and easy to overview” (P16), that users should experience systems as “easy to navigate” and “easy to overview” (P17), and that users can “understand where I am at... and which work tasks that are ongoing vs. complete” (P17). Fourth, **consistency across platforms and contexts of use** addresses the need for continuity of interaction regardless of technical environment. This is explicitly expressed in requirements such as “the system shall... have equally good usability irrespective of which platform it is used on” (P14), emphasising reduced relearning and stable user experience across contexts. Finally, **user-centred design and experience orientation** highlight usability as a central aspect to include in the design process beyond functionality to include user perception, work support, and emotional experience. For instance, usability is defined in terms of “fit for purpose, effectiveness, and satisfaction” (P5), and systems should be “developed with the users’ needs in focus” (P17). Moreover, the goal is that the user should “get a good feeling and a good relationship to the system” (P18), underscoring the importance of perceived usability and user experience.

Together, these themes demonstrate that usability and ergonomics are conceptualised as a combination of accessibility, simplicity, cognitive support, consistency, and user-centred experience, reflecting a comprehensive human-centred design perspective.

2.8 Robustness

Robustness refers to a digital system's ability to maintain stable, reliable, and continuous operation under varying conditions, including high workload, failures, and system changes. As a usability-related quality, robustness concerns the resilience of the system in use, for example through consistent performance, error tolerance, and protection of user work and data [1]. In the analysed procurement cases, requirements related to robustness are moderately common, appearing in 11 of 20 cases. However, their relative extent, measured as the proportion of words devoted to such requirements, is very limited, ranking fourteenth among the fifteen aspects.

The robustness-related requirements reveal four interrelated themes: performance stability and scalability, high availability, fault tolerance and resilience, and robust operation during updates and maintenance. Together, these themes reflect expectations that systems should provide reliable and uninterrupted service while maintaining performance, preserving data integrity, and supporting long-term operational continuity. First, **performance stability and scalability** are emphasised through requirements that systems must maintain consistent performance for parallel use and as the user base grows. For example, that *"the system shall have functionality to handle at least 1.000 simultaneous users"* and that *"multiple users shall be able to simultaneously register data... for the same client"* (P2). And, as the number of users increase that *"response times do not degrade as the data base grows, irrespective of database size"* (P3) and *"response times for searching shall in 90 % of cases be maximum two (2) seconds"* (P13). Second, **high availability and continuous operation** are highlighted through expectations of uninterrupted service, such as that systems should be *"available for users all day, 24 hours a day"* (P2) and *"available all year round (365 days per year) around the clock (24/7)"* (P5), including the ability to perform operational activities without disruption of work, for instance *"Backup... without impact on operations during work hours"* (P6). Third, **fault tolerance and resilience to failures** including data integrity and retained work are reflected in requirements ensuring continuity under adverse conditions, such as that *"no performed transactions are lost at a potential system crash"* (P5), that systems *"should withstand shorter communication failures without loss of work"* (P16), and that users should not lose progress, e.g. *"that work that has been started shall not be lost..."* (P6), supported by recovery measures like *"transaction logs... shall be backed-up at least every 15 minutes"* (P17). Finally, **robust operation during system updates and maintenance** captures the need for stability during updates and evolution, for example that *"locally adapted help texts shall remain intact after change of software version"* (P4) and that processes must ensure *"that errors are not transferred to the production environment"* (P6).

Together, these themes show that robustness is conceptualised as the ability to maintain stable performance, ensure continuous availability, protect data and user work under failure, and remain reliable during ongoing system change. However, the examples found in our material illustrate the difficulty of expressing good, measurable, and realistic requirements on these aspects. For example, requiring 100% uptime 24/7 is a very tough quality requirement to meet, in particular for systems that rely on internet connectivity. Also, such requirements can not be verified since it is impossible to test that something always works.

2.9 Safety and Error Prevention

Safety and error prevention is expressed in a majority of our procurement cases (18 of 20) and described in the documentation to a moderate extent (ranked 8 of 15), as functionality that helps the end user perform their work in a safe way, reduces the risk of making mistakes, and prevents negative consequences from incorrect use of the system [6]. As an example, one can imagine a patient not getting the correct medical treatment if the user (a home care nurse) is interrupted when inserting new information about the patient's medication into the system. A reminder from the system of finalizing the action, can mitigate such consequences and thus increases patient safety.

Safety and error prevention refer to the extent to which a system supports users in performing tasks correctly, for example by guiding actions, preventing invalid input, and reducing the risk of harmful consequences arising from mistakes [6]. This aspect is particularly important in digital work environments where errors can have significant practical consequences. In the analysed procurement cases, requirements related to safety and error prevention are highly prevalent, appearing in 18 of 20 cases. The relative extent of this aspect is moderate, ranking eighth among the fifteen aspects. The analysed requirements reveal three interrelated themes concerning safety: workflow control and input validation, alerts and situation awareness, and communication safety. Together, these themes reflect an emphasis on preventing errors, supporting informed decision-making, and reducing risks associated with communication and coordination. Firstly, a dominant theme concerns **workflow control and input validation**, where systems enforce correct process execution and prevent invalid actions. For example, for users to proceed *"specific conditions must be met... [and] clear signals of what is expected"* (P2), and systems *"prevent deviations and that steps are performed in the wrong order"* (P11), including mechanisms to *"warn/block so that steps cannot be skipped/missed... in accordance with*

legislation” (P19). This is complemented by extensive validation features such as warnings for “missing information” (P3), prevention of “illogical inputs... if the end date precedes the start date” (P4), and feedback that explicitly “describes in plain text what is incorrect and shows the correct input” (P13). These controls are further reinforced through functions that reduce inconsistency and human error, such as “prevent... [information from being] registered more than once” (P2, P4) and enabling controlled correction of mistakes, where erroneous entries can be amended but remain traceable (P4, P15). A second important theme is **alerts and situation awareness**, where systems actively signal risks, pending tasks, and time-critical events to support safe decision-making. Requirements emphasise reminders and monitoring functions such as “monitoring of follow-ups and decisions that are about to expire” (P4), notifications when “the assignment has not been carried out within a certain time” (P6), and alerts for expiring delegations (P20). Systems also support awareness of operational risks by issuing warnings when “staff lack the necessary competence” or activities are planned outside permitted conditions (P4), and by making critical patient information such as “infection and hypersensitivity” clearly visible (P10) or indicated through symbols (P20). Such features ensure that users remain aware of evolving conditions and can act before issues escalate. Finally, a third theme concerns **communication safety and reducing misunderstandings**, highlighting the importance of correct communication and coordination between actors. The material contains requirements that aim to minimise misrouting and ambiguity, for instance by ensuring system functionality that “reduces the risk... of incorrectly sending information to the wrong user” (P11), and enabling users to “recall... an incorrectly sent order/request” (P12) or to specify that it shall be possible to “direct orders/requests to the correct executor and provide an acknowledgement upon receipt” (P12). Traceability of communication events is also mentioned, for example that users should be able to verify whether a message has been read (P12) and supporting accountability and shared understanding.

Together, these themes illustrate how safety in such systems emerges from **a combination of enforced correctness, proactive user guidance, and structured communication**, all aimed at preventing human error and supporting safe, reliable work practices in complex organizational settings.

2.10 Security

Security refers to the protection of information, system access, and system use against unauthorized access, misuse, and data breaches, encompassing technical, organisational, and legal safeguards. In the context of digital work environments, particularly in regulated domains, security extends beyond technical controls to include accountability, governance, and compliance with formal requirements. In the analysed procurement cases, security-related requirements are moderately common, appearing in 11 of 20 cases. Their relative extent is high, ranking fourth among the fifteen aspects.

The analysed requirements reveal six interrelated themes concerning security: authentication and access control, logging and monitoring, encryption and secure communication, legal compliance and governance, operational security and continuity, and organizational and physical security. Together, these themes reflect a socio-technical conception of security that combines technical safeguards, organisational controls, operational resilience, and compliance with legal and regulatory requirements. Firstly, a dominant theme concerns **authentication and access control**, where systems must ensure that “only the right person has access to the right information” (P12) through mechanisms such as SITHS-based authentication (P2), “strong verification” (P9), multifactor authentication (P7), and role-based access where permissions can be “read, write, modify, delete, approve” (P5). Secondly, a closely connected theme is **logging and monitoring** to ensure accountability, with requirements to “log user activities... identity at login... date, time, and type of activity” (P2), to enable full traceability of “which actions have been taken... time... the user’s... identity” (P17), and to support systematic log audits and detection of “suspicious log events” (P17). Third, **encryption and secure communication** are pervasive, mandating that “all communication... must be protected with encryption of at least AES256 bit” (P5) and that “sensitive personal data... in open networks must be protected, for example through encryption” (P12), including for mobile and distributed use scenarios. Fourth, these technical controls are tightly coupled to **legal compliance and governance**, with explicit references to regulatory frameworks such as “the Patient Data Act (2008:355)” (P2) and requirements ensuring that systems support compliance with “HSLF-FS 2016:40” and data residency within “EU/EES” (P12), illustrating that security is embedded in legal accountability structures. Fifth, **operational security and continuity**, including session and account lifecycle management, are emphasized through requirements such as “automatic logout after a certain period of inactivity” (P2/P5), account lockout after failed logins (P5), and robust backup procedures ensuring data can be restored within defined timeframes (P12). Finally, the requirements extend beyond the technical system into **organizational and physical security**, including “physical protection – data centre... access controls” (P12) and the assignment of roles such as “information security manager” (P18), reflecting a socio-technical view of security.

Together, these themes demonstrate a holistic approach where identity, accountability, protection mechanisms, and governance structures are tightly integrated to support secure everyday work practices in complex, regulated environments.

The lack of clear requirements on this important aspect is a topic to be explored in our further analyses and also in our field studies, to determine, to what extent this aspect is overlooked and why. Security and usability are recognized as causing conflicts in system design, and finding requirements that successfully align them is of great interest [8].

2.11 Subjective Satisfaction

Subjective satisfaction refers to users' overall experience of system use, including their perceived comfort, acceptance, and emotional response during interaction. As one of the three core components of usability defined in ISO 9241-210, satisfaction captures how users experience and evaluate the system beyond its functional performance [9], and has been identified as an important indicator of well-functioning digital work environments [5]. In the analysed procurement cases, requirements related to subjective satisfaction are notably rare, appearing in only 3 of 20 cases. The extent to which this aspect is described in the procurement documentation is very limited, ranking twelfth among the fifteen aspects, with an average of 49 words per case including the aspects (roughly 1-2 sentences).

The analysed requirements reveal three interrelated themes concerning subjective satisfaction: perceived usefulness and goal fulfilment, cognitive simplicity, and emotional user response. Together, these themes indicate that satisfaction is addressed indirectly through users' experiences of accomplishing tasks effectively, interacting with the system effortlessly, and having a positive overall experience. Firstly, satisfaction is closely tied to **effective goal fulfilment**, where systems are expected to clearly support users in accomplishing their tasks in a smooth and productive manner. This is reflected in requirements emphasising *"how well the platform can be used for its intended purpose... [and] contributes to achieving intended outcomes and necessary administrative tasks"* as well as how tasks should be completed *"quickly and efficiently, with minimal effort for the user"* (P5). Similarly, performance expectations such as that the system should be *"fast to work with, with short response times... only in exceptional cases waiting times occur"* (P16) and that response times should not degrade even for large volumes of data (P12) indicate that efficiency and flow are central to a positive experience of work. Second, satisfaction is strongly linked to **cognitive simplicity across user groups**, highlighting the importance of low cognitive load and intuitive interaction. Systems should be *"simple and intuitive... [with] minimal need for training and onboarding"* (P16), with interfaces where *"menus and visuals... [are] clear and easy to overview"* (P16). Importantly, these qualities must accommodate diverse user profiles, as usability is considered *"particularly important... for so-called 'infrequent users'... while [it] must also be perceived as functional and logical"* for frequent users (P9). This reflects a requirement for inclusive design that reduces confusion and increases confidence regardless of experience level. Finally, an explicit experiential dimension is present, where satisfaction is framed as an **emotional response** to system use. This is evident in requirements stating that the platform should provide *"satisfaction and a positive experience during use"* (P5).

Taken together, these themes suggest that subjective satisfaction emerges from the interplay between **effective task support, effortless interaction, and a positive experiential quality**, illustrating how digital work environments are expected not only to function correctly but also to feel efficient, understandable, and rewarding to use in everyday practice.

2.12 System Interplay

System interplay refers to the ability of a system to integrate and interact with other systems, services, and technologies, enabling seamless data exchange and coordinated work across organisational and technical boundaries. By reducing the need for users to manually transfer or remember information across systems, interoperability supports efficient work practices and lowers cognitive load in digital work environments [5]. In the analysed procurement cases, requirements related to system interplay are highly prevalent, appearing in 19 of 20 cases. Moreover, this aspect is described in considerable detail, to an extent that ranks third among the fifteen aspects, with an average of 493 words per case. The only case for which this aspect is not found is P1, which may partly be explained by the fact that the procured system is to be implemented by the municipality itself, and thus, integration with other systems is handled by the procurer rather than by the supplier. Even so, it is surprising that the ability of the procured system to be integrated with others, e.g. through open APIs, is not specified in the requirements for P1.

The analysed requirements reveal four interrelated themes concerning system interplay: ecosystem integration across organisations, real-time data integration and synchronisation, openness and interoperability, and integration with digital devices and external technologies. Together, these themes reflect a digital work environment characterised by

interconnected systems, continuous information flows, and collaboration across organisational and technological boundaries. First, **ecosystem integration across organisations** positions the system as part of a broader institutional network, where work is inherently distributed across organisational boundaries. The system must “*support and facilitate collaboration and information exchange with other actors such as regional healthcare organisations and external providers*” (P2) and evolve integrations with “*existing government agencies’ environments (the Swedish Social Insurance Agency, regions/county councils, and the Tax Agency, among others)*” (P2), including bidirectional exchange with shared infrastructures such as NPÖ where information is both “*consume[d] and produce[d]*” (P2, P6). This reflects a work environment dependent on seamless collaboration across multiple authorities and care providers. Second, **data synchronisation and real-time integration** highlight how work becomes increasingly continuous and data-driven rather than document-based. Requirements for “*real-time saving from support systems*” and “*export of real-time data*” (P3), together with automatic updates where “*changes in personal data must be able to be updated automatically [...] in all ongoing cases*” (P4), indicate that information must circulate immediately across systems. This supports a responsive work environment where decisions rely on up-to-date, synchronised data flows. Third, **openness and interoperability infrastructure** frame the system as a flexible digital platform rather than a closed application. The requirements stress that “*the information in the database must be accessible from external systems and must not be locked in*” and that functionality must be accessible “*via XML, web services, or file-based communication*” (P4), while also requiring that the system be “*‘open’ to enable integrations with the municipality’s other systems*” (P2). This enables a configurable and evolvable work environment where new integrations and tools can be incorporated over time. Fourth, **integration with digital devices and external technologies** extends system interplay beyond traditional IT systems into hybrid, cyber-physical work settings. The system must support inputs from patient-operated technologies, such as the ability to “*receive the measurement values that the patient records [...] so that the values are also transmitted directly to primary care facilities*” (P6), and integrate with operational devices like “*keyless locking systems [...] in the mobile execution tool*” (P4). These requirements reflect a work environment where digital systems are intertwined with physical practices, mobile work, and patient participation.

Taken together, these four themes show that interoperability is not merely a technical feature but a core condition for how digital work is organised, enabling coordination across organisations, continuous data flows, infrastructural flexibility, and the integration of digital and physical work practices.

2.13 Training and Support

Training and support refer to the resources, activities, and structures that enable users to learn, adopt, and effectively use a system over time, including initial training, ongoing competence development, and access to user support. While not usability attributes in themselves, training and support are closely related to usability through their influence on ease of learning and memorability, and are essential for successful system implementation in digital work environments [5], [10]. In the analysed procurement cases, requirements related to training and support are common, appearing in 16 of 20 cases. In these procurements, the extent with which this aspect is described is high, ranking fifth among the fifteen aspects, with an average of 272 words per case.

The analysed procurement cases reveal five interrelated themes concerning training and support: role-based and work-oriented training, continuous learning, embedded user support, training infrastructures, and structured support services. Together, these themes reflect an understanding of training and support as ongoing socio-technical processes rather than one-time implementation activities. First, **role-based and work-oriented training** emphasises that competence development is embedded in organisational structures and responsibilities. Training is consistently described as “*role-based training at implementation*” (P8, P9) and targeted toward specific professional groups such as “*system administrator, case officer, unit manager, care staff, licensed personnel*” (P19), with explicit delegation of learning responsibilities where “*persons who in turn train the municipality’s users*” (P1) and superusers “*will then act as internal trainers for other staff*” (P2). Second, **continuous and lifecycle-oriented learning** reflects that competence must be maintained over time in a changing environment, where “*it must be possible to request training continuously during the contract period*” (P8, P9), supported by “*further training [...] on ... newly developed functions during the contract period*” (P19), and where “*the training material must be continuously updated so that it corresponds to the current version of the service*” (P6). Third, **embedded learning and contextual user support** highlight how learning is integrated into everyday work practices, with systems required to provide “*built-in help texts [...] connected to the part of the system the user is using*” (P2), “*context-based help*” (P8), and guidance that “*help users to easily proceed in the system*” (P6), alongside flexible formats such as “*e-learning, mobile learning, training videos, recorded webinars*” (P6) and materials accessible “*digitally and on mobile devices where the user is located*” (P10). Fourth, **training and support infrastructures** establish the material and technical conditions for learning through dedicated environments and

resources, including “a training environment separate from the production environment” (P1), environments that “mirrors the municipality’s production environment” (P15), and accessible documentation where “the customers must have full access to current system documentation” (P6), with reusable material that the organisation can “adapt, distribute, and edit” (P19). Finally, structured support services ensure continuity and reliability in digital work through formalised processes and availability, such as support “available on weekdays excluding public holidays during office hours 8:00–17:00” (P2) or even “operational support around the clock 24/7/365” (P1, P18), combined with traceable support processes where “support cases must be assigned a case number” (P7) and users can “follow the progress of the [support] case” via customer portals (P1, P12).

Together, these themes show that training and support are not peripheral services but foundational to digital work environments, enabling distributed competence, continuous adaptation, embedded learning in practice, infrastructural support for experimentation, and stable operational conditions.

2.14 Utility and Adaptability

Utility and adaptability capture a central dimension of how digital systems support work, focusing not only on whether the right functionality is provided but also on whether that functionality can evolve in response to changing needs. *Utility*, understood as “the extent to which the product provides the right kind of functionality so that the users can do what they want to do” [6], is thus closely intertwined with the system’s capacity for adaptation across contexts, tasks, and over time. In our material, this aspect is highly prominent and is found in nearly all procurement cases (19 of 20) and to a very high extent, ranking second among the 15 identified aspects, with an average of 609 words devoted to it per case. This indicates that ensuring systems are both functionally appropriate and adaptable to diverse and evolving work environments is a core concern across the examined procurements, shaping requirements at multiple levels, from local configuration to long-term regulatory alignment.

The analysed requirements reveal three interrelated themes concerning utility and adaptability: configurability and local adaptation, operational and data flexibility, and legal adaptability. Together, these themes position systems as configurable and evolving resources that must accommodate changing organisational practices, information needs, and regulatory requirements over time. First, **configurability and local adaptations** emphasise that systems should be flexible enough to accommodate local organisational needs, work processes, and information structures through user and organisational configuration. Users are expected to actively configure the system, for example by being able to “create their own headings ...that fit different types of operations and legislation” (P1) and “create their own forms that automatically retrieve data” (P2), while core elements such as the “the service catalogue [...] is determined by the municipality” (P2). This reflects a work environment where systems must support diverse workflows and organisational variation, reinforced by broader expectations that the system should “support and create conditions for improvements in the organisation’s processes [...] ways of working and routines” (P2). Second, **flexibility in data handling, reporting, and operational logic** reflects the need for systems to accommodate evolving administrative, analytical, and operational requirements. This includes the ability to “create reports and retrieve statistics [...] variables should be able to be combined with each other” (P2), support changing rules such as “handle changes in calculation principles, fee compensations, and reimbursement levels” (P2), and enable human discretion through functions that allow users to “enter a fee amount manually that overrides a calculated fee” (P2). Long-term adaptability is further emphasised through requirements that “information and documents must be able to be archived in system-independent formats for long-term preservation” (P2), indicating that utility extends beyond immediate operational needs to future data reuse, accessibility, and governance. Finally, **legal adaptability and regulatory compliance** position responsiveness to regulatory change as a fundamental aspect of system utility. The system must “meet the requirements set by legislation, national regulations, and established practice” (P2), while suppliers must ensure that the system “complies with and is adapted to statutory changes” (P2) and can “be changed and adapted in response to changes in laws [...] at no additional cost” (P2).

Taken together, these themes show that utility in digital work is inseparable from adaptability. Systems must be locally configurable, operationally flexible, and continuously compliant to remain functional within complex, evolving work environments.

2.15 Work Interplay

Work interplay is a highly important digital work environment aspect [5] that concerns how well digital systems are integrated with work processes, practices, and routines, including how work is shaped through the interaction between users and systems [11]. In our material, this aspect is both highly prevalent and extensively represented. 19 out of 20

procurement cases include requirements related to work interplay and is the most extensively described aspect in terms of documentation, ranked 1 of 15 with an average of 1,232 words per procurement. This indicates that substantial attention is given to ensuring that systems are closely aligned with organisational workflows and collaborative practices, reflecting the central role of integrating the system with work processes

The analysed requirements reveal five interrelated themes concerning work interplay in digital work environments: process-integrated workflow support, seamless information flow, coordination across roles and organisational boundaries, end-to-end visibility and traceability, and the integration of documentation into work execution. Together, these themes depict digital work as a coordinated and information-intensive process in which systems actively structure, connect, and support work across tasks, actors, and organisational boundaries. First, **process-integrated workflow support** highlights how systems are expected to structure and guide work processes while balancing automation with opportunities for human intervention and control. For example, the system should be “*process-related ...[and] conditions must be fulfilled in order to proceed in the system*” (P2), while also allowing flexibility where “*planning in the work list should be possible both automatically and manually*” and “*automatically generated plans should be able to be adjusted manually*” (P4), as well as enabling both automated and manual contributions where “*the material is compiled automatically ... [as well as] manually*” (P6). Second, **seamless information flow across work phases** emphasises the importance of continuity and coordination through the automatic transfer, updating, and communication of information throughout work processes. Requirements describe that “*decided interventions are automatically transferred to the implementation plan*” (P2) similarly to for “*personal and contact details*” (P4) and how process coordination is maintained through “*automatic notification [that] is sent to the person who reported [an issue]*” (P5) or when “*a decision has not been followed through [...] a message is automatically sent to the decision-maker*” (P6). Third, **coordination across roles and organisational boundaries** reflects the need to support collaborative work involving multiple actors both within and beyond the organisation. The system enables collaboration where “*assignments are sent to the person responsible for execution*” and “*all internal communication [...] is handled through the service*” (P6), while also supporting coordination with external actors where information is exchanged with “*other actors, such as schools, preschools, and healthcare*” (P6) and tasks are “*distributed to the unit(s)/group(s) that will carry out the assignment*” (P4). Fourth, **end-to-end visibility and traceability** support holistic oversight of work processes by making activities, decisions, and interventions visible throughout their lifecycle. This is expressed through requirements that “*all decisions*” and “*all interventions [...] are gathered so that they can be seen together in an overview*” (P6), enabling users to monitor and follow work across process stages. Finally, **integration of documentation into work execution** emphasises that documentation should be embedded within work practices rather than performed as a separate administrative activity. Requirements specify that “*all documentation takes place [...] through the service*” and that “*those executing an assignment document [...] for example the implementation plan*” (P6), supported by capabilities such as documenting directly in context where “*journalling [can be done] directly in the mobile unit*” (P4).

Taken together, these themes show that work interplay in digital environments is achieved when systems are tightly embedded in workflows, enable continuous and coordinated information flows, support collaboration across boundaries, provide transparency over work processes, and integrate documentation seamlessly into everyday practice.

3 Research Method

We conducted a document study to investigate how digital work environment aspects are specified in public procurements of digital systems performed by Swedish municipalities. The study analysed procurement documentation from completed procurements and was performed in two main steps: 1) *recruitment and data collection*, and 2) *content analysis*.

3.1 Recruitment and Data Collection

Procurement cases were recruited from Swedish municipalities through requests for procurement documentation in accordance with the principle of openness in Swedish public administration, under which government agency documents are publicly accessible. We requested documentation for one procurement conducted during the previous ten years (2013-2023) within municipal home healthcare. A *request for documentation* was prepared based on our joint understanding of procurement processes and municipal home health care. We focused on procurements of larger IT systems for home health care and social care, in particular business systems or health informatics systems. For each procurement, we requested documentation from the tendering and the evaluation phase. This included call-for-tender documents (e.g. RFQs and requirements specifications) and documentation related to supplier assessment, bid evaluation, and contract award decisions. The request can be found in Appendix A.

The request was sent out in January 2023 to all of Sweden 290 municipalities and we received documentation from 92 of these for 85 completed procurements cases (including 3 procurements which involved 2-4 municipalities). We selected 20 of these cases for analysis based on the completeness of the received documentation and with an emphasis on municipalities in the southern part of Sweden (11 of 20 cases are from Scania/Skåne including neighbouring regions) to allow for later observational studies. The selection also sought to capture variation in procurement procedures by including both *open procurements* and *competitive negotiated* procurements. An overview of the selected procurement cases is shown in the table in Figure 2.

3.2 Analysis

We analysed the documentation used in the tendering phase for the 20 selected procurement cases using *qualitative content analysis* in nVivo by coding digital work environment aspects. The main aim of the analysis was to identify requirements related to work environment and usability [12] and how these are specified in the procurement documentation. To align our perspectives and experiences, an initial coding scheme was developed through exploratory and collaborative coding of three procurement cases and refined through iterative discussions. The remaining cases were then analysed using the agreed coding framework. The coded material associated with each digital work environment aspect was subsequently reviewed and grouped into themes describing how the aspect was specified in the procurement documentation. To complement the qualitative analysis, matrix coding queries were performed in NVivo and exported to Excel, where descriptive statistics were calculated to examine the frequency and distribution of digital work environment aspects across procurement cases and document types.

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References

- [1] J. Nielsen, 'Enhancing the explanatory power of usability heuristics', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, in CHI '94. New York, NY, USA: Association for Computing Machinery, Apr. 1994, pp. 152–158. doi: 10.1145/191666.191729.
- [2] K. M. Adams, 'Understandability, Usability, Robustness and Survivability', in *Nonfunctional Requirements in Systems Analysis and Design*, K. MacG. Adams, Ed., in Topics in Safety, Risk, Reliability and Quality. , Cham: Springer International Publishing, 2015, pp. 201–220. doi: 10.1007/978-3-319-18344-2_11.
- [3] N. A. Stanton, P. R. G. Chambers, and J. Piggott, 'Situational awareness and safety', *Safety Science*, vol. 39, no. 3, pp. 189–204, Dec. 2001, doi: 10.1016/S0925-7535(01)00010-8.
- [4] D. D. Woods and E. Hollnagel, 'Prologue: Resilience Engineering Concepts', in *Resilience Engineering*, 1st edn, E. Hollnagel, D. D. Woods, and N. Leveson, Eds, CRC Press, 2017, pp. 1–6. doi: 10.1201/9781315605685-1.
- [5] E. Håkansson and E. Bjarnason, 'Including Human Factors and Ergonomics in Requirements Engineering for Digital Work Environments', in *1st Int Worksh on Reqts Engin. for Well-Being, Aging, and Health (REWBAH)*, pp. 57–66. doi: 10.1109/REWBAH51211.2020.00013.
- [6] J. Preece, H. Sharp, and Y. Rogers, *Interaction design: Beyond human–computer interaction*. Wiley, 2001. [Online]. Available: <https://doi.org/10.1007/s10209-004-0102-1>
- [7] S. Lauesen, *Software Requirements. Styles and Techniques*. Addison Wesley, 2002.
- [8] B. Naqvi and A. Seffah, 'A Methodology for Aligning Usability and Security in Systems and Services', in *2018 3rd International Conference on Information Systems Engineering (ICISE)*, May 2018, pp. 61–66. doi: 10.1109/ICISE.2018.00019.
- [9] 14:00-17:00, 'ISO 9241-210:2019', ISO. Accessed: Aug. 17, 2026. [Online]. Available: <https://www.iso.org/standard/77520.html>
- [10] P. Tearle, 'ICT implementation: what makes the difference?', *British Journal of Educational Technology*, vol. 34, no. 5, pp. 567–583, 2003, doi: 10.1046/j.0007-1013.2003.00351.x.
- [11] J. Persson and C. Rydenfält, 'Why are digital health care systems still poorly designed, and why is health care practice not asking for more? Three paths toward a sustainable digital work environment', *Journal of Medical Internet Research*, vol. 23, no. 6, Art. no. 6, 2021, doi: 10.2196/26694.
- [12] H.-F. Hsieh and S. E. Shannon, 'Three approaches to qualitative content analysis', *Qualitative health research*, vol. 15, no. 9, pp. 1277–1288, 2005.

APPENDIX

A. Text used for the data collection and requesting copies of official documents.

Hello,

As part of a research project, we would like to request documentation related to the procurement of a digital system used within municipal health and social care services, including tender documents, requests for tenders, contract award decisions, requirement specifications, supplier selection and exclusion decisions, and any other relevant associated materials.

Relevant systems include, for example, electronic health record (EHR) systems or operational planning systems. We request procurement documents for systems that have been procured within the last 10 years. If multiple procurements have been carried out during this period, we would like the documentation relating to the most recent or otherwise most relevant system based on the description above.

If you intend to charge a fee for providing the copies, we would appreciate advance notification of this and an indication of the approximate cost.

The research project “You Get What You Ask For! Support for Specifying Requirements for the Digital Work Environment in Municipal Health and Social Care” (Reference No. 220103) is funded by AFA Insurance and aims to improve requirements specification in the procurement of digital systems with regard to usability, and to contribute to increased demand for systems that support a good digital work environment.

Kind regards