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Land-use policy instruments for sustainable housing: insights from municipality planners in Finland

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ABSTRACT

Local land-use governance is critical for enhancing sustainable housing, which is a topical issue in implementing UN Sustainable Development Goals. Yet, information is lacking on how the use of land-use policy instruments and fulfilment of goals connect with each other. To fill this void, this study addresses local operationalization of sustainable housing aims, and their effects on the use of local land-use policy instruments in Finnish municipalities with legislative power to promote local sustainability through their own actions. The material of the study is based on online survey data collected in 2021 from land-use planners working in Finnish municipalities. According to our results based on quantitative analysis implemented with multi-variate methods, themes to promote sustainable housing in the Finnish municipalities are the Citizen focus enhanced by formal, and the Construction focus enhanced by informal approaches. Thus, despite the similar regulatory possibilities for their simultaneous promotion, local land-use governance instruments seem to be used in Finland to enhance either social or environmental sustainability. The phenomenon may exist also in other countries calling for more information on simultaneous promotion of different sustainability aspects in housing, e.g. by uptake of mixes of informal and formal land-use planning instruments in local decision-making.

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1. Introduction

Sustainability in housing is related to the environmental (e.g. climate change mitigation), social (e.g. comfortable housing conditions), and economic (e.g. resource efficiency) lifecycle impacts of residential buildings (e.g. He, 2019; Janjua et al., 2020; Wiedenhofer et al., 2018). Globally, about a third of carbon dioxide emissions are estimated to be derived from the manufacture of building materials and use of residential buildings (United Nations Environment Programme, 2021). In addition,

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human health in the built and natural environment is a fundamental part of sustainable development and is significantly affected by the decisions made in land-use planning (Barton, 2009). Aspects of housing have therefore gained increasing attention in the land-use planning, especially during the 2000s (Choguill, 2007; Shama & Motlak, 2019; Winston, 2014).

Enhancing sustainability in housing is connected with the United Nations Sustainable Development Goals (SDGs) requiring consideration of the needs of citizens (Winston, 2022) in human settlements, i.e. cities, towns, and villages (hereafter referred to as municipalities) (Barton, 2009). SDG 11, with its aim of making 'cities and human settlements inclusive, safe, resilient and sustainable', is especially related to sustainable housing. In addition to housing as such, SDG 11 addresses aspects in the built and natural environments, which are affected by land-use planning processes (Koskivaara & Lähtinen, 2023). The actualisation of SDGs is based on their operationalisation in local policies, strategies, and practices connected with decisions made in municipalities (Kettunen et al., 2020; Krantz & Gustafsson, 2021).

In municipalities, land-use planners and other local authorities hold considerable power to implement sustainable building and housing policies as decision makers to control land-use planning and as communicators of sustainability issues (Retzlaff, 2009). In addition, depending on national land-use planning systems, municipalities to a different extent have the power to make decisions on the land use in their territories (e.g. Silva & Acheampong, 2015). In Finland, land-use planners are in key positions to use considerable power in land-use management processes: they act as information hubs and communicators, and they both prepare and introduce land-use plans for local decision makers (Kanters & Wall, 2014; Peltonen & Sairinen, 2010; Puustinen, 2006). As a result of their multiple roles in local land-use governance, Finnish land-use planners have an 'essentially unlimited mandate to devise sustainable solutions' (Säynäjoki et al., 2014). Yetfor example, Swedish land-use planners have been found to lack awareness of the long-term impacts of their decisions on municipalities' future sustainability development potential (Kanters & Wall, 2014). Combined with the recognition of their power as civil servants, this may also be related to the professional experience and knowledge of sustainability required to implement more challenging land-use planning processes with multiple objectives (Lähtinen et al., 2019)

Compared with local politicians, who follow local political election cycles and probably shorter-term sustainability goals (Kettunen et al., 2020), land-use planners as professionals are not restricted by such time limitations, adding to their power in land-use management processes (e.g. Lähtinen et al., 2019). Since achieving land-use planning goals for complex issues requires more than just regulation (Stead, 2021), this has increased in many countries the utilisation of softer land-use planning policy tools (Allmendinger & Haughton, 2009; Bäcklund et al., 2018; Hincks et al., 2017; Pettersson & Frisk, 2016).

In practice, land-use planners need to supplement statutory governmental logic (i.e. formal land-use policy instruments based on laws and norms) with approaches and practices that adhere more to mixed, layered, and ambiguous logics of visionary, strategic, and framework-conditioning governance (i.e. informal land-use policy instruments based on, e.g., actor collaboration and strategies within municipalities) (Bäcklund et al., 2018; Stead, 2021). For example, to advance local sustainability, land-use planners need to navigate at strategic (e.g. formulation of long-term plans) and operative (e.g.

implementation of short-term projects) levels, within and across varying policy fields and in relation to multiple actor networks (Granqvist et al., 2021; Viljanen et al., 2023).

In the context of building and housing, urban planners may benefit from collaboration with businesses and building owners through an increase in knowledge of sustainable housing (e.g. the technological and economic feasibility of solutions) in line with the use of formal land-use policy instruments (Kanters & Wall, 2018). In addition, the collaboration between local public authorities and other actors may enhance innovations, enhancing sustainability (Kangas & Ryynänen, 2022). Especially, in the context of building and housing, the development of local innovation systems is of fundamental importance (Koskivaara & Lähtinen, 2023). In relation to the global sustainable housing goals addressed in the SDGs, Finland is the top-ranked European country in its sustainable development performance in cities and communities (SDG 11) (D'Adamo et al., 2022).

In this study, the focus is on the views of the land-use planners who are working in Finnish municipalities to prepare general and/or detailed plans in line with the prerequisites set by the Land Use and Building Act (1999). The objective of the Land Use and Building Act is 'to ensure that the use of land and water areas and building activities on them create the preconditions for a favourable living environment and promote ecologically, economically, socially and culturally sustainable development'. The aims of sustainable development are therefore to be pursued by land-use planners by law. However, the legislation does not stipulate how this should be done in relation to municipality strategies required by the Local Government Act (2015), for example (e.g. Kettunen et al., 2020).

Due to the national land-use policy and regulation, Finnish municipalities play a key role in implementing sustainable housing goals (e.g. Kettunen et al., 2020; Lähtinen et al., 2019) by using land-use policy instruments (e.g. Koskivaara & Lähtinen, 2023; Mäntysalo et al., 2011). Thus, they may be considered as good cases for providing information about the usability of formal and informal land-use management approaches connected with municipality strategies, including multiple goals for sustainability. Currently, research gap exists on how views of sustainability in housing goals are reflected in the local land-use policy tools (Koskivaara & Lähtinen, 2023). There is therefore neither information about the potential weaknesses in using the array of land-use policy tools nor knowledge of their development potential to enhance sustainability through municipality actions, especially in relation to housing. The scarcity in research information concerns not only Finland, but also in other countries the seek for local sustainability practices for land-use policies are a key point of interest (e.g. Hersperger et al., 2018; Kaczorowska et al., 2016). Thus, the results of this study therefore also bring new insights into other countries on the potential to use and develop different types of land-use policy instruments in local contexts.

To fill the void in the existing research information, this study's overall purpose is to provide new information about how municipalities' housing goals, with a consideration of their sustainability aspects, explain the use of different types of land-use policy instruments, and how the use of such instruments could be developed in local land-use planning processes. Related to this, three research questions are formulated: 1) What are the general housing goals in Finnish municipalities' land-use planning, and specifically with reference to the views of sustainability in housing? 2) How are housing goals connected with the use of formal and informal land-use policy instruments? 3) How

can land-use policy instruments be developed to enhance sustainability in the context of housing, especially through municipality land-use planning approaches? The study's data comprise online survey material gathered in 2021 from Finnish planners working in different land-use management tasks in Finnish municipalities. Research question 1 is analysed with exploratory factor analysis (EFA), research question 2 with EFA and binary logistic regression analysis, and research question 3 with the results on research questions 1 and 2 in reference to findings made in previous empirical studies.

2. Empirical background on the use of land-use planning instruments in municipalities

In many countries, municipalities are local autonomies with strong power and responsibilities in legal, financial, and political matters in their territories (van Houwelingen, 2018). Among other things, local land-use management decisions play an important role in implementing municipalities' tasks to enhance sustainability (Hersperger et al., 2018). In the context of housing, sustainability relates to allocation of land for building, guidelines or rules for building materials, consideration of building standards, and inclusion of community and affordability views on housing (Choguill, 2007). To enhance achievement of land-use management goals, municipalities may use both formal (i.e. statutory) land-use policy instruments, based on laws and norms, and informal instruments (e.g. local building codes, public-private projects, and development strategies) (e.g. Albrechts & Balducci, 2013; Bäcklund et al., 2018; Kuronen et al., 2010).

Compared with formal land-use planning instruments, informal approaches enable more freedom for visionary work, and they can build on actions (e.g. agreement practices, bids, and grant schemes) rather than regulation (Albrechts & Balducci, 2013; Mäntysalo et al., 2015). However, since laws and norms pose the regulatory boundaries for land-use planning processes, civil servants such as urban planners need to find balance in using the formal and informal tools (Howlett, 2004; Lumijärvi & Lepojärvi, 2014; Tellmann, 2012). For example, boundaries for building activities within municipalities are set by the statutory land-use governance system and thus informal tools cannot replace but may complement the formal approaches (Jutila & Outila, 2022; Kanters & Wall, 2014).

It has been argued that the formal local land-use planning policy tools are not sufficient to deal with the challenges related to complex sustainability questions (Hytönen, 2019; Solly, 2021). Thus, goals for enhancing local sustainability, for example in housing (Kaczorowska et al., 2016), have increased the need to uptake and consider the implications of different instruments, and the mixes of formal and informal approaches (Howlett, 2004; Juhola, 2014; Schneider et al., 2021). Furthermore, the infusion of sustainability goals in local planning has created a momentum to expand planning instrumentation (Lazarevic et al., 2020), and renew the use of planning tools with innovative approaches, which enable meeting the sustainability challenges (Koskivaara & Lähtinen, 2023; Mäntysalo et al., 2019; Solly, 2021). This may relate, for example, the uptake of informal land-use policy instruments that enable networking between public and private actors supporting common learning, capability building, and development of new solutions for sustainability (e.g. Sahamies et al., 2022).

In the case of Finland, all municipalities must have a strategy guiding all local decision-making, planning, and development actions, for example, to advance the well-being of residents and the development of living environments (Local Government Act, 2015). Implementation of municipality strategies requires the use of both formal and informal land-use policy instruments (Granqvist et al., 2019; Sahamies et al., 2022; Valtonen et al., 2017). In connection with municipal strategies, local land-use planning goals typically include zoning support for the suburban development and the realisation of the well-being strategy, creating land-use conditions to increase the social diversity in neighbourhoods and encourage sustainable construction (Rekola et al., 2014; Sandberg, 2020). In addition, due to the needs for climate-change adaptation and biodiversity conservation, consideration of environmental aspects has become an intrinsic part of municipalities' land-use planning processes (Koskivaara & Lähtinen, 2023).

In all, the land-use management processes in Finland have multiple connections with municipalities' strategic economic, social, and environmental sustainability goals (Jokinen et al., 2018; Kettunen et al., 2020). However, in the Finnish municipalities, the efforts have been found to be traditionally driven by economic sustainability, which the local decision-makers have considered to support also the achievement of social and environmental sustainability goals (Kettunen et al., 2020). At the same time, Finnish municipalities have multiple statutory tasks (e.g. social care and primary health care) (Kauppi & Taponen, 2022) that require them to seek a balance between economic, social, and environmental sustainability (Koskivaara & Lähtinen, 2023; Yrjänä et al., 2018).

Overall, the Finnish land-use planning system has become more complex due to increasing pressures for municipalities to enhance multiple goals, for example, related to sustainability (Mäntysalo et al., 2015). Despite this, the incorporation of sustainability aspects into Finnish land-use planning processes has neither been systematic nor addressed sustainability in its profoundest sense (Säynäjoki et al., 2014). It is therefore important to make visible how informal and formal land-use planning instruments are and can be used at the local level (i.e. municipalities) to enhance sustainability in housing, and what types of issues explain the differences in the use of instruments among municipalities (see, e.g., Koskivaara & Lähtinen, 2023). Since the need for sustainability change in housing is a global phenomenon (Choguill, 2007) and addressed, for example, in SDGs (Barton, 2009), information on the potential of local formal and informal land-use planning instruments to support positive development is needed also outside Finland (e.g. Schneider et al., 2021).

Based on the empirical literature, both formal and informal land-use planning instruments are used to promote housing goals and different aspects of sustainability in municipalities. Built on this, the analytical framework of the study (Figure 1) is composed to assess whether linkages between the land-use planning goals for housing in the municipalities and the use of formal and informal land-use planning instruments may be found. The analysis starts with the identification of the general goals for housing (research question 1) followed by the evaluation of whether the goals connect with the use of formal and informal planning instruments (research question 2). As the final phase of analysis, evaluation is implemented on the possibilities to develop the use of formal and informal tools to fulfil the

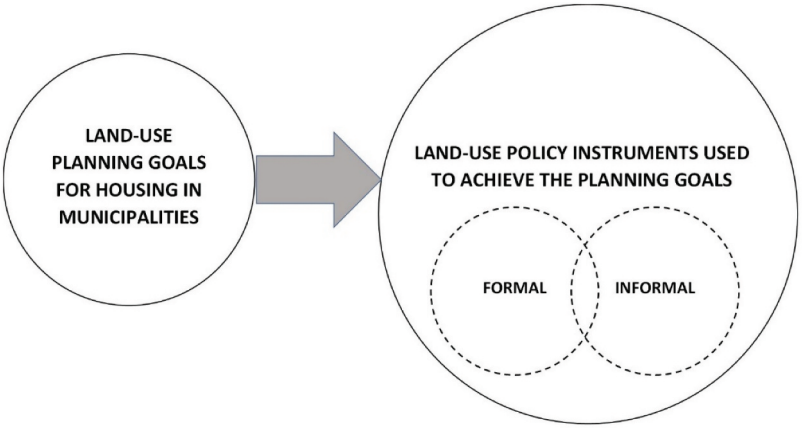

Figure 1. Analytical approach of the study to assess the impacts of land-use planning goals on the choices of informal and formal land-use policy instruments in the context of housing.

municipalities' housing goals especially in reference to views on sustainability (Research question 3).

3. Data and methods of analysis

3.1. Material of the study

This study's data were gathered in March–April 2021 through an online questionnaire from land-use planners working in Finnish municipalities' land-use planning tasks. The recipients of the questionnaire were contacted by an email that comprised both the cover letter and electronic link to the online questionnaire available in both official languages in Finland (i.e. Finnish and Swedish). The email addresses of the recipients had been gathered from the internet pages of all the Finnish municipalities (in total, 309) in mainland Finland and Åland. The email was sent to 1,012 professionals, who, according to the information about the municipality's internet pages, were working in land-use planning tasks in February 2021.

With educational and professional background information about the respondents, the online questionnaire comprised about 20 questions on economic, social, and environmental aspects connected with municipalities' land-use planning processes. In this study, the focus of the analysis is limited to information gathered on the land-use planning aims for housing (Question 22; see Table 1 for a detailed description of the data variables) and the instrumentation to implement these aims in Finnish municipalities by using informal and formal land-use planning instruments (Question 14; see Table 2 for a detailed description of the data variables). The dataset has previously been used by Koskivaara and Lähtinen (2023) to study land-use planning and regional innovation systems, with information about municipalities' actor collaboration, criteria for land zoning and infill development, use of land-use policy instruments (information from Question 14 also used in this study), and planning goals for housing (information from Question 22 variables a and b also used in this study).

Table 1. Importance of informal (I) and formal (F) land-use policy instruments for implementing planning goals within municipalities (question 14). By variables, the highest proportions of 'not important at all' (underlined), 'very important' (bold), and 'I don't know' (italics) responses are denoted in the cells.

	How important are the following options to implement the land-use planning aims in your municipality?	Not important at all (1)	Not very important (2)	Neither without importance nor important (3)	Quite important (4)	Very important (5)	I don't know (6)
a.	Strategic alliances for development projects (e.g. Public-Private Partnerships) (I)	7 4.3%	10 6.1%	26 16.0%	64 39.3%	46 28.2 %	10 6.1%
b.	Municipal development programmes (e.g. sustainable building programmes) (I)	6 3.7%	14 8.6%	27 16.6%	69 42.3%	44 27.0 %	3 1.8%
c.	Regional development programmes (e.g. development programmes of Regional Councils) (I)	6 3.7%	18 11.0%	36 22.1%	75 46.0%	20 12.3 %	8 4.9%
d.	National development programmes (e.g. government programmes to promote building with wood) (I)	7 4.3%	22 13.5%	46 28.2%	62 38.0%	14 8.6 %	12 *7.4%*
e.	Statutory plans made by the authorities at detailed municipal level (i.e. local detailed plans and their attachments) (F)	0 0.0%	3 1.8%	5 3.1%	19 11.7%	135 **82.8 %**	1 0.6%
f.	Statutory plans made by the authorities at general municipal level (i.e. local master plans and their attachments) (F)	1 0.6%	6 3.7%	4 2.5%	30 18.4%	120 **73.6 %**	2 1.2%
g.	Statutory plans made by the authorities at regional level (i.e. regional plans) (F)	3 1.8%	5 3.1%	17 10.4%	81 49.7%	53 32.5 %	4 2.5%
h.	Statutory decisions made by the authorities at national level (i.e. national land-use objectives) (F)	2 1.2%	13 8.0%	24 14.7%	65 39.9%	53 32.5 %	6 3.7%

Regarding the statements on municipalities' planning goals for housing, sustainability aspects were integrated indirectly in the variables with concepts on different aspects of sustainability selected from the empirical scientific literature and Finnish municipalities' strategy documents. As examples of the operationalisation of the sustainability aspects in the statements, the selection of building materials is especially connected with environmental sustainability (Kuittinen & Häkkinen, 2020), and consideration of equality is especially related to social sustainability (Stender & Walter, 2019). Yet they may both also concern economic sustainability, for example, through resource efficiency gains and cost-savings through material choices and the extended lifecycles of buildings through renovations that enhance both environmental and social sustainability (Harju & Lähtinen, 2022; Viljanen et al., 2023).

The indirect approach to operationalising the aspects of sustainability in the Question 22 variables was preferred to direct references to environmental, social, or economic sustainability for two reasons related to the validity of the data: first, land-use planning processes are guided by municipality strategies addressing housing goals with practical concepts, for example (e.g. climate-wise construction or equal possibilities for all citizens). The alignment of the concepts with practical approaches was therefore expected to enhance the comprehensibility of the statements. Second, a consideration of environmental and social sustainability with economic sustainability is fundamental in land-use

Table 2. Finnish land-use planners' opinions on the fit of the statements with their municipality planning goals for housing (question 22). By variables, the highest proportions of 'not important at all' (underlined), 'very important' (bolded), and 'I don't know' (italics) responses are denoted in the cells.

22.	Our municipality ...	Very poorly (1)	Quite poorly (2)	Neither poorly, nor well (3)	Quite well (4)	Very well (5)	I don't know (6)
a.	...strives to govern the use of building materials in new housing production	18 11.0%	29 17.8%	39 23.9%	55 33.7%	11 6.7%	11 6.7%
b.	...strives to govern the use of building materials in renovations for old housing	18 11.0%	28 17.2%	46 28.2%	34 20.9%	8 4.9%	29 *17.8%*
i.	...pursues the enhancement of distinct images of neighbourhoods and strengthens the self-identities of their inhabitants	4 2.5%	13 8.0%	31 19.0%	73 44.8%	40 **24.5%**	2 1.2%
j.	...pursues the hindering of segregation between different neighbourhoods	8 4.9%	17 10.4%	26 16.0%	63 38.7%	43 **26.4%**	6 3.7%
k.	...pursues the hindering of segregation between different citizen groups	8 4.9%	20 12.3%	30 18.4%	61 37.4%	35 21.5%	9 5.5%
l.	...strives to enhance the balanced supply of homes for different citizen groups (e.g. size of households, age of citizens) in all neighbourhoods	9 5.5%	18 11.0%	26 16.0%	70 42.9%	33 20.2%	7 4.3%
m.	...strives to secure sufficient infrastructure for public transport and services in all neighbourhoods	10 6.1%	12 7.4%	34 20.9%	70 42.9%	36 22.1%	1 0.6%
n.	...pursues ensuring sufficient supply of homes with different types of ownership and services in all neighbourhoods (e.g. assisted living buildings, owner-occupied housing, right-of-occupancy housing, rental housing)	7 4.3%	16 9.8%	32 19.6%	64 39.3%	30 18.4%	14 8.6%
o.	...zones land for building of community spaces for the shared use of inhabitants in certain neighbourhoods (e.g. buidlings intended for free-time activities)	22 13.5%	39 23.9%	47 28.8%	36 22.1%	6 3.7%	13 8.0%
p.	...promotes complementary building to hinder segregation between different neighbourhoods	13 8.0%	13 8.0%	32 19.6%	64 39.3%	29 17.8%	12 7.4%
r.	...promotes renovations (e.g. retrofitting and overhauls in suburbs) to hinder segregation between different neighbourhoods	7 4.3%	20 12.3%	42 25.8%	49 30.1%	19 11.7%	26 *16.0%*

planning processes and urban planners' work. The respondents may therefore have been reluctant to give low ratings, especially to environmental or social sustainability aspects, if they were not expressed with practical approaches (for more on social desirability bias, see Sjöström et al., 1999).

Respondents' background information (e.g. education and professional experience) was also used to assess the survey information's validity. As there is no comprehensive directory of land-use planners in Finland, no information is available about the entire planner population that would enable unambiguous assessments of the response rates in surveys sent to them. However, Puustinen (2006) has estimated that in the mid 2000s, about 600 professionals were working as urban planners in Finnish municipalities. In addition, there are other types of experts responsible for municipality land-use planning tasks, and especially in the smaller municipalities, a planner position can be shared with several jurisdictions. Furthermore, some municipalities outsource some of their planning to qualified consultants. As a result, the most feasible option for collecting data was considered to be an online approach (i.e. the use of email addresses and an online questionnaire).

After three rounds of data gathering, responses were received from a total of 92 Finnish municipalities through the participation of 163 professionals (the response rate

of those who had received the questionnaire was 16.1%). In 2020, the number of residents living in those 92 municipalities was 3.78 million, comprising approximately 70% of the Finnish population (5.51 million) (Association of Finnish Municipalities, www.kuntaliitto.fi). The average population of a Finnish municipality was 18,751 in 2021, and half the 92 municipalities represented in the data were above (49), and half below (47), the average. The municipalities' background characteristics therefore support the validity of the data in providing insights into the general municipal land-use planning characteristics in Finland. Similarly, the professional profiles of the respondents support the assumption that the study's participants were typical of Finnish land-use planners working in the Finnish municipalities (for a more detailed description, see, e.g., Lähtinen et al., 2019). All the 163 respondents stated that they worked with different types of local land-use planning tasks.

3.2. Analysis of results with exploratory factor analysis and binary regression analysis

The data were analysed using exploratory factor analysis (EFA) (e.g. Beavers et al., 2013; Henson & Roberts, 2006) and binary linear regression (BLR) analysis (Pampel, 2000; Peng, Lee & Ingersoll, 2010) run with IBM SPSS Statistics 25.0 software.

The first phase of the analysis comprised the implementation of EFA (Kaiser normalisation, Maximum Likelihood Estimation, and Varimax rotation) for the selected Question 22 variables with Likert scale values of 1–5 (i.e. 'I don't know' responses were omitted from the models by treating them as missing values). The purpose of this was to seek a factor solution with original variable loadings that were either as large or as small as possible and to examine if the large set of variables could be represented more parsimoniously as latent variables. Empirically, EFA was implemented to assess whether general themes for land-use planning goals for housing existed in Finnish municipalities, with a consideration of views on economic, social, and environmental sustainability.

Kaiser's eigenvalue >1 rule was employed as an EFA background criterion to decide the number of factors to be retained. This phase also comprised a scrutiny of the Kaiser–Meyer–Olkin measures for sampling size adequacy (a minimum value of 0.50) and Bartlett's test of sphericity (i.e. information about the correlations between original variables). In model building, all original variables with loadings below 0.4 were removed from the EFA solutions, combined with the checking of Cronbach's alphas (i.e. information about the reliability of the analysis). During the EFA modelling process, no single variable factor loading was retained. Alongside the statistical measures, the empirical validity of the original variable loading's EFA solutions were evaluated. As an outcome of EFA modelling, latent variables describing land-use planning aims for housing in Finnish municipalities were acquired. The latent variables were saved in the form of factor scores to be used in the BLR analysis described next.

The second phase of the analysis concerned BLR analysis, which can be employed to model relationships between a binary (dichotomous) dependent choice variable and independent variables. As a proxy for the utilisation of different types of governance

mechanisms in the municipalities to implement their land-use aims, a categorical binary variable was formulated by using data on Question 14 variables. In the procedure, the responses 'Very important' (Likert scale value 5) were given the value 1 (i.e. the phenomenon exists), and the responses 'Not at all important' (Likert scale value 1), 'Not very important' (Likert scale value 2), 'Neither important, not entirely without importance' (Likert scale value 3), and 'Quite important' (Likert scale value 4) were given the value 0 (i.e. the phenomenon does not exist).

In the BLR analysis, factor scores on general themes for land-use planning aims in Finland were employed as independent variables to model the likelihood of the use of certain governance mechanisms (Figure 2). Positive parameters were to indicate an increase, and negative parameters a decrease, in the likelihood of the use of a particular governance mechanism fulfilling latent land-use planning aims. Odds ratios (i.e. ratios of probabilities of using a particular governance mechanism over not using a particular governance mechanism) were calculated after exponentiating the regression parameters. The intercept and parameters were estimated using the maximum likelihood method (Peng et al., 2002). A similar methodological approach to combining EFA and BLR to statistically model the causalities between the independent variables represented by factor scores and dependent dichotomous variables has been employed by Lähtinen et al. (2021), for example.

The performance of the BLR models was statistically evaluated (e.g. Peng et al., 2002) by examining the individual predictors (i.e. β coefficients tested with Wald's χ^2) and the models' general goodness of fit (i.e. omnibus test for model coefficients χ^2). The following threshold values were employed as indications of the statistical significance of the results: $0.01 \leq$ p-value < 0.05 = moderate evidence of statistical significance and < 0.01 p-value = very strong evidence of statistical significance.

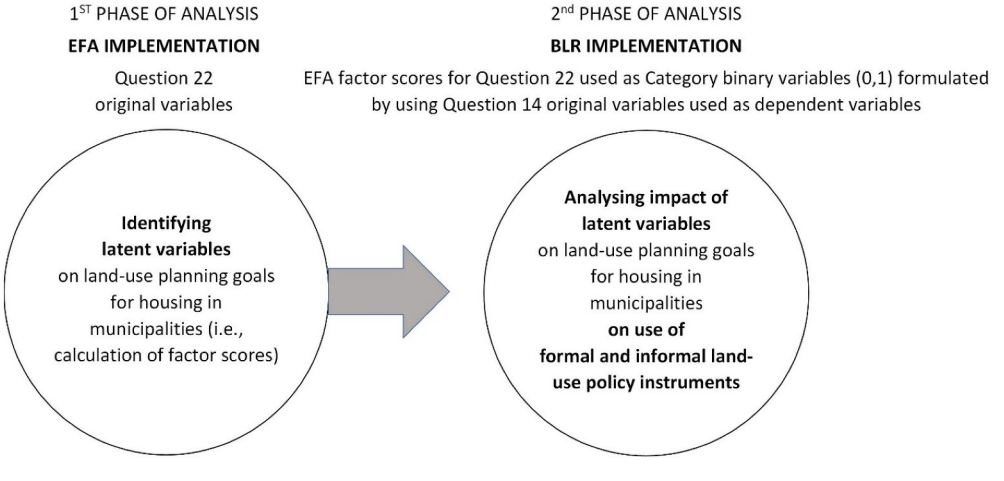

Figure 2. Logic of employing exploratory factor analysis (EFA) and binary linear regression (BLR) analysis in the study.

In addition, pseudo R-squared measures (i.e. Cox and Snell's R^2 and Nagelkerke's R^2 statistical indices) were scrutinised with a recognition of the limitations that may be related to their use in assessing the predictive power of BLR models (Menard, 2000; Peng et al., 2002). Alongside statistical measures, the predictive model accuracies were evaluated by comparing their predicted group membership (i.e. the use of a particular governance mechanism predicted by the models) with observed group membership (i.e. the information about the use of a particular governance mechanism as recorded in the data) (Pampel, 2000).

4. Results

4.1. Overview of answers on the importance of different informal and formal land-use policy instruments

Before the EFA and BLR analysis, the frequencies of the responses on the variables in Questions 14 and 22 were assessed. Table 1 illustrates the importance of different formal and informal policy instruments from the perspective of planners in implementing municipality's land-use planning aims. Overall, very few respondents considered any of the instruments to be of no importance at all (at most 4.3% of the respondents perceived strategic alliances for development projects and national development programmes as 'Not important at all' (i.e. variables a. and d.). The number of 'I don't know' responses was also small: it was highest for the variable measuring the importance of national development programmes (7.4%). In line with the strong statutory power of Finnish municipalities to govern the use of their territories through land-use planning monopolies, formal instruments employed by urban planners (i.e. local detailed plans and local master plans addressed in variables e. and f.) were evaluated by most respondents as very important (82.8% and 73.6% respectively).

Table 2 shows the views of respondents on the fit of statements on the land-use planning aims with the housing goals in their municipalities. Overall, the poorest fit was related to governing the use of building materials, both in the context of new buildings and renovations (variables a. and b.) and zoning land for building community spaces (variable o) for inhabitants in certain regions (i.e. the proportion of 'Very poorly' answers was 11.0%, 11.0%, and 13.5% respectively). In addition, the largest proportion of 'I don't know' answers concerned the governing of the use of building materials for renovations (17.8% of the responses) and promotion of renovations to hinder segregation (16.0% of responses). On the other extreme, respondents assessed the best fit with the municipality land-use planning goals for housing to be linked with the pursuit of distinct images of neighbourhoods and the strengthening of their inhabitants' self-identities (variable i) and the hindering of segregation between different neighbourhoods (variable j) (i.e. the proportion of 'Very well' answers was 24.5% and 26.4%, respectively).

4.2. Exploratory factor analysis results of land-use planning goals for housing in municipalities

EFA was run to identify latent variables in general themes in the municipalities' planning goals for housing. EFA modelling resulted in a two-factor solution comprising 10 of the

Table 3. Exploratory factor analysis (EFA) results in the land-use planning goals for housing in Finnish municipalities. Based on the original variable loadings, factor 1 is named the *Citizen focus*, and factor 2 is named the *Construction focus*.

	Our municipality . . .	Communalities (Extraction)	Factor 1 Citizen focus	Factor 2 Construction focus
a.	. . .strives to govern the use of building materials in new housing production	0.517	0.270	**0.666**
b.	. . .strives to govern the use of building materials in renovations for old housing	0.633	0.126	**0.785**
i.	. . .pursues the enhancement of distinct images of neighbourhoods and strengthens the self-identities of their inhabitants	0.452	**0.544**	0.396
j.	. . .pursues the hindering of segregation between different neighbourhoods	0.896	**0.912**	0.254
k	. . .pursues the hindering of segregation between different citizen groups	0.829	**0.882**	0.224
l.	. . .strives to enhance the balanced supply of homes for different citizen groups (e.g. size of households, age of citizens) in all neighbourhoods	0.377	**0.574**	0.219
m.	. . .strives to secure sufficient infrastructure for public transport and services in all neighbourhoods	0.545	**0.696**	0.244
n.	. . .pursues the ensuring of sufficient supply of homes with different types of ownership and services in all neighbourhoods (e.g. assisted living buildings, owner-occupied housing, right-of-occupancy housing, rental housing)	0.547	**0.624**	0.398
o.	. . .zones land for building of community spaces for the shared use of inhabitants in certain neighbourhoods (e.g. buildings intended for free-time activities)	0.408	0.418	**0.483**
r.	. . .promotes renovations (e.g. retrofitting and overhauls in suburbs) to hinder segregation between different neighbourhoods	0.468	0.460	**0.506**
	Cronbach's a		0.896	0.774
	Eigenvalues		3.585	2.087
	Explained variance, %		52.961	11.818

Kaiser–Meyer–Olkin measure of sampling adequacy 0.880, Bartlett's test of sphericity $p = 0.001$, Goodness-of-fit test $\chi 2 = p = 0.001$.

original 11 variables (Table 3). Factor 1 composed of statements mostly connected with citizen aspects (i.e. goals concerning neighbourhood's characteristics, segregation alleviation, and social diversity) and was named the *Citizen focus*. Factor 2 comprised statements mostly linked with construction aspects (i.e. goals concerning building materials, new housing production, and renovations) and was called the *Construction focus*. Overall, the EFA solution can be considered to function well, as the factors explain 64.8% of the total variance.

Most of the original variable loadings are considerably higher for both factors. The wordings of the variables with more equal loadings on two factors address construction activities from human aspects (i.e. land zoning for community spaces and promoting renovations to avoid segregation). Although the main content of Question 22 and variables o and r thus concerns views on construction, for some respondents, they may have also been means to promote social aspects in housing. The variable loadings for each factor therefore depict different approaches to what sustainability means in relation to housing issues in the context of land-use planning and suggest what types of solutions are sought.

Table 4. Binary logistic regression (BLR) models for the effects of municipality land-use planning goals (i.e. *Citizen focus*, *Construction focus*) on the choices of whether to use informal (I) and formal (F) land-use policy instruments to implement goals.

	β	SE β	Wald's χ2	df	p	Odds ratio (eβ)	χ^2	Predictive accuracy (%)	Cox & Snell R^2	Nagelkerke R^2
Strategic alliances for development projects (I)							0.268	71.9	0.023	0.033
Intercept	−0.970		20.542	1	0.000**	0.379				
F1: Citizen focus	0.373		2.336	1	0.126	1.452				
F2: Construction focus	0.039		0.023	1	0.878	1.040				
Municipal development programmes (I)							<0.001**	81.6	0.190	0.282
Intercept	−1.591		25.621	1	0.000**	0.204				
F1: Citizen focus	1.215		11.164	1	0.001**	3.371				
F2: Construction focus	0.983		6.945	1	0.008**	2.672				
Regional development programmes (I)							0.005*	91.2	0.088	0.196
Intercept	−3.003		30.169	1	0.000**	0.050				
F1: Citizen focus	0.358		0.805	1	0.370	1.430				
F2: Construction focus	1.600		7.288	1	0.007**	4.954				
National development programmes (I)							0.030*	93.9	0.060	0.162
Intercept	−3.402		27.147	1	0.000**	0.033				
F1: Citizen focus	0.934		2.530	1	0.112	2.545				
F2: Construction focus	1.234		3.297	1	0.069	3.436				
Statutory plans made by authorities at detailed municipal level (F)							0.113	82.5	0.037	0.063
Intercept	1.691		39.927	1	0.000**	5.423				
F1: Citizen focus	0.524		4.245	1	0.039*	1.688				
F2: Construction focus	−0.144		0.255	1	0.614	0.866				
Statutory plans made by authorities at general municipal level (F)							0.002*	73.7	0.101	0.145
Intercept	0.990		19.518	1	0.000**	2.691				
F1: Citizen focus	0.607		7.086	1	0.008**	1.835				
F2: Construction focus	0.459		3.467	1	0.063	1.583				
Statutory plans made by authorities at regional level (F)							0.157	73.7	0.032	0.047
Intercept	−1.076		23.544	1	0.000***	0.341				
F1: Citizen focus	0.320		1.695	1	0.193	1.378				
F2: Construction focus	0.337		1.557	1	0.212	1.401				
Statutory decisions made by authorities at national level (F)							0.003*	71.9	0.099	0.140
Intercept	−0.994		18.394	1	0.000**	0.370				
F1: Citizen focus	0.468		3.429	1	0.064	1.597				
F2: Construction focus	0.762		6.772	1	0.009**	2.143				

*moderate evidence of statistical significance; **very strong evidence of statistical significance.

4.3. Binary linear regression analysis results for the linkages between land-use planning aims for sustainable housing and land-use policy instruments

The results of BLR analysis (Table 4) provide information about whether the use of different types of land-use policy instruments results from different types of land-use planning aims for housing within municipalities. Alongside the results for the existing interlinkages between the aims and instruments, the BLR analysis also enables insights to be gained into the differences between the use of informal and formal land-use planning

instruments in relation to different types of goals for sustainable housing in municipalities.

The results of the BLR models provide evidence of statistically significant connections between the goals of sustainable housing and several land-use policy instruments. In general, both the *Citizen focus* and *Construction focus* on land-use planning aims for housing increase the probabilities of using municipal development programmes (informal), statutory plans made by the authorities at general municipal level (formal), and statutory decisions made by the authorities at national level (formal).

However, based on the strength of the statistical evidence, different types of sustainable housing goals explain the use of the instruments differently. In relation to this, the *Citizen focus* and *Construction focus* are similarly implemented only through the use of municipal development programmes (i.e. very strong evidence of statistical significance for both goals). In enhancing the *Citizen focus*, the use of statutory plans made by the authorities at general municipal level is more important (i.e. very strong evidence of statistical significance) than in implementing the *Construction focus* (i.e. suggestive evidence of statistical significance). In comparison, in fulfilling the *Construction focus*, using statutory decisions made by the authorities at national level (i.e. very strong evidence of statistical significance) plays a significant role while, for the *Citizen focus*, no statistical evidence of any significance is gained. Overall, according to the results, the *Citizen focus* is more emphasised at the municipal level (both formal and informal planning tools), whereas the *Construction focus* plays a more important role at the regional and national levels.

By odds ratios, the *Construction focus* on land-use planning aims for housing shows stronger statistical evidence than the *Citizen focus*, affecting the choices in using different informal and formal land-use policy instruments. In addition to other instruments, regional development programmes are especially used in enhancing sustainable housing through the *Construction focus* (i.e. very strong evidence of statistical significance). Furthermore, by odds ratios, the *Construction focus* also has a stronger impact on the choice of instruments: apart from municipal development programmes and statutory plans made by the authorities at general municipal level, for which the odds are higher for the *Citizen focus* (3.371 and 1.835), all other odds of the *Construction focus* affecting the choices of informal and formal land-use policy instruments are higher, with the greatest value for regional development programmes (4.954).

5. Discussion

Although local land-use governance actions have been found to play a fundamental role in enhancing sustainable housing and promotion of sustainability in line with the UN SDGs (e.g. He, 2019; Kettunen et al., 2020), information on the linkages between the use of land-use policy instruments and the fulfilment of goals is scarce (e.g. Koskivaara & Lähtinen, 2023). To add knowledge on the theme, this study's overall purpose was to study the role of different local land-use policy instruments in fulfilling sustainable housing aims, and of how the use of such instruments could be developed in practical land-use planning processes. The data were collected, and analysis implemented in the context of Finnish municipalities with strong power to set strategic goals and use different

types of land-use planning instruments within the national land-use governance system (e.g. Kettunen et al., 2020; Local Government Act, 2015; Land Use and Building Act, 1999).

The results for the frequencies of urban planners' answers regarding the importance of different informal and formal instruments for the implementation of land-use planning aims within municipalities indicate the significance of local statutory approaches in Finnish municipalities. The detailed plan especially can be seen as an unavoidable instrument, as about 83% of the respondents considered it a very important tool in their practical land-use planning work. In comparison, only 27% of the respondents saw the municipal development programmes (i.e. informal) linked with municipality strategies required by law as important. The result for the dominance of formal land-use planning approaches in Finnish municipalities is strongly supported by previous studies (e.g. Lähtinen et al., 2019; Valtonen et al., 2017; Viljanen et al., 2023), even if some results have already predicted that the shift to informal instruments is leading the planning system to enter a 'post-zoning era' (Rantanen & Rajaniemi, 2020). Overall, our results of EFA and BLR analysis indicated that the uptake of mixes of informal and formal land-use planning instruments may be ongoing. Yet our results suggest that the application of different types of planning tools depends strongly on municipalities' housing goals.

The results of this study show that in the context of housing, the promotion of local sustainability through the systematic integration of environmental and social aspects (e.g. in line with SDGs) in land-use planning processes (e.g. Koskivaara & Lähtinen, 2023) remains a work in progress in Finnish municipalities. This was concretised both in the outcome of EFA and BLR analysis. First, according to the EFA results, municipalities' housing goals are thematically siloed and address either views on citizens or construction. Factor 1, named the *Citizen focus*, is predominantly connected with social sustainability aspects, while Factor 2, named the *Construction focus*, is dominated by environmental aspects, with some characteristics of social and economic sustainability (e.g. multiple benefits received from zoning land for community spaces for the shared use of inhabitants in certain neighbourhoods). Second, according to the BLR results, social and environmental housing goals are promoted very differently by informal and formal land-use planning instruments, although Finnish laws enable the local promotion of both citizen and construction aspects with formal approaches, for example (e.g. detailed plans).

According to the EFA and BLR results, enhancing sustainable housing in municipalities through the *Construction focus* (i.e. an emphasis on building materials, renovations, or buildings) relies strongly on informal programmatic approaches at the local and regional levels (see also Vihemäki et al., 2020). Regarding statutory land-use planning instruments, statistical evidence of the *Construction focus* driving the use of formal land-use planning approaches was found only for the national level. This finding is important for two reasons. First, although urban planners perceive formal local land-use policy instruments as very important in their implementation of local land-use planning goals, planners do not seem to be active in using their existing statutory power (e.g. Lähtinen et al., 2019; Säynäjoki et al., 2014) to affect the use of building materials or building processes. Second, by giving up proactively setting the frames for building through local statutory approaches, urban planners exclude themselves from being the proactive initiators of the local sustainable building criteria (see also Kanters & Wall, 2018).

Our results for the *Construction focus* are strongly connected with the Finnish aims for sustainable building and the important role of municipalities in the construction sector sustainability change (e.g. Koskivaara & Lähtinen, 2023; Viljanen et al., 2023). In connection with this, according to the results, urban planners as introducers, preparers, communicators, and information hubs for land-use planning processes (Puustinen, 2006) are not exploiting their statutory power in municipalities. Instead, they are relying on national statutory standards and building codes and informal local land-use planning processes, which enhance actor collaboration, capability building, and innovation activities (Koskivaara & Lähtinen, 2023). For example, although informal approaches enable proactive discussions with construction companies on local land-use planning goals for housing that may be enhanced on specific building sites (Viljanen et al., 2023), they may also simultaneously pose risks for legitimacy and transparency in governance (Mäntysalo et al., 2015).

The EFA and BLR results for the *Citizen focus* (i.e. an emphasis on the equality of citizens, identities of neighbourhoods, and avoidance of segregation) illustrate the promotion of social justice in land-use planning primarily through the lenses of formal (especially, local master plans but also detailed plans) and informal (i.e. municipal development programmes) local tools. The result is logical, as Finnish municipalities have multiple statutory tasks which are to a large extent connected with social issues (e.g. health and education) (Kauppi & Taponen, 2022). For example, Winston (2014) found Finland to be high in the in-neighbourhood quality indices in international comparison. This is explained by the fact that the inclusion of social aspects in local land-use planning processes is better established in the Finnish land-use planning system than the integration of environmental issues connected with construction through the use of building materials, for example (e.g. setting requirements in local detailed plans for buildings' load-bearing materials) (Lähtinen et al., 2019).

Overall, according to our results, the *Citizen focus* seems to drive municipalities to become initiators and active developers of social equity with legally enabled formal local land-use planning tools. This is a considerable difference with the results for the *Construction focus*. Yet the results for the *Citizen focus* show that reliance on formal local land-use planning tools does not remove the need for informal approaches: like the *Construction focus*, the *Citizen focus* also initiates the use of municipal development programmes (i.e. an informal local land-use-planning tool) based on municipality strategies (Local Government Act, 1995). Alongside the direct goals for citizen well-being, municipality strategies aim to provide guidelines for zoning regulation to enhance sustainable construction, for example (Rekola et al., 2014). Related to the simultaneous use of multiple land-use planning tools, especially in the case of environmental sustainability issues, concerted action is required at various land-use governance levels (Juhola, 2014).

Our EFA results and BLR analysis show that the explicit sustainability work in Finnish municipalities above all concerns social sustainability. This is in line with the results of Sandberg (2020), where Finnish housing policies were found to be at the forefront of both strategy and action. In contrast, consideration of environmental sustainability through local governance for construction activities and simultaneous consideration of both social and environmental sustainability seem lacking. For example, in relation to the environmental impacts of housing, the results of Shi et al. (2023) show building with

wood in Finland (i.e. an abundant local and renewable material) to be an important factor that enables greenhouse gas emissions to be decreased during buildings' lifecycles. As building with wood is also connected with the perceived well-being of dwellers (e.g. Harju & Lähtinen, 2022), it is important not to consider construction in land-use planning processes only as building activities or structures but as everyday living environments with social impacts on people.

Following Lazarevic et al. (2020), the revealed two foci on citizens and construction in the Finnish land-use planning goals for housing may be interpreted as land-use planning regime destabilisation and rearrangement. The policy instrument packaging unveiled by this study's results especially have characteristics of what Kivimaa et al. (2017) call 'novel institutional and organisational practices and routines'. Based on our findings, although most formal and informal land-use planning hierarchies have a positive effect on targeted housing goals, the effect of different instruments differs, depending on the types of sustainability foci.

Regarding this study's limitations, it must be remembered that the results are based on the views of one civil servant group (i.e. urban planners) involved in municipalities' land-use planning processes. Collecting information from other municipality actors (e.g. other professionals or politicians) may therefore have resulted in differing views. However, as only urban planners among municipalities' civil servants are involved in all the phases of land-use planning processes (including the implementation of binding plans), their local power in the Finnish land-use planning system is indisputable (see, e.g., Säynäjoki et al., 2014).

Another limitation of this study is its focus on one country, i.e. Finland, and convenience sampling. Its results cannot therefore be directly generalised to other countries, for example. However, as similar findings have been made in previous studies addressing different countries (e.g. Kanters & Wall, 2018), our results provide insights into the issues requiring attention (e.g. detachment from silos in sustainability actions related to the land-use planning goals for housing). In future, it will be important to gain comparable information from different countries to evaluate which types of land-use planning practices seem to promote environmental, social, and economic sustainability in housing with a consideration of the lifecycle aspects of building. In relation to this, it would be valuable to add knowledge about how different actors can collaborate in formal and informal approaches to enhancing innovation activities efficiently and transparently, and the uptake of new building solutions in housing markets.

6. Conclusions

Our study first asked what general themes for land-use planning aims existed in Finnish municipalities in relation to views of economic, social, and environmental sustainability in housing. Planning issues touching on social sustainability in its various dimensions, ranging from equitable urban structures to community spaces, as well as those steering the construction and renovation towards sustainable means and materials, were highlighted.

Second, we studied how distinct themes for land-use planning aims were related to the use of various types of formal and informal spatial planning tools. Our findings seem to paint a picture of solid reliance on statutory planning instruments. However, we found convincing statistical evidence for two distinct regimes, which on the one hand focus on material solutions (building materials, retrofit qualities, the provision of certain types of add-ons for

social purposes) and ,on the other, combine strategic issue management with the operationalisation of spatial justice policies for a wider social responsibility approach (countering spatial and social segregation through principled action and building policy). However, these regimes should not be seen as depictions of formal policy packaging but as constructs presenting the foci of how planners see the practical unfolding of the existing policy packages in their municipality.

Finally, we aimed to shed light on the potential of different types of land-use planning aims to enhance the development of sustainable housing and the prospects of different types of governance mechanisms for contributing to various housing sustainability aspects. Overall, our results indicate that at an aggregated level, social responsibility and material solution goals are differently emphasised in different land-use planning instruments in Finnish municipalities. Understanding this and actively working to align the plans and strategies in all hierarchies will be important both for enabling an effective planning framework and for municipalities to pursue their sustainability goals and combine their local 'sustainability fix'.

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Data availability statement

The data are unavailable because of ethical restrictions.

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