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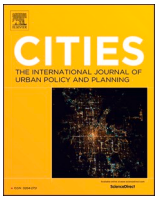

Governing urban regions with a network of plans

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ABSTRACT

As our environment becomes increasingly urban, the governance of urban regions faces multifaceted challenges. There is growing recognition that studying the governance of urban regions requires looking beyond individual plans and examining networks of plans. Existing work on plan networks focuses on documents, neglecting the agency of the people and governments who create and implement the plans. To help fill this gap, we develop and test an analytical framework for assessing urban governance within a network of plans, focusing on the alignment of plan content, interactions, and the relative efficacy of the plans. We apply this framework in metropolitan Austin, Texas (USA), studying five strategic plans that address the region's built environments, transportation systems, and natural areas over a 20 year-period. The analysis reveals how voluntary regional scenario-planning conducted decades earlier continues to shape city and regional development goals; how alignment between plans on paper can belie poor cross-jurisdictional coordination in practice; and how plans addressing transportation and natural areas are more efficacious for implementation than plans for the built environment. In addition to making plan dynamics visible, the framework thus allows for rigorous, empirical assessment of regional governance through a network of plans.

1. Introduction

In the context of today's increasingly urban environments, a disconnect exists between the geographic boundaries of government jurisdictions with authority to act and the spatial extent of land use and transport challenges (Albrechts et al., 2017; Rosan, 2016). This disconnect poses multifaceted challenges in the governance of urban regions. Limited by a lack of authority and its reliance on collaboration, regional governance often resorts to flexible, exploratory and agreement-based planning that bridges administrative boundaries (Albrechts & Balducci, 2013).

Plans are essential in the governance of urban regions, with several plans often developed for the same region and interacting among themselves (Hopkins & Knaap, 2016, Lieu et al., 2018, Berke et al., 2019). It is becoming increasingly apparent that studying the governance of urban regions requires seeing beyond individual plans and considering the relationships among plans, i.e., studying networks of plans (Bacău et al., 2020; Berke et al., 2021).

The concept of a network of plans refers to a set of interconnected plans, that multiple organizations or agencies create, adopt and implement with interdependent actions, and that, together, guide future development and decision-making (Berke et al., 2019; Berke et al., 2021; Hopkins, 2001; Woodruff, 2018; Woodruff et al., 2022). Such networks typically include plans created at different scales by diverse government and non-government civic organizations (Berke et al., 2021). In principle, all plans adopted for a city or a region should pursue common and consistent goals, enhancing integration across policy domains (e.g., housing, transport, agriculture) at different spatial scales (Acheampong, 2018; Bacău et al., 2020; Stead & Meijers, 2009). Contradictions and inconsistences among plans are, however, common in practice (Hopkins & Knaap, 2016, Berke et al., 2019, Bacău et al., 2020).

The small but growing literature on the relationships among plans in such networks has focused largely on the plan documents themselves and the alignment of policies across plans in similar or closely related domains. Pioneering research in this direction has yielded new methods to assess policy integration and improve planning for vulnerability to hazards and climate change (Berke et al., 2015; Berke et al., 2019; Berke et al., 2021) and to assess the inclusion of local knowledge and participation in climate adaptation planning (Lieberknecht, 2023). In addition, some studies have specifically targeted the relationship between

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plans at different levels of government. For instance, studies have examined the consistency between master plans and zoning codes (Norton, 2008), between plan mandates and local plans (Hoch, 2007), between strategic spatial plans and land-use plans (Schmid et al., 2021), and between general plans and capital improvement plans (Mathur, 2017). For example, Bacău et al. (2020) analyzed ten plans in place in the Bucharest (Romania) region and found a high degree of alignment on concerns and general objectives, but a lack of consistency regarding projects. Most recently, Woodruff et al. (2022) called attention to underdeveloped methodological approaches for analyzing networks of plans by comparing four complementary approaches to studying the relationship between plans.

These document-based studies provide valuable insights into policy alignment and plan consistency, yet they fail to address whether and how plan networks exist beyond the documents themselves. Existing investigations neglect the agency of the people and governments who create and implement the plans, and therefore do not consider the efficacy of individual plans in the network. Further, little work has examined plan networks that operate both at multiple administrative or governmental levels and across multiple domains, considering, for instance, the built environment, transportation systems, and natural areas together. Such work is needed to understand whether and how a network of plans might perform as a means of regional governance, and new research frameworks and methods are needed to do so.

In this study we propose and test one such framework, conceptualizing the network of plans as a system. In this system, the plan documents themselves represent nodes, and important interactions between planning actors – such as joint strategies or collaboration – provide the links connecting those nodes. Using this heuristic, our proposed analytical framework focuses on three components of the plan network: (i) alignment of plan content, (ii) interactions among distinct actors and responsible agencies, and (iii) the relative efficacy of each plan included in the network. We rely on textual analysis of the plan documents to assess (i), and we use original data collected from planning staff and stakeholders in interviews and supporting questionnaires to evaluate (ii) and (iii).

By emphasizing not only policy alignment and plan consistency but also interactions among planning agents and plan efficacy, this framework allows us to ask nuanced questions necessary to understand governance with a network of plans. For instance, when developing their own plans, how do planners draw on other plans? How and why do planners coordinate with and cross-reference some plans but not others to support their concerns and strengthen their plan? And how do network interactions – such as collaborative activities among actors at different levels – influence the efficacy of plans?

As a case study, we use the region of Austin, Texas (USA) and five strategic plans addressing three crucial planning domains – built-up areas (used in this study as a synonym for built environment), transportation systems, and natural areas – over a 20-year time horizon. We see such networks of strategic plans as especially important for governing complex urban regions (Albrechts et al., 2017), but we also acknowledge that the Austin region's full network includes both strategic (non-binding) and statutory (binding) plans. We define strategic spatial planning as a process through which various actors, such as private groups, citizens and non-governmental organizations, in various institutional settings come together to formulate coherent long-term plans and strategies to implement spatial transformation (Albrechts et al., 2017; Clifford & Tewdwr-Jones, 2013; Healey, 2009). Strategic spatial planning develops visions and strategic actions for realizing specific territorial developments, which may include, e.g., new housing settlements, transportation network improvements, or the preservation and expansion of green infrastructures (Hersperger et al., 2019). Unlike more binding project-level plans developed by a single implementing authority or land-use plans and statutory zoning codes adopted by a local government, strategic spatial plans emerge from a variety of planning actors, and the implementation of such plans depends on collaborative interactions among those actors.

In the sections that follow, we first present in greater depth the analytical framework we devise for studying governance with a network of plans. Next, we describe the study area and the plans themselves, as well as our processes for data collection and analysis. Finally, we present and discuss the results regarding the three components of the analytical framework.

2. Analytical framework for studying governance with a network of plans

We take a consolidated understanding of strategic planning as the starting point for this study of governance within a network of strategic plans. In particular, our framework draws on recently synthesized evidence on the two phases of strategic spatial planning: plan-making activities, which are required to build trust, and plan-implementation activities, which formalize legal and financial agreements to support concrete projects and development strategies (Hersperger et al., 2019). In accordance with previous studies (Boyer & Hopkins, 2016; Hopkins, 2014; Lai, 2018), 'the plan' (as a document) occupies a central position in this conceptualization of strategic spatial planning. To ensure that both plans and planners are adequately considered when studying networks of plans, and in line with the nodes-and-links-heuristic presented above, the following components form our analytical framework: alignment of plan content, interactions, and the relative efficacy of each plan. We discuss these components below and provide details on their operationalization in the Methods section and in Appendix A.

Alignment of plan content: Alignment of plan content refers to the degree of consistency in planning intentions across plans, evidenced, e.g., by similar goals, policies, or recommended future actions. This external consistency across plans (Bacău et al., 2020) is influenced largely by the ability of policy-makers, planners and stakeholders to reach agreements across policy domains and levels (Stead & Meijers, 2009). The alignment of plans can be supported by general plan-to-plan acknowledgements, or by one plan referring to another plan as an important inspiration. For instance, one plan might anchor its own planning intentions for green-space preservation to another plan's intention to provide flood protection. Similarly, two separate plans might align by recommending the same road extension.

Interactions: In a network of plans, planners engaged in making and implementing one strategic plan are likely to engage with other plans and interact with the planners responsible for those plans, e.g., transportation planners engage with land-use plans and their creators. Such interactions promise to reveal more nuanced qualities of the plan network than the mere alignment of plan content can show. Interactions may capture, e.g., how planners reference the goal of polycentric development mentioned in another strategic plan in order to argue for neighborhood centers in their own plan, and such interactions may be one-way or mutual, and supportive or contradictory (Bacău et al., 2020). Notably, references can also be negative, if planners argue against another plan or against a certain planning intention included in that plan.

A plan's relative efficacy: Not all plans within a network are equally important for a region's governance. For example, some strategic plans influence others and shape the development of a region, while others are ineffective for a variety of reasons (Oliveira & Hersperger, 2018). It is therefore helpful to understand the relative efficacy of all plans in a network. By efficacy, we mean the extent to which strategic spatial plans can facilitate or hinder the local implementation of concrete development strategies (Palka et al., 2021). Governance performance and the impact of external forces are key components for conceptualizing and assessing the efficacy of strategic planning (Palka et al., 2021). Following Palka et al. (2021), with the term governance performance we refer to the dynamics of plan-making and plan implementation endogenous to an urban region. It reflects, e.g., the region's experience with strategic planning, trust in the planning process, and the participation of

a broad range of actors. External forces include plan influences that are exogenous to the region, such as national regulations, wider social and environmental concerns, and competition with other regions, that can influence the likelihood of plan implementation.

3. Methods

Below, we first provide an overview of the planning area. We next describe our criteria and rationale for selecting which plans to include in the study and introduce the individual plans. We then explain how we collected data, from the plans themselves and from interviews and questionnaires targeting the relevant planning actors, to enable our analysis of the alignment of plan content, interactions, and each plan's relative efficacy, considering its governance performance and external forces.

3.1. Study area: the Austin region

Metropolitan Austin connects the main urban regions of Texas with each other, with Dallas–Fort Worth to the north, Houston to the east, and San Antonio to the south. The five-county region boasts low unemployment and a high quality of life, and has attracted a rapidly increasing population over the last several decades. While much growth has been concentrated in the City of Austin, ranked among the 20 fastest-growing US cities, the wider metropolitan region—which includes the counties of Travis (in which Austin is located), Bastrop, Caldwell, Hays and Williamson—is also expanding at a rapid clip. Indeed, greater Austin was among the fastest growing large US metropolitan areas from 2010 to 2020 (Austin Chamber of Commerce, 2021).

A number of planning efforts over several decades have acknowledged that economic and physical growth have dramatically changed the landscape of Austin and its surrounding counties, and several have promoted steps to better manage future growth (Zhao et al., 2020). As in almost all US metropolitan regions, however, land-use authority lies with the local city and county governments (Lewis & Margerum, 2020). The regional coordination of local growth and development depends largely on voluntary action (Rosan, 2016) and has had limited impact (Allred & Chakraborty, 2015).

3.2. Plan selection

We used the following criteria to bound the network of plans in our study. First, recognizing the extreme growth pressures facing the region, we sought strategic plans, i.e., each individual plan had to articulate a vision for guiding and coordinating medium- to long-term territorial development within the urban region. Second, we selected plans with spatial implications across multiple domains, including built-up areas, natural areas, and transportation systems. We further sought to include plans produced by a range of key jurisdictional authorities and representing several major interests. Following this rationale, we identified five strategic plans that fulfill these criteria, address the greater Austin region, and were issued between 2003 and 2019 (Table 1). Except for Envision Central Texas (ECT), all plans were issued by government entities. All plans are public, and we retrieved them from the websites of the planning authorities in charge. Together, these are the main planning instruments that have guided urban development in the Austin region since 2000 and that articulate a strong focus on designing and implementing "compacted and connected" forms of development in the region.

Envision Central Texas (ECT) formed in 2001 as a non-profit organization in Central Texas to catalyze a regional visioning process across the Bastrop, Caldwell, Hays, Travis and Williamson counties. Its board of directors represented broad constituencies concerned with growth, including business, government, and neighborhood, environmental and social equity groups (Steiner, 2011). In 2003, ECT compiled four possible growth scenarios and convened numerous public sessions to identify one preferred growth scenario for the Central Texas region, which emphasized cooperation to preserve and enhance the region's natural resources, economic vitality, social equity, and quality of life (Envision Central Texas, 2003). Its impact has reverberated through later plans in the Austin region (Steiner, 2018).

The *CAMPO 2035 Regional Transportation Plan*, referred to as the regional transport plan in this paper, addresses future transportation needs in the five-county Austin region and was produced by the region's Metropolitan Planning Organization (MPO), the *Capital Area MPO or CAMPO*. Under US law, MPOs are federally required planning bodies that work in all urbanized areas with populations over 50,000 to develop a 20-year (long-term) regional transportation plan and a near-term capital program to guide and coordinate regional transportation investments (Lewis & Margerum, 2020; Sciara, 2017). The regional transport plan calls for a regional transportation system that would improve economic opportunities, quality of life, and environmental stewardship, and it encourages new growth in compact mixed-use activity centers, where jobs, housing, and services are connected by roads and transit routes (Capital Area Metropolitan Planning Organization, 2010).

The *Travis County Land, Water and Transportation Plan (TCLWTP)* referred to as the Travis County plan in this paper, provides a 25-year vision for the county, to protect its land and water resources, build effective transportation and parking systems, and deliver appropriate services to all residents. The plan area includes 22 municipalities from Travis County and their Extra-Territorial Jurisdictions. The Travis County Plan sets long-term goals and policies that the Travis County Commissioners Court uses to guide development and conserve land and water resources in unincorporated areas of Travis County and to facilitate collaboration among local and regional agencies and governments (Travis County Commissioners Court, 2014).

The *Imagine Austin Comprehensive Plan (IACP),* referred to as Austin's comprehensive plan in this paper, is the current spatial plan guiding development of the City of Austin. A central plan aim is to prevent land overcrowding and to avoid undue concentration or diffusion of population or land uses (Austin City Council, 2012). The City of Austin engaged extensively with the public over two years, using surveys, public meetings, travelling teams, and other innovative approaches to secure public input in the development of the plan's vision and the plan itself. The plan has been recognized for its best practices in civic engagement, innovation and comprehensive community planning (Austin City Council, 2012; Steiner, 2018).

Table 1
Spatial plans investigated in this study, listed in order of the date issued.

Plan (abbreviation)	Issued	Time horizon	Issuing authority	Area covered
Envision Central Texas (ECT)	2003	2043	Envision Central Texas non-profit organization	Travis, Williamson, Bastrop, Hays, and Caldwell counties
CAMPO 2035 Regional Transportation Plan (CAMPO)	2010	2035	Capital Area Metropolitan Planning Organization (CAMPO)	Travis, Williamson, Bastrop, Hays, and Caldwell counties
Imagine Austin Comprehensive Plan (IACP)	2012	2039	Austin City Council	City of Austin
Travis County Land, Water, and Transportation Plan (TCLWTP)	2014	2035	Travis County Commissioners Court, Transportation and Natural Resources department	Travis County
Austin Strategic Mobility Plan (ASMP)	2019	2029	Austin City Council	City of Austin

The City of *Austin Strategic Mobility Plan (ASMP)* (2019), referred to as Austin's mobility plan in this paper, draws on mobility corridor studies to identify ways to improve safety, to increase mobility and accessibly for drivers, pedestrians, bicyclists and transit users, and to create better regional connections. Austin's mobility plan was also intended to inform the revision of Austin's Land Development Code, which was anticipated to include incentives for compact and transit-oriented development and complete streets, in line with "compact and connected" development (Austin City Council, 2019).

3.3. Data collection and analysis

We analyzed the network of these five strategic plans using content analysis of plan text, interviews, and questionnaires (Table 2 and Fig. 1). Further, we conducted separate analyses for each of the three domains: built-up areas, transportation, and natural areas (forests, agricultural land, conservation land). Some plans address additional domains, such as water management and social aspects, but we did not analyze these aspects.

3.3.1. Assessing alignment of plan content

We sought first to understand how the five plans in the network align in terms of content. We carefully reviewed the text of each plan to observe whether a plan specifically referenced another plan by name and whether the plans shared discrete planning intentions, with or without attributing them to the other plan (Bacău et al., 2020). Thus, we searched for the names of plans adopted earlier than the plan under study. We began our analysis with the second plan to be adopted, MPO's transportation plan, and searched for the name of the preceding plan, Envision Central Texas. We examined the third plan (Austin's comprehensive plan) for references to the two previous plans and continued in this way until we had searched all plans. To analyze specific planning intentions, we first extracted statements addressing all goals, policies, and recommended future actions mentioned in each plan, then identified instances of alignment across plans in these discrete statements.

3.3.2. Assessing interactions and plan's relative efficacy

To collect data specifically about interactions and about the relative efficacy of the plans in our network, we conducted 20 in-person interviews with relevant agency staff and experts, and we also asked the interviewees to complete questionnaires.

We identified target respondents for the interviews based on: (i) their knowledge about the overall planning process (both plan-making and implementation phases) for one or more of the five plans in the sample; (ii) their expertise in regional and local planning and policy related to transportation, urban areas, and natural lands; and (iii) their knowledge about the dynamics of land-use changes over time. We selected respondents using a snowballing principle. With this procedure, we selected 20 interviewees to represent: (i) academic consultants, (ii) governmental planners and (iii) private organizations (for information on the interviewees and rationale for their selection see Appendix B). We conducted the interviews in May and June 2019 in Austin, Texas and Philadelphia, Pennsylvania. Each interview lasted approximately 60 min.

We recorded and fully transcribed all interviews and then used content analysis to extract respondents' statements about interactions. We noted instances where respondents referred to other plans, by mentioning working on similar goals to support another plan, or by pointing to cases where interaction was lacking.

We further asked each interviewee to complete a questionnaire about each plan, and we used this information to quantify the relative efficacy of each plan. The questionnaire, developed by Palka et al. (2021) and Palka et al. (2022a) for calculating efficacy values with an Analytical Hierarchical Process, collects respondents' assessments of how strongly (i) various governance performance factors and (ii) various external forces serve to facilitate or hinder strategic plan development and implementation. It asked respondents to quantify the strength of these factors or items (see Appendix A), using a scale of 0 to 2 for governance performance items and − 3 to 3 for external forces, and we assigned relative weights through pairwise comparison (for details on data collection with the Analytical Hierarchical Process see Appendix C).

Each respondent completed one questionnaire for each plan that they were knowledgeable about. Respondents who were knowledgeable about more than one plan completed the corresponding number of questionnaires. We also asked respondents to comment on their choices by explaining, e.g., why they gave the maximum or minimum value to an item or by illustrating their choices with concrete examples or more details. Following this procedure, we collected 25 valid questionnaires and related comments from the 20 interviewees (ETC 4, CAMPO 3, TCLWTP 4, IACP 12, ASMP 2). We checked the data quality by assessing the variation of the answers between different interviewees with the coefficient of variation. Most of coefficients of variation are between 0.2 and 0.4, indicating the data is valid for further analysis and that our sample is sufficiently large. We then followed the data transformation procedure outlined by Palka et al. (2022b) to derive a numerical value indicating the strength of governance performance, external forces, and plan efficacy for each plan.

Table 2
Data and measures for testing the framework for network-of-plans analysis.

Framework components	Data used	Measures
Alignment of plan content	Plan text	- References to other plans - Evidence of shared planning intentions
Interactions	Interviews	- References to other plans - References to other planning agencies / their staff
Plan's relative efficacy	Questionnaires	- Plan efficacy · Governance performance · External forces

4. Results

In the following section we present the results of our network-of-plans analysis, discussing the alignment of content across plans, interactions between actors and agencies, and each plan's relative efficacy. Within these components of our analysis, we review our findings for the three distinct planning domains: built-up areas, transportation, and natural areas.

4.1. Alignment of plan content

We find overall that the five plans in our study form a network characterized by many common planning intentions, as reflected in goals, policies and recommended actions that are similar across the plans. Fig. 2 uses arrows to depict these shared planning intentions, revealing fairly strong overall alignment of plan content within the network. We arrange plans in the network chronologically, moving clockwise in the figure from the first plan adopted (Envision Central Texas in 2003) to the last (Austin's mobility plan in 2019). For each document, we show with dashed arrows the domains (built-up areas, transportation, natural areas) in which substantive planning intentions align with those in earlier plans. We further note with bold arrows where a plan not only shares substantive intentions with an earlier plan but also explicitly references or names that earlier plan.

In some cases, a plan shares planning intentions with an earlier plan; such alignment within transportation, for instance, is visible in Fig. 2 between two plans (CAMPO's regional transport plan, Austin's mobility plan) and the 2003 Envision Central Texas plan. We also see that intentions for natural areas in Austin's own mobility plan align with natural area intentions in the city's comprehensive plan and the regional

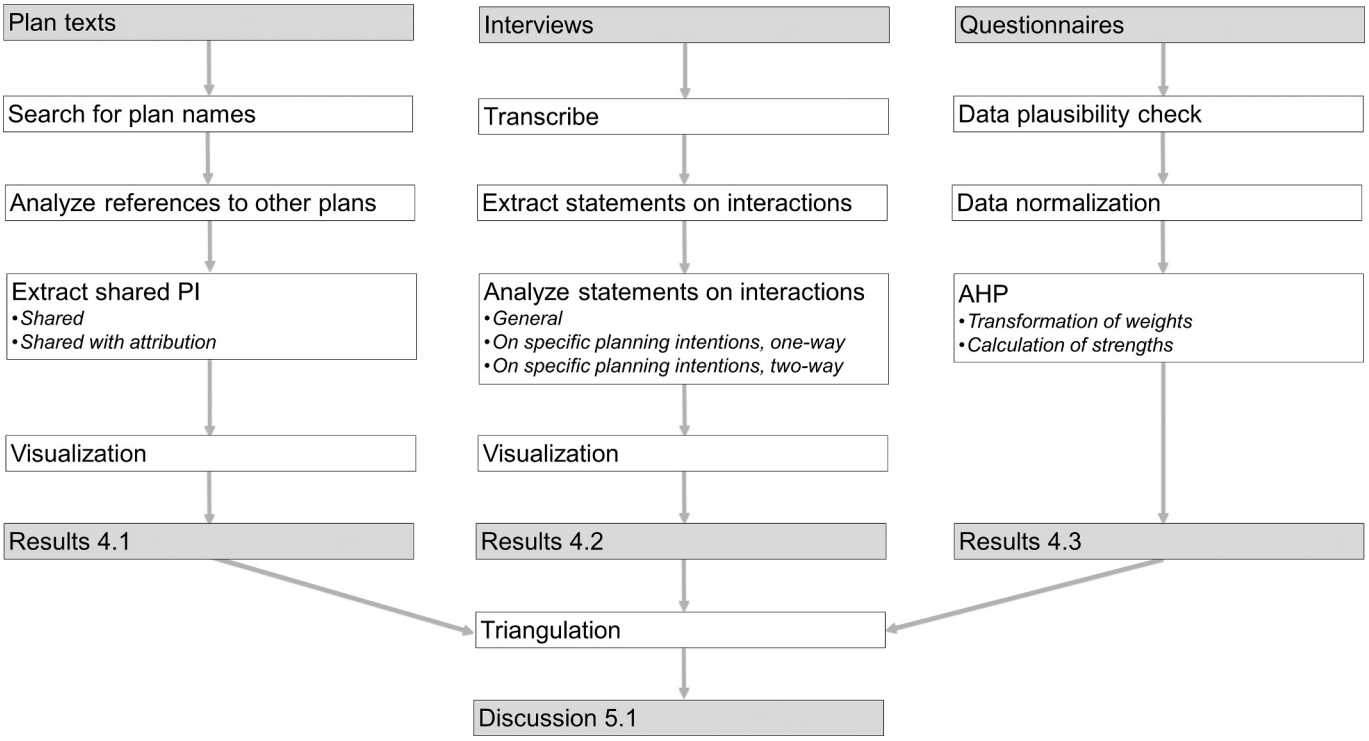

Fig. 1. Data analysis procedure. PI stands for Planning intention.

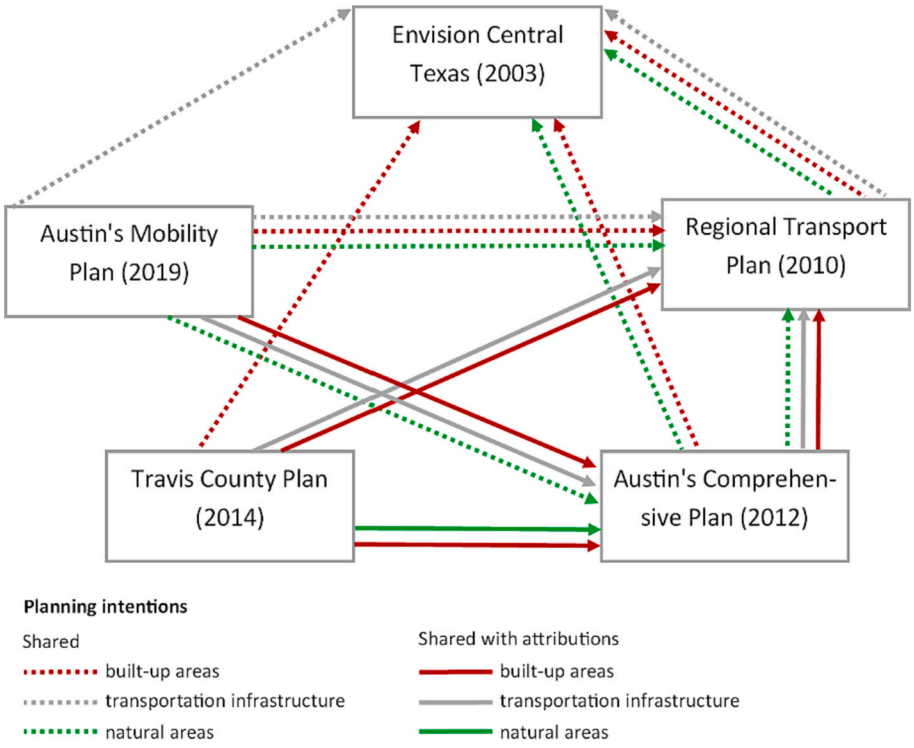

Fig. 2. Alignment of plan content, based on shared planning intentions. For each document, dashed arrows show the domains in which planning intentions align with those in earlier plans. Bold arrows show where a plan not only shares substantive intentions with an earlier plan but also explicitly references or names that earlier plan.

transport plan. In many cases, we observe an even stronger connection, where an explicit reference or attribution is made to the earlier plan to highlight the corresponding planning intention. For example, the Travis County plan not only shares planning intentions for built-up areas with Austin's comprehensive plan, but also references the comprehensive plan by name.

We observe especially strong alignment of planning intentions between Austin's 2012 comprehensive plan and the earlier regional transport plan. The Austin comprehensive plan references the regional transport plan regarding available funding for transportation projects

(including roadway, public transportation, and bicycle and pedestrian projects), and the future built-up areas noted in Austin's comprehensive plan reflect the centers of future development designated in the regional transport plan. We also find that planning intentions for environmental protection and greenhouse gas emissions reduction in Austin's comprehensive plan align with those in the regional transport plan.

Beyond the considerable alignment of content between Austin's comprehensive plan and the regional transport plan, we also observe that both plans reveal the legacy of the earlier Envision Central Texas visioning process. The Envision Central Texas vision is reflected, e.g., in regional transport plan intentions regarding the provision of highways and a multi-modal transportation system; the focus on polycentric future development directed toward compact, dense mixed-use centers; the conservation of ecologically sensitive lands; and measures to minimize transportation-related air pollution. Further, the Austin comprehensive plan discusses in its introduction that its plan-making process explicitly considered Envision Central Texas. The comprehensive plan also aligns notably with Envision Central Texas by focusing on compact and connected urban growth, infill development, and connected greenways and waterways throughout the city.

The legacy of Envision Central Texas planning intentions is visible in later plans as well. For instance, Austin's mobility plan promotes transit-supportive densities, multimodal transportation expansion, and completion of sidewalk, bicycle and urban trail systems—all transportation intentions in line with Envision Central Texas.

For the one Travis County plan examined in our network, we find strong alignment with the regional transport plan and Austin's comprehensive plan. The Travis County plan references the regional transport plan by name in its introduction and specifically identifies common transportation projects, including construction of a Colorado River bridge connecting Burleson Manor Road to SH 71, as well as common land development intentions for a network of high-density mixed-use centers oriented around transportation investments. Further, the Travis County plan supports implementing Austin's comprehensive plan's centers concept and other Austin goals, including directing development away from sensitive environmental resources, and protecting existing open space and natural resources.

In Austin's mobility plan, the most recently adopted plan in the network, we found that planning intentions were shared between the regional transport plan and Austin's comprehensive plan, especially regarding transportation goals. Like the regional transport plan, the comprehensive plan anticipates new roadway connections and enhanced highway system capacity. It also mentions explicit policies to support the transportation goals of Austin's comprehensive plan. Further, Austin's mobility plan outlines a fast, reliable, and efficient transit priority network that links land use with transportation, explicitly following the growth concept and supporting the activity corridors and centers in Austin's comprehensive plan.

4.2. Interactions

We drew on interviews for the second component of our analysis, to learn about plan network interactions, including collaborative activities or strategies among planning actors at different levels. We mapped where planning actors themselves discussed how one plan influenced another plan in general (Fig. 3a) and how specific planning intentions from one plan were reflected in another plan (in Fig. 3b).

First, we found that stakeholders view Envision Central Texas as influential and reverberating in later plans, especially in Austin's comprehensive plan and, to a lesser extent, in the regional transport plan (Fig. 3). Experts emphasized that the large-scale scenario-based planning process and massive citizen participation of Envision Central Texas created foundations that strongly influenced those later planning efforts.

Interviewees emphasized that Austin's comprehensive plan adopted important ideas from Envision Central Texas in its planning intentions addressing open-space planning, transportation, and development centers. As one planner said:

> "[…] Envision Central Texas was responsible for Green Print, and the Green Print was used in open-space planning for [Austin's comprehensive plan …] Then, much of the transportation research that was used by Envision Central Texas was important for [Austin's comprehensive plan…] last, the centers concept."

Second, we learned that the influence that CAMPO and its regional transport plan have on Austin's comprehensive plan—visible in its planning intentions for transportation, including roadways, public transportation, and bicycle projects—appears linked to the funding that CAMPO approves. Various interviewees noted that collaboration between the City of Austin and CAMPO was motivated primarily by Austin's need to secure transportation funding to implement specific projects through the MPO; beyond this collaboration, the city is perceived as acting fairly independently within the region. A similar dynamic is visible between the Travis County plan and CAMPO's regional transport plan; the planning experts we interviewed described Travis County coordination with CAMPO mostly in terms of funding of transportation projects.

Planners also described how the region's MPO works to reflect local government planning intentions in updates to its regional transport plan, required every five years by federal law. For instance, interviewees in Travis County and the City of Austin noted that CAMPO had used

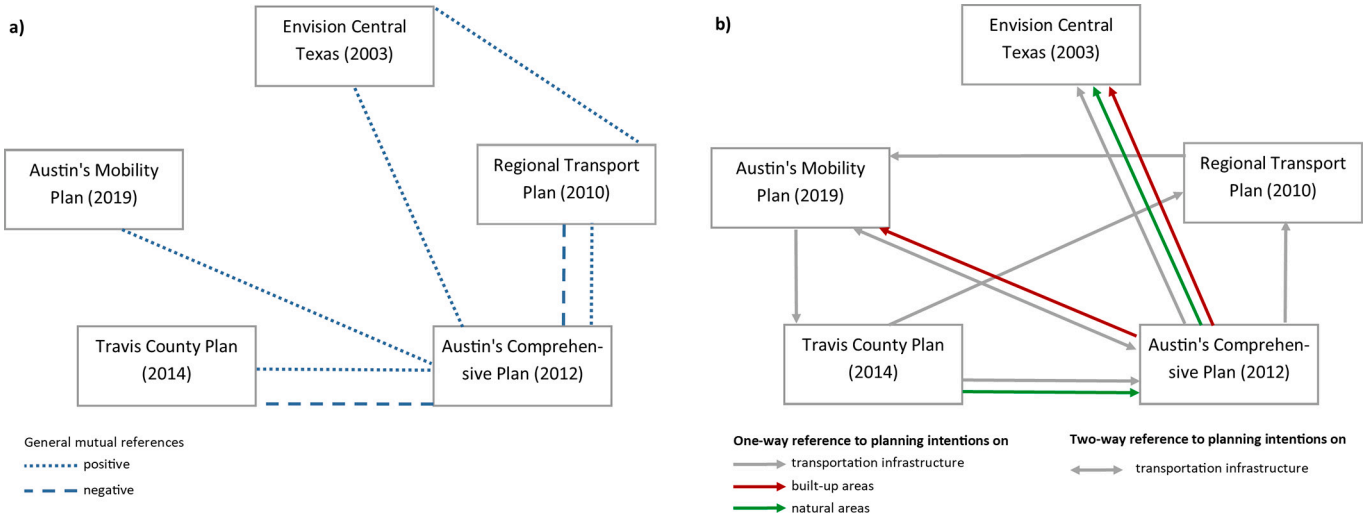

Fig. 3. Interactions with other plans, based on interviews. Fig. 3a shows where planning actors themselves discussed how one plan influenced another plan in general (Fig. 3a) and how specific planning intentions from one plan were reflected in another plan (in Fig. 3b).

recent plan updates to incorporate planning intentions from the Travis County plan, as well as the maps, roadway recommendations, and projects from Austin's mobility plan.

Despite this evidence of CAMPO's interactions with other plan-making entities in the region, some respondents characterized the role of the MPO in our study area as comparatively weak:

> "in other MPO regions, the MPO is much more engaged in coordinating and helping all of the different entities come together and build a plan, […] that is not what happens in this region."

Interviewees offered similarly divergent assessments of interactions between the City of Austin and Travis County. On the one hand, respondents noted that the two jurisdictions collaborate during plan-making; staff a joint development services office and coordinate on day-to-day decisions; and work on transportation projects together, especially for county-owned roads situated in the city. One planner recounted that the city:

> "[…] did work pretty close double-checking roadway recommendations and making sure that we were matching up [with the County] because a lot of the roads go in and out of jurisdiction between us and them."

On the other hand, many respondents also highlighted poor coordination between them:

> "[…] they really are not coordinated. […] they are really not looking at the development regulations in the Travis County compared to the City of Austin, and each…is kind of doing their own thing."

We also learned that interviewees consider coordination between the city's mobility plan and its comprehensive plan to be relatively strong, particularly with respect to transportation and projects on built-up land (Fig. 3b). Experts mentioned that the two plans focus on developing corridors, accessible sidewalks, and multimodal transportation; on creating a more compact and connected city; and on increasing density along the corridors and key centers. Respondents attributed the strong link between the plans to the fact that some of the same planning staff worked on both the comprehensive plan and the mobility plan that followed later. Also, the mobility plan is designed to be the more focused strategic plan for delivering the transportation components of the comprehensive plan. One planner explained:

> "[…] that's why there are so many similarities between the two: on our part, programs are based on outcomes, and they've got outcomes; they've got metrics, and we've got metrics. So, it's very similar."

Further, Austin's mobility plan does not have a separate budget but rather reorganizes and prioritizes the resources identified in the comprehensive plan.

4.3. Plan's relative efficacy

In the final part of our analysis, assessing plan efficacy, we used the questionnaire described in Section 3.3 for planners to gauge the extent to which plans in the network might facilitate or hinder local implementation of tangible development strategies. A plan's efficacy score –between 0 and 1.0 – reflects both governance performance in the region and the external forces shaping a plan's potential impact in the region. Higher efficacy values represent greater plan importance.

We find that plan efficacy for all plans and domains (i.e., built-up areas, transportation, and natural areas) is rather high, with most values between 0.5 and 0.7 (Table 3), suggesting that all five plans have a roughly comparable potential to shape development in the region. Still, we note that the efficacy values are somewhat lower for the regional transport plan and Austin's comprehensive plan than for the other plans, a result that we explore further in the discussion. The lowest values in individual domains are found for the regional transport plan; respondents scored the regional transport plan's importance for both built-up and natural areas at 0.4 (Appendix D). This result is somewhat expected, as this is a transportation plan.

We note that across all plans the efficacy value for built-up areas is lower than values for natural areas and transport. This suggests that planners see all plans in the network as broadly challenged in shaping settlement and development patterns in the region. The plans are seen to have more potential impact for shaping transport and preserving natural areas.

5. Discussion and conclusions

We analyzed the five strategic plans of Austin, Texas with multiple methods in this network-of-plans analysis. The empirical data reveal the existence of a rich and multifaceted plan network, alive in plan documents and strategies and in the consciousness of planning agents. In this discussion, we present a consolidated view on the network, reflect on our analytical framework, address limitations and future research questions, and provide concluding observations.

5.1. The network of strategic plans in the Austin region

Consistent evidence of the influence of the regional visioning process through Envision Central Texas emerges across all three components of the framework, even 20 years later. Planners see Envision Central Texas as influential and reverberating across later plans, especially Austin's comprehensive plan and CAMPO's regional transport plan. This lasting impact is striking, at first blush, given that Envision Central Texas was a voluntary effort. Evidence of the effect of voluntary participative regional scenario planning processes is somewhat scarce. Allred and Chakraborty (2015) found that regional scenario plans may not result in supportive local plans without appropriate funding for the envisioned spatial development. Yet, Sherman and Chakraborty (2022) found that voluntary regional visioning efforts in Madison, Kansas City, and Boston, comparable to Envision Central Texas, did influence planning norms across the region in ways not immediately apparent in plan documents. This dynamic might also be at play in our study area.

Interactions across government authorities are driven considerably by pragmatism, and especially by funding schemas, in our study. Indeed, discussions with planners suggest that money is the mechanism through which CAMPO's regional transport plan has influence. Margerum et al. (2019) similarly found that transit investments impacted the adoption of regional visioning process outcomes in local comprehensive plans. Also, federal planning requirements may explain CAMPO's efforts to reflect in its own regional plan the intentions from earlier city and county plans.

For these reasons, the five plans in our network work synergistically regarding transportation goals. Clearly, one means of encouraging coordination among local planning efforts is to incentivize local governments to participate in and align with regional efforts, for example through the allocation of transport funds (Margerum et al., 2019). However, since the metropolitan arena is filled with public and private actors at many levels who are active in all sectors of urban policy, the MPOs are rarely able to influence local land-use decisions (Sciara, 2020a,

Table 3
Plan efficacy values [from 0 to 1] for the five plans of Austin, Texas (USA). Values are given for the domains built-up area (B), transportation (T), and natural area (N).

Plan efficacy			
	B	T	N
Envision Central Texas	0.6	0.7	0.7
Regional transport plan	0.4	0.6	0.4
Austin's comprehensive plan	0.5	0.6	0.6
Travis County plan	0.7	0.7	0.8
Austin's mobility plan	0.6	0.8	0.6

2020b), and collaboration across all domains and jurisdictions is needed.

A somewhat surprising result is that efficacy scores were lower for the regional transport plan and for Austin's comprehensive plan than for the other plans in the network (Table 3). Because we simultaneously find comparatively good alignment of plan content and many interactions between these two important plans (Figs. 2 and 3), we cannot confirm a relationship between efficacy and measures for plan alignment and interactions in our network of plans. The detailed results in Appendix D show that the low scores for Austin's comprehensive plan stem from respondents' perception that the impact of this plan on local implementation and concrete development strategies depends heavily on exogenous influences (such as competition with other regions). The low efficacy scores for the regional transport plan are driven largely by a single factor—"multilevel agency cooperation during plan implementation"—which scored exceptionally poorly. Investigating the reasons behind these assessments would be interesting for practitioners and researchers alike.

5.2. Framework

The three-part analytical framework used here has helped us to construct and tell a story about governance in greater metropolitan Austin, reflecting the planning efforts in this region and how they relate to and influence each other. The framework provides a language and systematic method for describing these relationships and is therefore valuable for understanding planning in the context of multiple strategic plans active at different administrative levels and addressing multiple domains. This analytical framework provides a strong complement to the narratives occasionally reported in the planning literature about how plans have influenced others over time (e.g., for the Austin region in Le Guen, 2017, Steiner, 2018).

One particularly useful aspect of the three-part framework was that it compelled the collection, assessment, and comparison of evidence and measures from different sources—the text of the plans themselves, and the observations and evaluations of the planners who develop and apply them. This variety of data paints a more nuanced picture. For example, textual analysis revealed shared planning intentions between many plans (Fig. 2), while interview data suggested fewer connections (Fig. 3). Because existing network-of-plans studies have focused on plan documents, it is difficult to know whether such nuances are also detectable in other networks, indicating a general pattern, or only in our study area.

In addition to this framework, this study offers two important innovations. First, its focus on interactions greatly enhances the far more limited view of plan networks that is available from analysis of policy documents alone. Second, the study accounts for the often-neglected fact that not all plans in a network are equally effective. A novel mix of quantitative and qualitative methods allows for these innovations. The contribution of this study to planning science is thus to be seen in particular in the development and testing of the methods presented.

5.3. Limitations and future research

While our results support a noticeably coherent narrative about the network of plans in question and resonate with existing literature on plan networks and regional visioning, we note here the specific challenges and limitations of our work. Our method enabled us to detect the presence of shared planning intentions and interactions among actors and agencies, but it did not allow the quantitative assessment of those connections. For example, the links or lines depicted in Figs. 2 and 3 represent shared planning intentions and interactions but do not communicate the strength of those connections. We caveat that our visualizations of study results are more conceptual than quantitative. There is room in future research to measure interactions more expansively, perhaps capturing further data on interactions, e.g., from formal memoranda of agreement or collaborative programs. As does any case study, our research has limits with respect to generalizability. The dynamics revealed in this in-depth investigation of planning governance in the Austin Texas, region may not apply in different regional contexts with different planning institutions. While we recognize these limits to its generalizability, we expect our research to generate hypotheses about and inform further research on networks of plans.

Since theoretical and empirical research on networks of plans is fairly nascent (Berke et al., 2019, Woodruff et al., 2022), many questions remain open and could be addressed with further innovation in conceptual development, research methods, and data. To begin, conceptual development is needed, e.g., to address the temporal dimension in a network: plans are developed, put into effect later, and then—more or less—regularly updated. Plans can also expire and be replaced by other plans, or not. Future research should thus develop means to explicitly recognize plan updates in the framework. Further, future research could also test the analytical framework and methods in other planning contexts, i.e., in urban regions with more complex networks of plans and strongly interrelated strategic and land-use plans. For studying larger networks of plans, the use of natural language processing should be explored. These computational techniques have been used successfully to identify areas of topical emphasis in 461 city-level general plans in California (Brinkley and Stahmer, n.d.) and to investigate vagueness in 36 urban transport plans in France (Buhler, 2021). A normative research approach could also advance the understanding of networks of plans. For example, common planning intentions could be ranked according to their importance and promoted according to the plan's effectiveness. Finally, future research on urban regional governance and on networks of plans ought to, at minimum, investigate the three domains captured in this study: built-environment, transportation, and natural areas. Our results clearly show distinct patterns for the three domains, confirming the observations of Palka et al. (2021) and suggesting parallel but interrelated sub-networks, an idea that should be explored further. For example, research should develop means to compare a network of all plans in a region with a focus on the natural area with a corresponding network with a focus on the built environment.

6. Conclusions

The interactions among different plans in an urban region are very complex. They are not well understood, and the scientific community does not have the necessary tools to analyze them. To contribute to closing this research gap, we investigated the governance of an urban region with a network of strategic plans. To this end, we applied an analytical framework, based on alignment of plan content, interactions, and relative plan efficacy, to five strategic plans adopted over the past 20 years to address the built environment, transportation system, and natural areas in the region of Austin, Texas.

The results of this network-of-plan analysis show that the voluntary regional visioning effort known as Envision Central Texas retains a palpable legacy in the region, that plans work most synergistically with respect to transportation goals, and that the framework's three components and associated measures provide a more complete picture than an analysis of plan content alone.

Our work confirms Lieberknecht's (2023) conclusions about the importance of looking beyond individual plans and explicitly addressing how a network or group of plans function together, be it synergistically or counterproductively. The analytical framework proposed and tested in this study can support such research and promises to expand our understanding of whether, under what circumstances, and how a network of plans can perform as a means of regional governance. We also see ample room for further theoretical and methodological development in this space.

Credit authorship contribution statement

Anna M. Hersperger: Conceptualization, Writing – original draft, review & editing, Funding acquisition.

Gian-Claudia Sciara: Conceptualization, Writing - review & editing.
Simona Bacău: Data analysis, writing.
Carole S. Imhof: Data analysis.
Chunhong Zhao: Data collection, Data analysis.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Components of the analytical hierarchical process model (Palka et al., 2021)

Items as input for governance performance

Experience in strategic spatial planning
Strength of coordination
Negotiation towards consensus
Involvement of citizens
Involvement of experts
Involvement of interest groups
Assigning regional authority in charge of strategic spatial planning (regional leader/election by citizens)
Trust in plan-making
Knowledge of funding scheme
Multilevel government cooperation
Regional planners

Items as input for external forces

National regulations
Devolution of spatial planning competences
Political cooperation between urban region and state
National and/or international private actors
Competition with other urban regions
Societal environmental concerns

Appendix B. Information on the interviewees and rationale behind their selection

Type	#	Rationale	Plans
Academic consultants	2	1. Knowledge on making and implementing processes of ECT and IACP	ECT and IACP
		2. Knowledge on making and implementing processes of ECT	ECT
Governmental planners	15	3. Knowledge on making and implementing processes of IACP; recommended by another interviewee	IACP
		4. Knowledge on implementing process of the transportation bond program	CAMPO 2035 and IACP
		5. Role and experience in the management of IACP	IACP
		6. Role and experience in the management of IACP	IACP
		7. Expertise in citywide policy initiatives	IACP
		8. Role in the management of IACP; recommended by another interviewee	IACP
		9. Role in transportation-related planning and policy initiatives	ASMP and IACP
		10. Experience in long-term transportation policy and planning; recommended by another interviewee	ASMP and IACP
		11. Expertise in the urban design and zoning applications based on IACP	IACP
		12. Role and expertise in TCLWTP and CAMPO 2035; recommended by another interviewee	TCLWTP and CAMPO 2035
		13. Role and expertise in TCLWTP and CAMPO 2035; recommended by another interviewee	TCLWTP and CAMPO 2035
		14. Expertise in developing and implementing policies and projects for Travis County; recommended by another interviewee	TCLWTP
		15. Role and experience in the management of TCLWTP; recommended by another interviewee	TCLWTP
		16. Role and experience in the management of TCLWTP; recommended by another interviewee	TCLWTP
		17. Role and experience in the management of CAMPO 2035	CAMPO 2035
Private organizations	3	18. Role and expertise in the IACP	IACP
		19. Knowledge on making and implementation processes of IACP; recommended by another interviewee	IACP
		20. Knowledge and role in making and implementation processes of ECT	ECT

Notes: ECT refers to *Envision Central Texas*; IACP refers to *Imagine Austin Comprehensive Plan*; TCLWTP: Travis County Land, Water, and Transportation Plan; ASMP refers to Austin Strategic Mobility Plan; CAMPO refers to *Capital Area Metropolitan Planning Organization Plan.*

Appendix C. Calculation of plan efficacy with Analytic Hierarchy Process (AHP)

Plan efficacy values were calculated following an Analytic Hierarchy Process (AHP) as described in Palka et al., 2021. AHP is a three-step technique for organizing and analyzing complex decision situations and processes. The steps taken in the present study were:

(1) Building the hierarchical schema.

(2) Collecting data on the strengths and weights of items in the schema.

(3) Calculating and reporting the scores.

1. Building the hierarchical schema

The hierarchical schema is based on the understanding of strategic spatial planning derived from the analysis of planning practices across European urban regions in Hersperger et al. (2018) and Hersperger et al., 2019). Plan efficacy was thus considered analytically as a combination of (i) governance (performance) and (ii) external forces. Governance performance was further simplified into a linear process consisting of two main steps: plan-making and plan-implementation.

The hierarchical schema is visible in the results reported in Appendix C. The schema of governance performance for plan-making is shown above the dashed line and for plan-implementation below the dashed line, both on the left. The schema for the external forces is shown on the right of the dashed line. Green boxes show items for which the values were gathered using the questionnaire (primary items); red boxes show items for which the values were computed (non-primary items). For a description and justification of the items, see Palka et al., 2021. Terms in square brackets in the following text refer to the items.

2. Collecting data on the strengths and weights of items in the hierarchical schema

Data was collected with a survey, using three types of questions: questions to obtain the strengths and weights of the governance performance items; questions to obtain the strengths and weights of the external forces items; and questions to gather the *relative* weights of governance performance and the impact of external forces.

The respondents were asked to quantify the strength of the primary items. For governance performance, responses were collected using a scale from 0 to 2. The value 0 meant, for example, that a given stakeholder had not participated in strategic planning. In contrast, the value 2 meant, for example, that a given stakeholder had been strongly involved in strategic planning. Intermediate values of 0.5, 1 and 1.5 were also possible. For external forces, the strength of an item was evaluated on a scale from −3 to 3. The value −3 meant that the external force significantly hindered the implementation of the content of the strategic plan, whereas a value of 3 indicated that the external force significantly facilitated the implementation of the content of the strategic plan.

Respondents further assessed the weight of each item on a hierarchical level through a pairwise comparison, for example, a comparison between [planning practice] and [coordination]. Therefore, the weight of an item (primary or non-primary) represents the assigned importance of this item relative to all other items. The weight of an item was thus determined by the respondents, through comparing pairs of items on the same hierarchical level on a scale of 1–9. A value of 1 indicated that the item on the left of the comparison was much more important than the item on the right. In contrast, a value of 9 indicated that the item on the left of the comparison was far less important than the item on the right. A value of 5 indicated that both items were of equal importance.

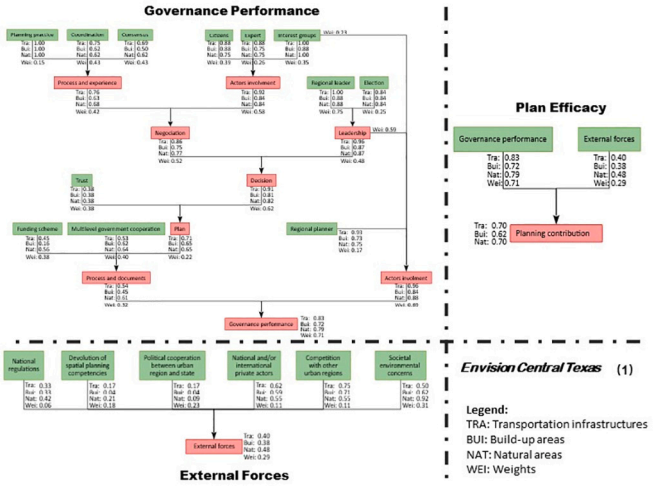
3. Calculating and reporting the scores

All calculations were done in Python with a script provided in EnviDat repository (Palka et al., 2022b). As the AHP requires weights between 0 and 1, the collected values for the primary items were first normalized using a simple linear transformation (range 0–1). For the items in the governance performance, the scores of primary items were divided by two to rescale the range 0–2 into the range 0–1. The transformation of the weights from the pairwise comparison into the weight for each item on the same hierarchical level, was performed according to Saaty's (1980) method and varied between 0 and 1. The strength of each non-primary item is the result of the sum of the products of the values and the weight of its constitutive items (items linked from above the hierarchical schema).

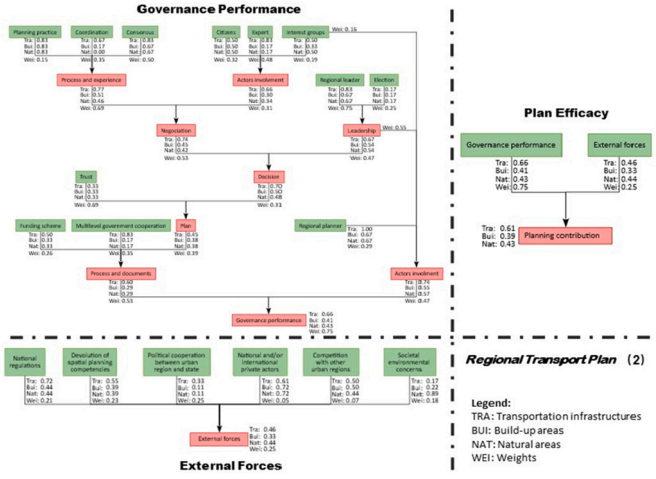
Illustration of Calculation: For Envision Central Texas (Appendix D), weights of 0.15, 0.43 and 0.43 for [planning practice], [coordination] and [consensus] items respectively, mean that [planning practice] accounts for 15 % of [process and experience].Thus, as weight of [planning practice] is lower than the weight of [coordination] or [consensus], a change of 0.1 in the value of [planning practice] has a lower impact on [process and experience] than the same change in [consensus] or [coordination].

If [planning practice], [coordination] and [consensus] for Transportation, for example, have strengths of 1.00, 0.75 and 0.69 respectively and their weights are the same as in the example above, the strength of the [process and experience] item for Transportation is $0.15*1.00 + 0.43*0.75 + 0.43*0.69 = 0.15 + 0.32 + 0.30 = 0.76$.

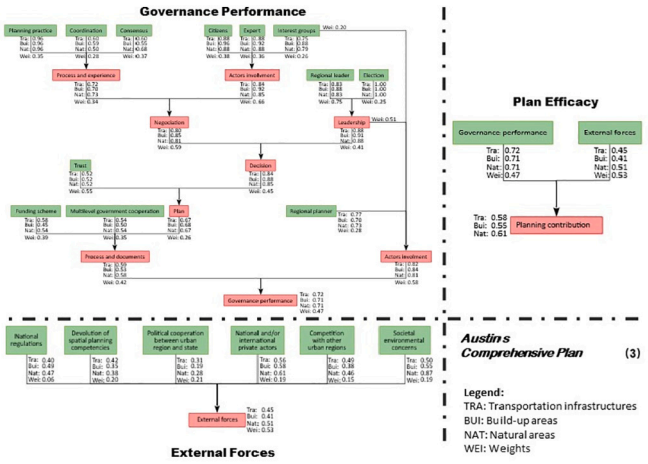
Appendix D. Detailed results on each plan's relative efficacy



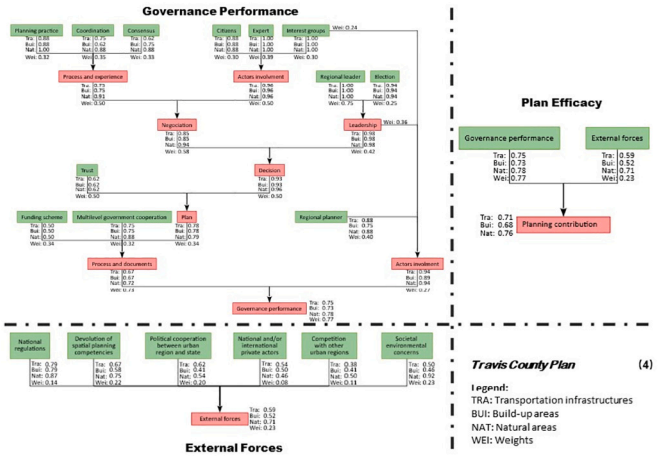
Envision Central Texas



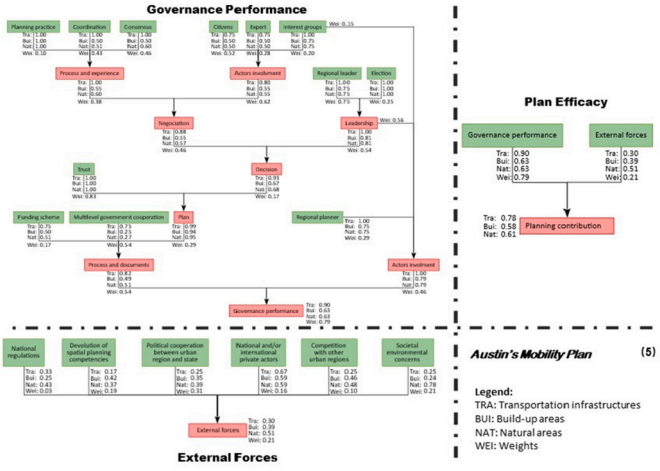
Regional Transportation Plan



Austin's Comprehensive Plan



Travis County Plan



Austin's Mobility Plan

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