Support in Policymaking: A Systematic Exploration of the Policymaking Process

Daniel Guzman Vargas[1,2] and Sidharta Gautama[1,2]
[1]Department of Industrial Systems Engineering and Product Design, Ghent University, Technologiepark 46, 9052 Gent-Zwijnaarde, Belgium
[2]Flanders Make, B-3920 Lommel, Belgium

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Abstract: Nearly all the public policy issues focus on complex social problems (sometimes referred to as 'wicked' problems). Failing to address such complexity may result in a weak formulation of the problem at hand and consequently to policy failure. A decision support system (DSS) appropriate for handling `wicked' problems in policymaking should help decision-makers cope with the problem's complexity, facilitate the assessing of multiple alternatives, and favour a discussion towards a common agenda. Making use of the above requirements, we present in this paper a methodology for a DSS that feeds from a frame representation of both expert knowledge and policy-related evidence to support decision-makers in the policymaking process. The application of the methodology in a specific use case suggests the methodology could be applied in a DSS for the identification of patterns and trends in policy-relevant data, the identification of possible policy configurations, and the drafting of alternative scenarios based on the possible configurations.

1 INTRODUCTION

The design of policies as effective solutions to social problems requires, from a policy science perspective, of sophisticated analysis on the facts with strong foundations on logic, knowledge, and experience rather than on political interests or the bargaining of conflicting interest groups. A weak analysis, and consequently failure to incorporate complexity, in the design and formulation of policies may lead to the failure of such policies (Howlett, 2012; Howlett et al., 2015; Schneider & Ingram, 2017), or to the 'creation of poor, even harmful, policies' (Cohn, 2004).

Complex social problems, sometimes referred to as 'wicked' problems, lack the sense of clarity that most of the problems in science or engineering have, where a problem statement can be clearly defined. These problems include nearly all of the public policy issues (Rittel & Webber, 1973), and a general conclusion seems to be that 'the methods for problem handling appropriate to pacified conditions do not transfer to more turbulent and problematic environments' generally ascribed to wicked problems (Rosenhead, 1996). Rosenhead (1996) suggests that when dealing with 'wicked problems', decision-makers are more likely to use a method and find it useful if it (a) accommodates multiple alternative perspectives, (b) can facilitate negotiating a joint agenda, (c) functions through interaction and iteration, and (d) generates ownership of the problem formulation and its action implications through transparency of representation. These requirements outline the specifications of a decision support system (DSS) appropriate to wicked problems.

According to Rosenhead (1996) the technical attributes of such a system include, the capability of **representing the problem complexity graphically** rather than algebraically or in tables of numerical results – to facilitate participation, allow for a **systematic exploration of the solution space –** 'lay people can generally express their judgments more meaningfully by choosing between discrete alternatives rather than across continuous variables', focus on the **identification of relevant possibilities** rather than estimation numerical probabilities, and the assessment of **alternative scenarios** instead of future forecasts.

In spite of the multitude of studies on policy analysis, policy failure, and policy transfer (Howlett et al., 2009), the authors have found no research

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focused on the development of such DSS. Making use of the above requirements, we present in this paper a methodology for a DSS that feeds from a frame representation of both expert knowledge and policy-related evidence to support decision-makers in the policymaking process.

The remainder of this paper consists of 4 parts. First, we develop a methodology for the systematic exploration of the solution space. Next, we apply the methodology to a specific use case; the development and implementation of *Urban Vehicle Access Regulations* (UVARs). We perform a small-scale experiment of 8 city case implementations, and finally, we present the conclusions from our findings and lay down possibilities for future work.

2 METHODOLOGY

The list of technical attributes in (Rosenhead, 1996) frames the design of the framework proposed in this paper. For this, our framework takes a systematic approach to define the solution space, guided, and supported by expert knowledge and policy-relevant information captured in city case studies.

Case studies can be used to assess a phenomenon (in this case the policy process) and its contextual conditions, relying on multiple sources of evidence to provide 'rich, thick description and analytic generalization' (Vogel & Henstra, 2015).

Case study research applied to policy processes relies on a large variety of sources such as official policy documents, meeting transcripts, council minutes, committee papers, etc. These data sources are rich in evidence to support the documentation of the different elements of the policy process (Vogel & Henstra, 2015), but at the same time pose a challenge to the researcher: 'case data is rich in qualitative detail'. As a result, the presentation of the empirical evidence in case study research is usually descriptive. However, as the number of cases increases, making a contrast between emergent theory, and a complete unbroken rendering of each case's story becomes infeasible (Eisenhardt & Graebner, 2007).

Additionally, a larger number of cases may drastically increase the volume of data which hinders researchers in the assessment and identification of important relationships.

These characteristics pose both a challenge and a motivation for the use of a decision support system. A DSS that could help policymakers draw relevant conclusions from the empirical evidence could support a large collection of multiple case studies.

But how can a DSS best find "patterns" from the textual description of the empirical evidence? For this, we take some inspiration from *content analysis*, 'a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns.' Consequently, the successful identification of patterns and relationships is highly dependent on the coding process (Hsieh & Shannon, 2005). The novelty of our framework is on developing a useful representation that could facilitate the identification of patterns in the description of empirical evidence, supported by expert knowledge, and working as a rubric for the collection of case data.

The methodology for the coding process consists of two main steps, the *parametrization of the solution space*, and the *definition of the Policy Life Cycle*. These two steps provide the coding categories, and their corresponding operational definitions, that provide non-binding guidance in the collection of case data, and that allow for a systematic interpretation of the empirical evidence, facilitating the identification of patterns, and underlying relationships, both within and across case analysis.

2.1 Parameterizing the Solution Space

In first instance, the relevant factors that interact in the development of a policy solution to a specific policy problem are identified and defined. Here three types of parameters should be considered: *contextual*, *control* and *time*.

Contextual parameters reflect the environment in which the policy problem is framed, the factors that can influence governmental decisions, and the elements that policymakers aim to influence with their decisions – these parameters define the context in which the policy problems take place. *Control* parameters refer to all the relevant factors that policymakers could control to implement their policies – these factors shape the overall policy from a strategic point of view. The third category refers to a single parameter: *time*. Social systems are dynamic, and so are policies (Hom, 2018). Time and timing in politics are a big deal. Timing can be a strategic tool (Djourelova & Durante, 2019); it can constraint the opportunity for the development of a policy – 'policy window' (Kingdon, 2014); and it defines the life-span of a policy – policy cycle (Howlett et al., 2009; Jann & Wegrich, 2017). Time helps define the dynamics of the policy process, providing coherence and logic to its narrative (Massey, 2017). Policymakers make decisions that affect and mould social systems, and consequently, this new state of the affairs demands a reaction from policymakers. This never-ending series of discrete events describes both the path taken by the policymakers in solving a policy problem and its implications and effects on the system.

The definition of the parameters is achieved through expert knowledge. A commission of experts consisting of academics, policy consultants, and other practitioners immerse in the implementation and development of such policies is put together to find a consensus on the parameters relevant to the policy process. Their input consists of the set of categorical parameters that best describe the policy context (*contextual parameters*) and the elements of the policy strategy (*control parameters*). The quality of the outcome of the methodology is therefore dependent on the quality of the expert's commission.

2.2 Definition of the Policy Life Cycle

In the process of defining the parameters of the solution space, the group of experts should be asked to think about the different stages that comprise the development of the policy strategy from its conception until after its implementation. For this, we refer the participants to the policy cycle for inspiration. The policy cycle intends to simplify the policy process by deconstructing it into discrete stages that describe the chronology of the policy process, starting with the *Agenda Setting,* where a problem is defined and recognized, and the need for intervention is expressed, passing onto *Policy Formulation*, where the objectives of a subsequent policy are defined and alternatives for action are considered. This is followed by the *Decision-making* stage, where the final adoption (final course of action) is formally set. Next, the *Implementation* phase*,* where the adopted policy is executed or enforced, and finally, the *Evaluation* stage, where the effects (intended and unintended) of the implemented policy are assessed in relation with the objectives previously set and the current problem perception (agenda). The outcome may lead to policy continuation, termination, or re-design (Howlett, 2019; Jann & Wegrich, 2017).

The policy cycle helps dive into the complexity of policymaking, providing guidance to action, and although it has been recognized that its application is by no means universal (‘practice varies from problem to problem’), the policy cycle is a good heuristic in policymaking for the answer to the question ‘what to do now?’ (Bridgman & Davis, 2003).

In our Framework, we rely on the policy cycle as a source of inspiration. Participants should be allowed to re-think and re-shape the stages in the way their experience find it more suitable. This new, “customized” definition of the policy cycle (hereinafter *policy life cycle*) is another output of our framework. Participants can make use of the *policy life cycle* as a tool to trigger the discussion on the parameters, both *contextual* and of *control*, that may play a role at each policy stage. Participants should be asked to describe all the factors of utmost relevance at each of the policy stages.

As proponents of the policy cycle propose, the fragmentation of the policy into stages allows for a more detailed view of the process. The *policy life cycle* is then used as a “custom” tool in the parametrization process that contributes to the definition of detailed elements that are part of a policy strategy and that may have been difficult to foresee at a higher level. Additionally, the linear temporality of the process provides streamlined thinking, and a conception of the parameters as changing elements in a policy as a timeline, i.e., as a sequence of discrete events describing the change of state of a (set of) parameter(s) as the policy matures. During this process, relationships between the parameters may arise and their use in finding new parameters not yet defined should be encouraged. However, participants should be asked to focus on the identification of the parameters only: the magnitude and characteristics of these relationships should not be discussed here.

3 THE UVAR CASE

To better illustrate the potential of the methodology, we apply it to the case of UVARs in Europe.

UVARs, in the broad sense, are measures to regulate the access of urban vehicles to urban infrastructure in order to cope with societal challenges that markets alone cannot. In general, such policies intend to deal with the negative externalities generated by traffic: pollution, congestion, traffic-related accident rates, etc. (Carnovale & Gibson, 2013; Elbert & Friedrich, 2019; Lopez, 2018). Given the range of objectives, magnitude of the problems, urban contexts, and political landscapes, UVARs may take many forms. Low emission zones (LEZs), for example, are designated areas where the access of polluting vehicles is restricted or penalized (Lopez, 2018). Congestion charging (CC) refers to the imposition of a fee to access congested areas during a specified time frame (Morton et al., 2017). Partial or total vehicle access bans such as a limited traffic zone (LTZ) (in Italian: *Zona a traffico limitato)* or a pedestrian zone. Traffic cell architecture where traffic between cells is limited by design (e.g., Barcelona

Superblock scheme). Or hybrid designs, e.g., CC with differential "emission" fees (Goddard, 1997).

With over 200 LEZs in place across Europe (Mudway et al., 2019), CC schemes present in major cities such as London, Stockholm, Milan, Superblock schemes in Barcelona and Vitoria-Gasteiz, and the LTZs predominant in Italian cities, the widespread of UVARs highlights the intention of decision-makers across Europe in dealing with negative traffic externalities through UVARs.

However, the implementation of restrictive policies, such as UVARs, is generally accompanied by strong public and political controversy, with public acceptability of a proposed UVAR playing a major role in determining, whether or not the proposed UVAR survives the policy process (Lopez, 2018; Morton et al., 2017). All in all, the extensive application of UVARs in urban areas across Europe poses a motivation for data-driven approaches that could satisfy the need for new and better implementations of such policies.

With this goal in mind, an expert commission consisting of academics, practitioners, and consultants with ample European experience in urban planning, transport planning, quality assurance, and development of urban mobility projects was set to follow our methodology. As a first result, the *policy (*UVAR*) life cycle* was defined by the experts' commission as consisting of four phases.

The *Ideation phase* covers the time span in which problems come to the attention of governments and a set of (conceptual) solutions emerges in response. The *Design phase* covers a time span in which UVAR measure's designs are developed in more detail. Multiple designs may be considered and assessed resulting in a proposal for the technical and strategic design of the UVAR measure. The *Implementation phase* involves executing the selected policy option. Involves all the necessary action to put the UVAR measure into practice. Finally, in the *Operation phase* all the activities following the launching of the full scale UVAR measure take place.

Additionally, during the definition of the *policy* (UVAR) *life cycle*, three "policy gates" were identified. Each "gate" refers to specific event(s) that determine the end of a phase (or the beginning of a new one). Together, the 4 phases and the 3 gates define the *policy life cycle* of an UVAR (Figure 1).

In the *Decision-making gate* the actual decision on a particular course of action to follow is made – selection of UVAR measure at a conceptual level. In the *Adoption gate* the final design is approved for implementation. Finally, the final decision needed for the full-scale operation of the UVAR is made in the *Commissioning gate*. Making use of the *policy life cycle* (Figure 1), participants can continue with the *parametrization of the solution space*.

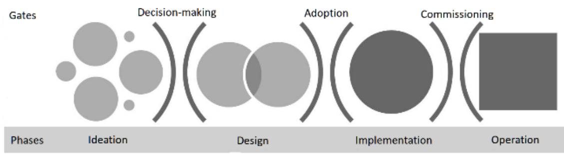

Figure 1: *Policy* (UVAR) *life cycle* as depicted by the experts' commission.

For the definition of the *contextual* parameters, participants were inspired by the work of (Gillis et al., 2016) on monitoring of sustainable mobility in cities. Through a review of relevant and scientifically sound indicators applicable in different social and economic contexts, (Gillis et al., 2016) identified a set of indicators that could be applied for the evaluation of a city's mobility system, monitoring, bench-marking assessment, and back-casting. However, instead of relying on the specific set of indicators proposed in (Gillis et al., 2016), the group of experts decided to focus instead on the set of parameters used for the calculation of such indicators. This to avoid further assessment and discussions on the validity of each indicator, or methodological issues in their determination. By doing so, the data collected allows a DSS to calculate this or any other set of indicators when performing an analysis, or to work with the granular information if appropriate.

Subsequently, participants reached a consensus on a total of 35 *contextual* parameters. These parameters can be grouped into 5 clusters: g*eneral information* parameters such as GDP, surface, distribution of direct and indirect land use for mobility, and availability of functional activities in the target area. *Demographic information* parameters account for the number of inhabitants, and population distributions by gender, age, employment status, income, and household size. *Transport information* parameters cover total length and distribution of road network by use, total number of passenger trips per year per transport or per shared mobility type, and vehicle fleet distribution per fuel type. *General mobility information* parameters map the availability of public transport (PT) and shared mobility modes, ticket prices for PT, availability of ticketing machines and offices, size and distribution of PT vehicle fleet, number of PT stops, and distribution of accessibility to and user satisfaction towards PT. Finally, *effects on inhabitants* parameters capture satisfaction levels towards noise level, quality of air, and public spaces, traffic accident rate, average distance, time and main transport modes for work-home/home-work trips.

For the *control* parameters, the process yielded a total of 23 parameters that reflect the experience of the participants gained through their academic and research background. The set of parameters can be grouped into 4 thematic clusters: *system design/technology*, *governance*, *user needs*, and *mobility services and concepts*.

System design/technology parameters focus on the availability, functionality, and status of UVAR-related systems. Covering aspects related to UVAR operation: technology options for enforcement, monitoring and evaluation, and communication-dissemination of UVAR-related information.

Governance parameters relate to the availability and types of legal frameworks, and political and planning instruments that can support the development of UVARs. Additionally, some of the parameters in this cluster intend to capture the actors and/or institutions that shape, influence and/or make decisions, as well as details on participatory and transparency issues.

User needs parameters focus on whether the different relevant user groups and stakeholders have been identified, and whether user needs have been included/considered. Additionally, some of the parameters here intend to monitor the tone of the general opinion, the level of acceptability towards the measure, and the main arguments for or against it.

Finally, *mobility services and concepts* parameters cover the types and status of developments related to improvements in PT, soft mobility, parking systems, shared mobility, urban logistics, etc.

To visualize the possibilities of our approach, we make use of a set of 8 different case studies covering 8 European cities that have implemented different UVAR measures (Table 1). Case study researchers have been given the set of parameters and the *UVAR life cycle* as a rubric for the collection of information. In this way, researchers were asked to use the definition of the different stages of the *UVAR life cycle* and the different parameter categories to focus and direct their research.

Table 1: List of city case studies and respective UVAR measure with correspondent planning instrument.

City	UVAR Measure	Planning Instrument
Milan, IT	CC	General urban traffic plan
Barcelona, ES	Superblock scheme	Urban mobility plan
Bologna, IT	LTZ	Traffic plan*
La Rochelle, FR	Delivery regulations	Urban travel plan
Ghent, BE	Traffic circulation plan (2017)	Mobility plan
Gr. London, GB	Pollution charge	Air quality strategy
Mechelen, BE	Cycling zone	Mobility plan
Amsterdam, NL	LEZ	Traffic plan for clean air

* The LTZ was initially conceived in the Traffic Plan (1972), at that moment it was not called LTZ, and later included in the General urban traffic plan (1996).

Before the beginning of the documentation, case study researchers were presented with the third parameter: *time*. Researchers were asked to focus on the chronology of the events that describe the process, making note of the time of occurrence of each event. Accounting for *time* as one of the relevant parameters means that the outcome of the data collection process will yield a timeline of data points containing the main events that describe the process (hereinafter *process timeline*), alongside changes in *contextual* parameters. Furthermore, the identification of the events in the *process timeline* that correspond to the "policy gates" helps us define the *policy life cycle*.

Finally, researchers had the task of reporting for each event the source of their information, e.g., academic papers, interviews, emails, etc. Thus, each event should be backed entirely by one (or a combination) of these sources and be independent of the researcher's understanding of the process.

4 DISCUSSION AND RESULTS

The *process timeline* in Figure 2 shows the *policy life cycle* for each of the city cases. Here we can see, for instance, that a constant throughout all the cases is the short span of the *implementation* phase (followed behind by the *design* phase) with respect to the

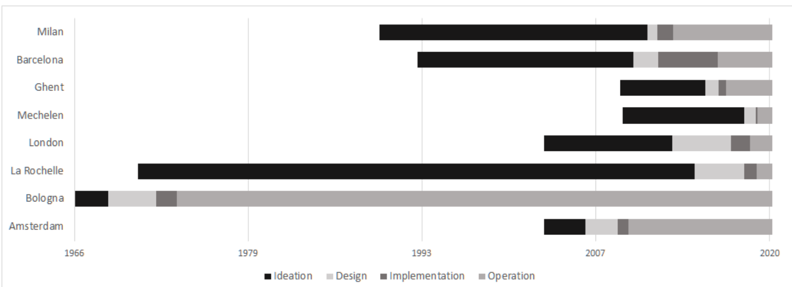

Figure 2: *Policy life cycle* of city case studies.

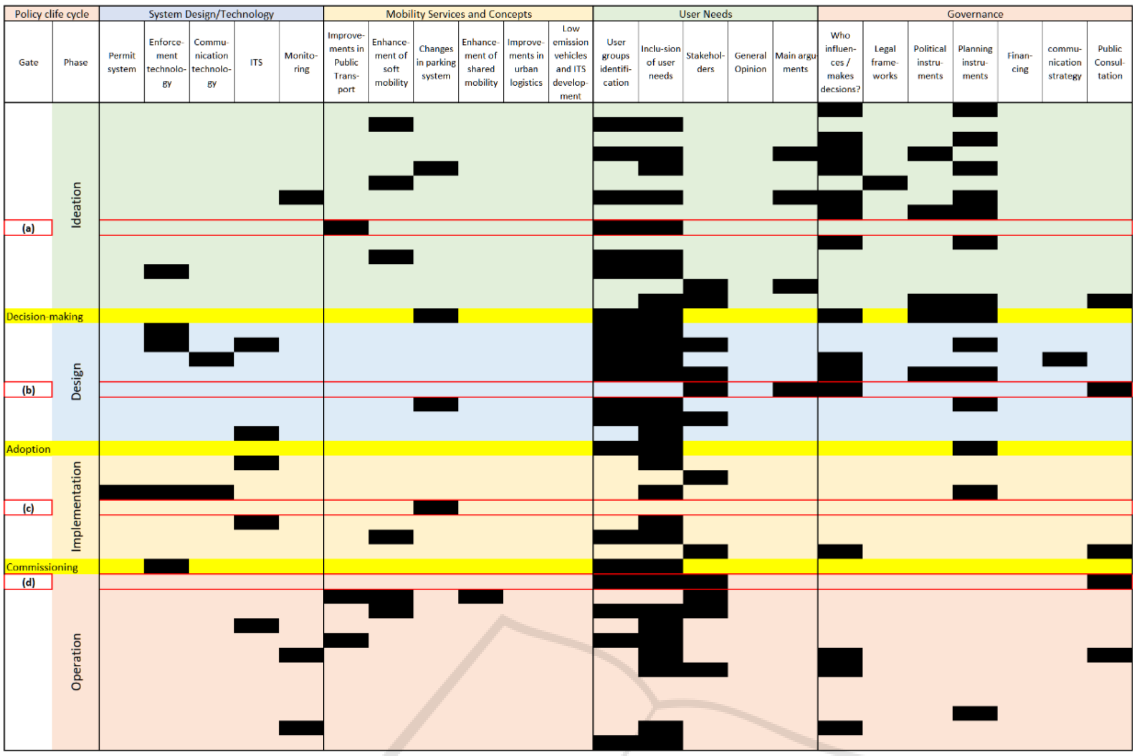

Figure 3: *Parameterized instance* - Case study Ghent (BE).

ideation phase. This could be explained due to how controversial UVAR measures are, and the political debate and discussions they trigger. Aiming for short implementations seems to be a strategic decision. Speeding up to materialize the measure, thus steering the political and public debate away from mere assumptions on the impacts they may have once launched. This strategic choice allows decision-makers to redirect the focus of users and opposition towards the real impacts and perceptions of a "tangible" measure. The speed of the process is again a motivation for the support of policymakers in the quick design of robust policy strategies.

Additionally, the coding of the information described in the *process timelines* using the parameters defined and identified by the commission of experts, allow us to represent the problem's complexity graphically. Which facilitates the visualization and identification of patterns in the data. Figure 3 illustrates the *parameterized instance* of the case study for the city of Ghent, i.e., a frame representation of the case of Ghent (BE). Here, each row marks the beginning of an UVAR-related event, and each black box corresponds to the "activation" of a *control* parameter triggered in each event. This could be, for instance, the renovation of PT infrastructure in the *ideation* phase (Figure 3 event (a)), a call for a referendum from part of citizen groups opposing the UVAR measure in the *design* phase (Figure 3 event (b)), the allocation of *Park and Ride* (P+R) locations to complement the UVAR measure in the *implementation* phase (Figure 3 event (c)), or the beginning of participatory workshops to gather citizen feedback on the measure in the *operation* phase (Figure 3 event (d)). Making use of the *parameterized instances*, we can easily identify common features in the UVAR process across cities.

From a between city analysis of the *parameterized instances* we can see that, for example, monitoring activities appear in the *ideation* phase in all 8 city cases (Figure 4). Furthermore, in all the cases, its occurrence is directly linked to the problem identification and definition.

Similarly, we can observe that improvements in PT are a constant across all city cases. This is expected, as these improvements may mitigate some of the negative externalities of road traffic, thus falling in line with the objectives of the UVAR measure and acting as a complement to it. For to an increase of supply and/or economic incentives for the use of PT, appear mainly in Bologna, Amsterdam, Milan, and London. This finding aligns instance, we can see how improvements in PT linked with the notion that this kind of interventions are of special

Figure 4: Emergence of monitoring activities in city case studies (in red). Events in green belong to the ideation phase.

importance in restrictive measures such as LEZs, LTZs, or CCs in order to provide an alternative to private vehicles (Croci, 2016).

Furthermore, just as the improvements in PT can be conceived as a complement to the UVAR strategy, an analysis of the *parameterized instances* allows us to see that in all the city cases the UVAR measure is formally developed as part of a broader strategy that represents the vision of the city in relation to air quality, mobility and/or sustainability (Table 1). The conception of an UVAR as one of the components of a major political instrument, instead of a stand-alone measure, seems to provide context and purpose to the measure, aligning it with the goals of the city and showcasing the UVAR measure as a "consistent" step towards the city's goals.

Another key point of the methodology relates directly to the data collection process. Making use of the outcome of the coding process as a rubric that highlights the important factors case study researchers should consider during the data collection process, facilitates the allocation of resources. Case study researchers can in this way find a major proportion of the information through desktop research, before going into the field to corroborate and complement their findings, e.g., through interviews or field visits. For the 8 city cases, on average 53 events were registered in the *process timelines* for each city case. From here, we could see that on average 62 different sources were cited per city case. The different data sources cover press releases, official (policy) documents, reports of special-purpose bodies, interviews, and academic articles. Of the total number of data sources, field interviews account for only 19% of the data sources. Meaning that the remainder 81% of the data sources could be collected without the need for a field study, thus reducing the number of resources needed in the documentation of each city case.

We can see then, how our framework could be used to identify patterns and common trends in the policy process that can give light into crucial aspects of the policy strategy, and thus support policymakers in the implementation and development of policies.

Additionally, the analysis of the city cases showcases possible system configurations in a graphic manner (Figures 3-4) which facilitates the identification and formulation of alternative scenarios based on the "patterns" observed in the relevant case studies. The small number of case studies, however, restraint us from drawing statistically significant results. Furthermore, the limited sample size in combination with the heterogeneity of the sample (in terms of their urban landscapes), hinders the identification of useful patterns among the *contextual parameters* that could help us support the validity of these parameters or assess the findings in (Gillis et al., 2016). Despite all this, we believe the findings summarized in this section can illustrate the potential of the methodology in the assessment of policy processes and inspire future research on the matter.

5 CONCLUSIONS AND FUTURE WORK

The methodology presented could be used to identify patterns and trends in the policy process that can give light into crucial aspects of the policy strategy, and thus support policymakers in policymaking. The methodology is based upon a systematic exploration of the problem space supported by expert knowledge and case study research.

To illustrate the Framework's potential, we have used the case of UVARs in a set of 8 city cases studies (Table 1). Despite the small sample size, experiments suggest that the methodology could be used in a DSS for the identification of patterns and trends in the data (in spite of the large amount of data and variables), and the identification of possible scenarios (policy configurations). Furthermore, the proposed methodology seems to facilitate the data collection process, supporting desktop research and reducing the time and effort needed for field research.

Finally, the ease of use of the methodology, and the features of the graphic representation (Figures 3 and 4) suggest that integration with advanced data analysis techniques could facilitate the identification of patterns and trends. Furthermore, the methodology could make use of Big Data to, e.g., monitor public opinion through the collection and analysis of social network data, or perform a continuous evaluation and monitoring of *contextual parameters*.

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