

# Eliciting and Prioritizing Services for Accessible Information

## for Residential Real Estate Transactions

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**Abstract.** A number of initiatives are underway for digitalizing real estate transaction processes. Public and private sector bodies are working to automate information retrieval and processing of the financial, ordinance and fiscal aspects of such transactions. Other initiatives, such as ours, are targeted toward helping stakeholders directly involved in selling and buying real estate. We present the results from a set of group sessions, where the focus was on improving the presentation of salient information to sellers and buyers of property. Based on an earlier conceptualization of perceived information difficulties, we elicited user stories for facilitating a better generation, provision and consumption of relevant information for the residential real estate transaction process. A total of ten services were aggregated from the user stories. We then asked a set of stakeholders to rate the effect of the services on functional objectives; i.e., on how they will affect the transaction process. We asked stakeholders at the managerial level to rate the functional objectives on strategic objectives. Combining the two sets of ratings, one obtains a rating of perceived benefit for the services, which can help in prioritizing which services to start developing first. In the outset, real estate transactions involve stakeholders with opposing interests. We conclude that multi-stakeholder group sessions can help generate services that serve these conflicting interests on a common ground.

**Keywords:** Real Estate Transactions · Technical Conditions Information · Service Design · Stakeholder Journey · Benefit Estimation

## 1 Introduction

In the wake of the rush for digitalization, where information is becoming ever more available, one is left with several challenges [26, 27, 25, 16, 17]. Two such challenges have received particular attention: information protection as expressed through legislation such as the General Data Protection Regulation (GDPR),<sup>3</sup>

<sup>3</sup> <https://gdpr.eu/>

and information accessibility as expressed in, e.g., the Web Content Accessibility Guidelines (WCAG).<sup>4</sup> These two important issues pertain to getting information out to everyone in a secure manner. Upon these basic features, however, other complex issues arise. Processes in the public space increasingly utilize and rely on the availability of information [17], and obligations are put on the public to provide, compile and consume information from several sources to make, and act upon, informed decisions [17, 14, 18, 13].

We study the increased demands for human information processing in residential real estate transactions. National legislation holds the property seller and buyer – both of which are usually lay persons – responsible according to the relevant information before the fact, with less opportunity to claim ignorance, or to claim on additional information, after the fact. This places added strain on stakeholders in an already stressful situation that involves a large private investment under an often undue time pressure. Our investigation concerns digital services to help stakeholders with their information processing in residential real estate transactions.

The process of selling and buying real estate is complex and involves information from several sources that may not be coordinated. It can be severely challenging for the stakeholders involved to retrieve and distil the information that is most relevant. Sellers must use this information to make decisions on when to sell, at what asking price and on what to fix in the case there are faults on the property. Buyers must choose between properties on offer, make decisions on how much to bid and have situational awareness on any refurbishments that may be needed. Decisions made must be sustainable in the sense that they are perceived to be valid by all parties after the transaction is completed so as to avoid conflicts and claims in the aftermath.

Responsibilities for the technical condition of a property under sale are becoming clearer cut, with less opportunity to sell real estate *as is*. Examples are the move in the U.K. from *caveat emptor* – where that the seller is not legally required to disclose known or unknown defects, and it is up to the buyer to investigate – to including real estate transactions under the Consumer Protection Against Unfair Trading Regulations<sup>5</sup> and the much stricter information requirements imposed on both the seller and buyer in recent Norwegian legislation.<sup>6</sup> Sellers have a greater obligation to document flaws and adhere to building regulations, and buyers are required to see to it that they are informed. On both sides, there are waning possibilities to claim ignorance. Various innovative digital solutions are being developed to meet the needs for heightened awareness of the attributes of real estate. Examples are Opendoor in the US and Solgt.no in Norway which both operate in the iBuying segment, where the idea is to facilitate home buying directly from sellers without involving a real estate agent.<sup>7</sup> It is important that solutions address the actual needs of stakeholders and that

<sup>4</sup> <https://www.w3.org/WAI/standards-guidelines/wcag/>

<sup>5</sup> <https://www.legislation.gov.uk/uksi/2008/1277/contents/made>

<sup>6</sup> <https://lovdata.no/dokument/LTI/forskrift/2021-06-08-1850>

<sup>7</sup> <https://www.opendoor.com/>, <https://solgt.no/>

the solutions are accessible to all parts of the public. While it may appear that successful innovation happens by unintended fluke, data suggests that this is only the case for an exceptional minority,<sup>8</sup> while the vast majority of innovations would benefit from analyses of stakeholder needs. For the presentation of real estate information that may have implications, both legal and otherwise, for those who give and possess this information, the development of information services has to be deliberate.

## 2 Background

To facilitate the deliberate design of information services, we suggested a stakeholder journey framework for innovations [11] based on Halvorsrud et al. [7]. In an earlier study, we used the framework to elicit a high-level journey with possible technology touch points in a real estate transaction process (Fig. 1).

As seen in the figure, the analysis was conducted for five groups of stakeholders, from bottom to top: the residential real estate buyer, the estate agent, the seller, the technical condition assessor and the insurance company providing latent defects cover, an insurance policy that protects the seller against claims from the buyer after the real estate transaction has taken place. Following [7], orange touchpoints are initiated by a service consumer, while blue touchpoints are initiated by a service provider. Solid arrows indicate state sharing between touchpoints. Dark-green touchpoints are adoption points for *innovators*, and light-green touchpoints are adoption points for *early adopters* [21]. Dashed arrows indicate adoption transfers from innovators to early adopters. Touchpoints with the gears symbol signify the type of services relevant to our discussion; namely, those to be provided by a company offering property transaction services. Touchpoints with text indicate existing services widely in use today. The white index cards indicate user stories describing how a particular stakeholder uses a service at a touchpoint.

In Fig. 1, the only touchpoint for the assessor is the technical condition report. The technical condition report is a central document in the Norwegian real estate transaction protocol. It is written by a certified assessor before a home is put on the market. The assessor surveys the home and writes an assessment of the technical condition in a semi-structured format, based on a standard [23]. For each part of the building, the report contains the following: a technical condition grade (TG) being an ordinal scale ranging from TG0 (best) to TG3 (worst) or exceptionally TGIU (not investigated). A TG0 signifies pristine conditions for a building part not more than 5 years old, while a TG1 signifies an intact building part older than 5 years. A TG2 should be given when there is an observable flaw, or likely grounds (e.g., age or unfortunate circumstances) for expecting a flaw if not observable, that needs attention in due course, while a TG3 signifies an acute need for attention to a flaw. In the case of TG2 and TG3, a textual explanation of probable cause and necessary measures to attend to the flaw is expected.

<sup>8</sup> <https://www.cbinsights.com/research/venture-capital-funnel-2/>

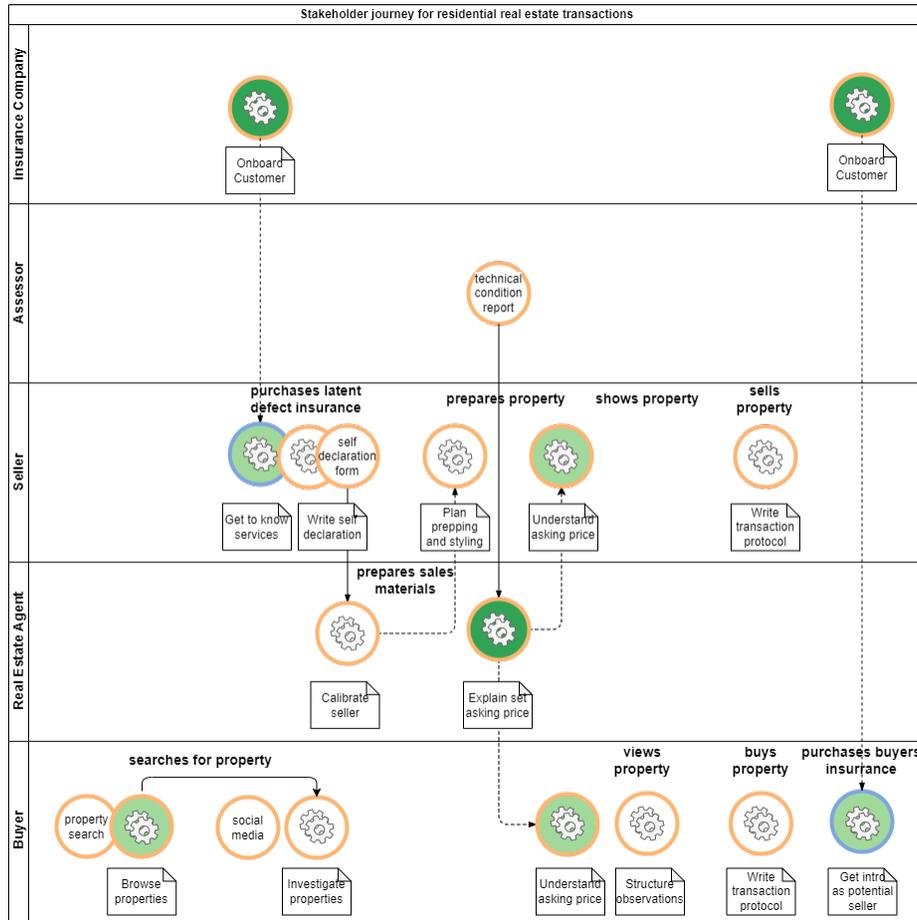
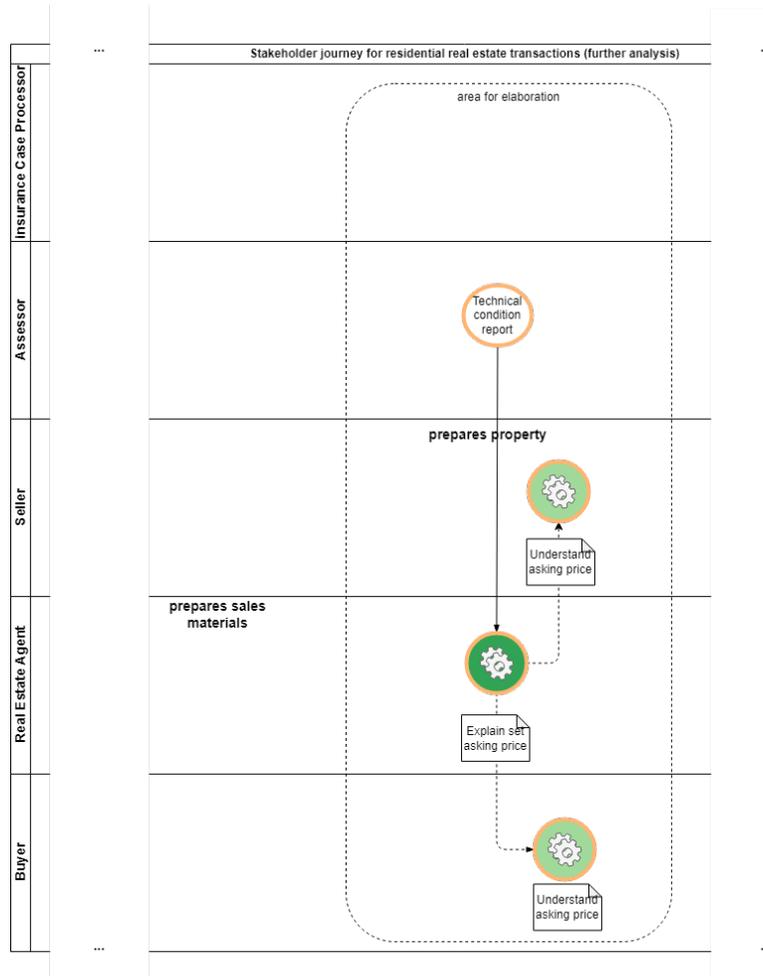


Fig. 1. Planned stakeholder journey, adapted from [11].

In practice, reports may contain technical terms that buyers and sellers have problems understanding. Also, the actual building parts that appear in reports and the organization of reports vary and are, to some degree, at the discretion of the assessor.

The technical conditions report is shown as a touchpoint, because real estate assessors use digital editing tools to generate technical condition reports. The analysis so far only considers the technical condition report as an information source to the touchpoint in the Estate Agent swim lane with the user story “Explain set asking price”, which reads as follows:

**Explain set asking price:** As an estate agent, I can get a seller to understand the rationale for my suggestion for asking price by using a service to show the technical condition of the property.



**Fig. 2.** The focus of the current studies.

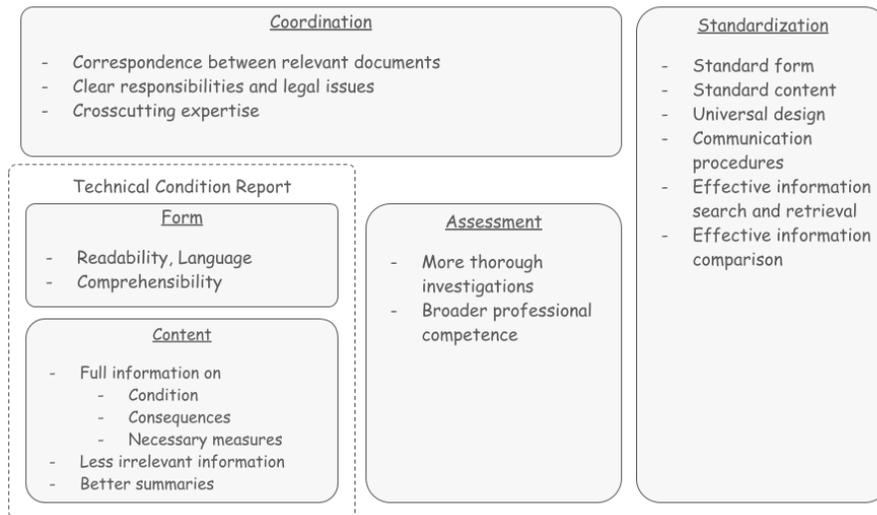
That touchpoint indicates a desire to make it easier for non-experts to grasp the technical condition of a residential property, and also to make it easier to compare the technical condition of different properties. Moreover, several comments in the previous workshops were related to managing expectations about price, as expressed in the following user stories:

**Understand asking price:** As a seller of a property, I can understand how the asking price is rooted in facts by using a service to show me how the technical conditions report affects the price in relation to other comparable properties.

**Understand asking price:** As a potential buyer of a property, I can understand how the asking price is rooted in facts by using a service to show me how the technical conditions report affects the price in relation to other comparable properties.

In the current study, we set out to elaborate on the technical condition report touchpoint and the touchpoints with the three user stories above, as indicated by the “area for further elaboration” frame in Fig. 2. In other words, we set out to understand how these touchpoints should function in more detail and what functionality the associated services should provide.

As a foundation for the current study, we conducted a survey [12] to uncover issues concerning the technical condition report from the point of view of the five groups of stakeholders above. From the content analysis of the survey, we developed the conceptual model in Fig. 3. The model shows the two themes of *Form* and *Content* for the technical condition report as what needs to be addressed concretely for producing better reports. Alongside to the right is the *Assessment* theme that calls for increasing the competence of those who produce the reports. Overarching the technical conditions report and the assessment theme is the theme of *Coordination* which calls for explicating and delineating the roles of various documents that are involved in a real estate transaction process and seeing to it that information is coordinated across those documents. Cross-cutting all of this is the theme of *Standardization*, which calls for the systemic oversight on the part of relevant regulatory and advisory bodies to provide ample support in the form of mandatory standards to ensure improvement in all the other themes.



**Fig. 3.** Presentation of themes for the first two group sessions.

### 3 Method

Research suggest that stakeholder and user involvement during the systems development process are essential for system success [22, 3]. Workshops are widely used to involve stakeholders, traditionally conducted in a shared physical setting, giving the participants the possibility of getting to know each other and to participate in exercises and discussions to explore a subject or a design. It is also recommended to use clearly defined artefacts for gathering information, and user stories are one of the most frequently used artefacts [22].

Due to the COVID-19 pandemic, researchers have needed to resort to online media to involve stakeholders in research and development activities. In the mean time, people’s familiarity and use of video conferencing systems have increased. Recent research indicates that the quality of workshops need not be compromised, and may even be improved, when moving from face-to-face to online environments, if carefully planned for [15].

We conducted four online workshops. The first two workshops were held online due to COVID-19 restrictions. We chose to conduct the remaining workshop online also, even though the restrictions at this time had ceased, since we had positive experiences with the online workshops and because it was easier to get participants to attend online. The aim of the first two workshops was to involve various stakeholders in identifying service functionality to improve on the information issues conceptualized in Fig. 3. In the third and fourth workshops, stakeholders were guided through a structured process to prioritize the previously identified services. The workshops and their results are presented in more detail below. The workshops were held in accordance with national ethics, data privacy and security regulations and were approved by the relevant regulatory body prior to holding the workshops.

#### 3.1 Online workshops to identify service functionality

The two first workshops were organized as focus groups with one representative from each of the five stakeholder groups. Each work shop was divided into two main activities:

1. For each of the themes in Fig. 3, elaborate on how digital tools can improve on the current situation.
2. Summarize the discussion from your point of view by writing user stories in the format **<Actor> performs <task> by using <functionality in tool> at <stage in buying/selling process>**.

The conceptual model in Fig. 3 was presented to participants as an introduction and also functioned as the theme guide for the discussion in the first activity. For the second activity, the participants entered their suggestions in a shared online spreadsheet with column names indicating the various parts of the user story format above. The participants of the two focus groups wrote a total of 52 user stories, several of which expressed similar ideas. To distill the essence of the user stories, we content analysed the **performs <task>** part of the user stories to define services. This resulted in the ten services presented in the next section.

### 3.2 Elicited Services

Each of the following ten services are presented in Tables 1–10 in terms of their constituent user stories, preceded by a high-level description of the service.

***On-site access to information*** enables assessors and buyers to use portable devices to access information about the dwelling on-site, either to write (assessor) or read (buyer).

**Table 1.** Service functionality for “On-site access to information”.

Actor	Task	Service functionality	Stage in process
Assessor	write digital report	use handheld device	on inspection
Buyer	read listings and reports on site	download listings and reports to handheld device (via QR code)	at a viewing

***Search and share information*** enables a stakeholder to locate technical condition reports or other documents based on search queries (buyer, estate agent, seller) or upload documents for other stakeholders to access (all stakeholders).

**Table 2.** Service functionality for “Search and share information”.

Actor	Task	Service functionality	Stage in process
Buyer	easily find reports to comply with obligation to examine	search for reports on device	when looking for new residence
Estate agent	make historical reports accessible	compile historical reports	when preparing documents
Seller	compare various assessors	view previous reports from various assessors, with explanations of assessor conclusions	before ordering an assessor
Estate agent	prepare sales assignment	retrieve relevant info from technical condition report to sales documentation, avoiding changes to wording that can confuse or mislead the buyer	when preparing sales documents
Estate agent	share documents better	share joint information with stakeholders persistently	when working with the technical condition report
Estate agent	can upload the sales documentation to a shared platform to save time for all	store documentation in one place without having to download from various sites	when posting the ad
Assessor	collect relevant information about the property	collect information on shared platform for seller, assessor and estate agent	during the process
Buyer	access all sales documentation readily and rapidly	use a one-click search bar where one can enter the address of the home of interest	before, during and after a viewing

**Readable documents** provides the non-professional stakeholder with explanatory information to help them understand terms or questions in documents or forms that they are to fill in. It also assists the assessor, a professional stakeholder, in writing the technical condition report by both suggesting text and changes to text and by checking the presence of specific topics.

**Table 3.** Service functionality for “Readable documents”.

Actor	Task	Service functionality	Stage in process
Buyer	understand documents	search within documents, or get explanation of technical words or phrases	upon reading technical condition report or a digital sales prospectus
Seller	understand questions in the self-declaration form	get information on what the items in the self-declaration form mean	upon filling in the self-declaration form digitally
Assessor	ensure the readability of technical condition reports	get fixed phrases for specific symptoms or deviations and get alternatives to difficult words	when preparing the report

**Assist report preparation** helps the assessor with preparing the technical conditions report by giving guidance on assessment and tips on information to include or leave out, as well as generating a summary and ensuring consistent treatment of legal issues with the estate agent.

**Table 4.** Service functionality for “Assist report preparation”.

Actor	Task	Service functionality	Stage in process
Assessor	ensure completeness of technical condition report	get building-part specific hints on what to comment on	when preparing the report
Assessor, Estate agent	uncover illegalities; e.g., related to rooms for rent within a home	ensure that potential legal issues are discussed across stakeholders	when preparing the documentation
Assessor	understand how building parts should be assessed	get guidance on the assessment to the relevant issue in the report	when writing the report
Assessor	improve the provided information	include images of problem areas and their locations on the floor plan	during and after the inspection
Assessor	avoid irrelevant information in technical condition reports	get notification when the provided information is not related to deviations	when writing the report
Assessor	make a technical condition report summary	collect critical technical condition scores and other relevant information automatically and include in summary	when writing the report

**Costs** provides the buyer with cost overviews for future maintenance and also how to make insurance claims related to the property transaction.

**Table 5.** Service functionality for “Costs”.

Actor	Task	Service functionality	Stage in process
Buyer	get an explanation of the cost of necessary improvements based on technical conditions	(This is mandatory in new technical condition reports since January 2022)	when reading a report
Buyer	get information about future maintenance and costs	view a prioritized list of items	when reading a report
Buyer	get an explanation of the latent defects insurance cover	search the insurance policy, get an explanation of its role and of how to make a claim	at the time of, or after, the transaction

**Check documents** assists the estate agent in accessibility and completeness of the provided information and consistency with other documents, when preparing the material for the future sale.

**Table 6.** Service functionality for “Check documents”.

Actor	Task	Service functionality	Stage in process
Estate agent	get accessibility guidance	receive hints on information accessibility; e.g., picking the right formats, providing meta-information on images.	before publishing the online advertisement
Estate agent	check the completeness of information	follow a checklist of questions ensuring that all relevant information is included	when preparing the sales prospectus
Estate agent	detect document conflicts	get a list of conflicts between documents, e.g., between the technical condition report and the sales prospectus	before publishing the online advertisement

**Summary of technical conditions** summarizes the technical conditions for the buyer.

**Table 7.** Service functionality for “Summary of technical conditions”.

Actor	Task	Service functionality	Stage in process
Buyer	get a summary impression of the technical conditions to help decide whether to go to a viewing	see an overview of the technical condition of the dwelling; e.g, using colours	before attending a viewing
Buyer	get an overview of deviations of the dwelling	(This is mandatory in new technical condition reports since January 2022)	when reading a report

**Compare dwellings** lets buyers compare documents pertaining to different dwellings.

**Table 8.** Service functionality for “Compare dwellings”.

Actor	Task	Service functionality	Stage in process
Buyer	compare technical condition reports or sales prospectuses on a portable device	compare documents on the same website as the search for dwellings is done; e.g., compare documents page by page.	before or after a viewing

**Check legal issues and vagueness** lets the real estate agent check the drawings and legal issues of the property during preparations for the sales prospectus. Also, the assessor is warned about potential issues with rooms in the technical condition report.

**Table 9.** Service functionality for “Check legal issues and vagueness”.

Actor	Task	Service functionality	Stage in process
Estate agent	detect deviations in drawings	check for deviations between text and drawings such as the floor plan	when writing the sales prospectus
Estate agent	fill out checklists related to technical conditions, regulations and legal issues	receive checklists and send the results to the assessor, on a platform open to other stakeholders	after the sales prospectus is drafted (and before the technical condition report is available)
Assessor	avoid vague assessments and unclear status of rooms	get a list of legal questions on rooms, e.g., is a basement room approved as a regular bedroom with an escape route?	when writing the report

**Standardization** assists stakeholders with producing uniform documents that has standardized contents or structure.

**Table 10.** Service functionality for “Standardization”.

Actor	Task	Service functionality	Stage in process
Assessor	generate an assessment following a standardized list of building parts	follow a checklist that standardizes which building parts that must be checked and included in the report	when writing the report
Estate agent	ensure the consistency of documentation	be presented with a fixed structure of document types	before writing documents

### 3.3 Online workshops to prioritize services

*Priority workshops* have been introduced as a participatory design technique [4], where the main idea is to support user participation in the design process to make it more transparent and to address contextual issues, conflicts of interest and quality of use. Rationality in the sense of explicit rules and rule-based structure of the decision process is emphasized. Various techniques of user involvement in prioritizing activities have been explored further [22].

As a part of the grounds for service providers prioritizing which services should be developed in what order, it can be useful to understand how services contribute to stated objectives and goals that the service provider must relate to. In this particular case, the service provider is a startup company running a research-based innovation project, whose *functional* objectives include:

- Improve the stakeholders’ level of understanding of a property’s technical condition – meaning that stakeholders understand the technical condition of various building parts, the severity of faults and damages, their necessary repairs and the immediacy of those repairs.
- Increase buyers’ and sellers’ levels of trust and confidence in the property transaction process – meaning that the stakeholders trust the available information, trust the other stakeholders and have confidence in their own competence to act in the process.
- Increase the accessibility and usability of the property transaction process – meaning that stakeholders find the tasks, and their dependencies in the process, well-defined and transparent through accessible and usable tool support.

Functional objectives pertain to services’ effects on business and personal processes. We asked a group of three stakeholders representing buyers, sellers and assessors to assess the magnitude of effect that they foresee the services will have on each objective. They conducted this assessment by assigning *benefit points* [9] from 1 to 10 to each service, for each objective, in group sessions, where stakeholders with various perspectives on benefit iteratively arrive at consensus.

Table 11 shows the stakeholder group’s ratings of the relative effect that the services have on each of the functional objectives. For example, the service **Search and share information** is one of four services rated highest on the functional objective **Improve understanding**, while **Check documents** was rated as having the lowest effect on that objective. All services were assessed on each functional objective in this manner. For each service (row), the geometric mean then aggregates the rankings across functional objectives by multiplying the rating for that functional objective and taking the cubic root (since there are three functional objectives). For example, for **On-site access to information**, the geometric mean is  $(8 * 8 * 7)^{1/3} = 7.65$ . More generally; the geometric mean  $g(s)$  for ratings of service  $s$  on  $m$  functional objectives is

$$g(s) = \left( \prod_{j=1}^m r_{s,j} \right)^{1/m}$$

**Table 11.** Experts’ assessments of the effect of services on functional objectives, with geometric means, unweighted and weighted.

Service	Functional Objective			geometric mean	weighted geometric mean
	Improve understanding	Increase trust and confidence	Increase accessibility and usability		
On-site access to information	8	8	7	7.65	7.61
Search and share information	9	9	7	8.28	8.20
Readable documents	7	7	7	7.00	7.00
Assist report preparation	9	8	6	7.56	7.52
Costs	7	10	8	8.24	8.02
Check documents	5	5	5	5.00	5.00
Summary of technical conditions	6	6	6	6.00	6.00
Compare dwellings	9	9	9	9.00	9.00
Check legal issues and vagueness	8	10	9	8.96	8.82
Standardization	9	9	9	9.00	9.00
Total	77	81	73		

where  $r_{s,j}$  is the rating of  $s$  on objective  $j$ . The geometric means are displayed in the unweighted geometric mean column in Table 11. It is appears that **Legal issues and vagueness** has the highest total rating. We will regard weighted geometric means shortly.

We use the geometric mean rather than the arithmetical mean commonly used to aggregate ratings, because the geometric mean is insensitive to ratings on different scales and to totals being unequal [24]. In our case, the three functional objectives have different underlying metrics, even though the effects on them are all rated on a 1–10 scale. The totals for each objective are not the same, since assessors were not required to keep track of the total. A common fix for the arithmetic mean is to normalize ratings to get equal totals; however this can lead to differences in rankings [24], and raises the question as to whether unequal totals may signify actual perceived differences in obtainable effects, or whether differences are an artefact of the rating exercise [8].

Objectives can be declared at various levels [10, 11, 8]. Functional effects can, in turn, give effects on objectives that pertain to more strategic goals. Lower-level objectives can thus be rated on how much they contribute to higher-level objectives. We asked a stakeholder group consisting of representatives for business management at the service provider to rate each functional objective on each of the following higher-level *business* and *societal* objectives stated for the innovation project:

- Increase the customer base, which is the business objective of increasing the number of users of the company’s service portfolio.
- Reduce the number of buyer-seller conflicts, which is the societal objective of avoiding the substantial number of conflicts arising today due to dissatisfaction in the aftermath of residential real estate transactions.
- Reduce the number of unfounded insurance claims, which is the business/societal objective of avoiding claims based on a poor understanding of the technical conditions under which the residential real estate was sold.

Table 12 shows how this stakeholder group rated the functional objectives on each business/societal objective on a scale from 1 to 10. For example, the group assessed **Increase accessibility and usability** and **Increase trust and confidence** as, respectively, least and most influential on the business objective **Increase customer base**. All functional objectives were assessed on each business/societal objective in this manner. For each functional objective (row), the geometric mean aggregates the rankings across business/societal objectives. For example, for **Improve understanding**, the geometric mean is  $(8 * 10 * 9)^{1/3} = 8.96$ . Formally, the geometric mean  $g(f)$  of ratings for functional objective  $f$  on  $k$  business/societal objectives is

$$g(f) = \left( \prod_{i=1}^k r_{f,i} \right)^{1/k}$$

where  $r_{f,i}$  is the rating of  $f$  on objective  $i$ .

**Table 12.** Experts' assessments of the impact of functional objectives on business/societal objectives, with geometric mean.

Functional Objective	Business/Societal Objective			geometric mean
	Increase the customer base	Reduce the number of buyer-seller conflicts	Reduce the number of unfounded insurance claims	
Improve understanding	8	10	9	8.96
Increase trust and confidence	7	5	5	5.59
Increase accessibility and usability	10	8	8	8.62
Total	25	23	22	23.17

We see that functional objectives have different worth when assessed on higher-level objectives. We can now use that fact to compute a *weighted mean* for the effect of services:

$$gw(s) = \left( \prod_{j=1}^m r_{s,j}^{g(j)} \right)^{1/\sum_{j=1}^m g(j)}$$

For arithmetic means, weights are expressed by multiplicative factors. Analogously, weights in a multiplicative mean are given as exponents. Here, the exponents are the corresponding geometric means for the functional objectives. For example, the weighted geometric mean for **On-site access to information** is

$$(8^{8.96} * 8^{5.59} * 7^{8.62})^{1/23.17} = 7.61$$

The weighted geometric mean for each service is then given in the rightmost column of Table 11. In this particular case, the ordering of services according to the unweighted and weighted geometric means is identical, but this may not necessarily be the case in general.

According to the stakeholders' assessments of benefit, the innovation project should prioritize work on the **Compare dwellings** and **Standardization** services, followed by **Check legal issues and vagueness**. The **Check documents** service is seen as the least beneficial according to the given criteria.

## 4 Discussion

The highest rated services were **Compare dwellings**, **Standardization** and **Check legal issues and vagueness**. The overarching theme of these services can be said to be standardized, correct and consistent information. The lowest rated services were **Check documents**, **Summary of technical conditions** and **Readable documents**. The overarching theme of these services is more about accessibility and usability. The reason for this prioritization may be that more emphasis is placed on the information content being unambiguous and correct than on it being user-friendly. This should be seen in connection with the fact that, for the buyer and seller in particular, buying and selling a home is a question of large sums of money and the associated risks. It is interesting to note that the assessment at the strategic level rates the functional objective **Increase accessibility and usability** at the highest mark on the business objective **Increase the customer base**, while the services that might effectuate that functional objective are rated low by the stakeholders that constitute part of that customer base. This should be a point for further investigation. None of the participants had disabilities, and one could speculate that had the stakeholder representatives been sampled more broadly, the ratings might have shown a different picture. On the other hand, it is conceivable that even for persons with a greater need for accessible and usable services, the requirement for unambiguous and consistent information will be more important than accessibility, in the light of the economic aspects. By law, the services must comply with the Norwegian Web Accessibility Directive (which refers to WCAG). This means that one might assume that services will have a minimum level of accessibility. It is not clear, however, if participants were aware of this fact and whether that awareness had any influence on the rating.

Physical meetings may be advantageous for plenary discussions and social aspects of communication such as body language. Digital workshops may facilitate an opportunity to combine discussions with a more intense focus and greater discipline when performing individual tasks. The success of an online workshop may also depend upon the tools and artefacts that are used, and the goal of the workshop. In our case the online worksheet where participants individually could enter user stories seemed to be understood intuitively and all participants contributed with a number of stories. Depending on the remote environment, it

may give an opportunity for working with individual tasks without disturbances and too much awareness of other people in the room, as may be the case in physical workshops. Moreover, the main goal of the workshop was to elicit information and to form consensus around services and the participants did not have a personal relationship. If, on the other side, it had been important to form or strengthen social bonds or gain certain interpersonal benefits, a physical workshop might have been a more appropriate method. Then the benefits of being physically next to each other might be crucial as opposed to, merely a positive side effect for most people.

In the two rating workshops, we asked stakeholders to rate the effectiveness of services and functional objectives on scales from 1 to 10. The geometric mean relies on this scale being a ratio variable; that is, the variable has equidistant intervals (so that addition and subtraction are meaningful) and a zero point (so that multiplication and division are meaningful). The assumption is then that raters perceive that giving a ‘4’ means “twice as much” as giving a ‘2’, and that two items that are rated ‘3’ and ‘2’, respectively, together have equal effect as another item rated ‘5’, etc. It is often more suitable to ask respondents to rank items instead of rating them, since this involves ordering items without any consideration of magnitudes. This is conceptually a different exercise and results in assessments on an ordinal variable, where intervals are not known to be equidistant. We could have asked stakeholders to rank services and functional objectives rather than to rate them. To generate an aggregate ranking is more complicated than computing a geometric or arithmetic mean, but various methods have been suggested [1, 2]. The main reason for us to use ratings, rather than rankings, is that a ratio variable lends itself to being incorporated into a benefit/cost index for further considerations of prioritization [8].

## 5 Conclusion

In many ways, the present real estate transaction process, with its hectic time line and inferior information quality, is designed for *co-destruction* [5, 20]. Recent measures to improve this situation places added information requirements and judicial pressure on citizens and may not lead to intended effects. This study aims to develop services that foster *co-production* [6]; which in our context is the trustful and confident collaboration using information services to achieve sustainable transactions. Co-production is hard enough when the collaborating parties ostensibly have the same goal, as in, e.g., public health services [19]. When there are conflicting or opposing interests, such as in public legislative services (tax, customs, etc. – the vast sums involved in tax evasion bears witness of opposing interests) and in real estate transaction (the seller strives for as high a price as possible, while the buyer wants as low a price as possible) service consumers and service providers will struggle in the outset to co-produce a viable result. We propose that multi-stakeholder sessions with systematic service design and benefits evaluations, that explicitly addresses divergence problems in service

production, may contribute to the design of services or tools to support better co-production in challenging contexts.

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