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Defining Human-Machine Micro-Task Workflows for Constitution Making[1]

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Abstract. This paper presents a novel task-oriented approach to crowdsource the drafting of a constitution. By considering micro-tasking as a particular form of crowdsourcing, it defines a workflow-based approach based on Onto2Flow, an ontology that models the basic concepts and roles to represent workflow-definitions. The approach is then applied to a prototype platform for constitution-making where human workers are requested to contribute to a set of tasks. The paper concludes by discussing previous approaches to participatory constitution-making and identifying areas for future work.

Keywords: Micro-tasking, micro-tasks, workflows, ontologies, political crowdsourcing, legal crowdsourcing, constitution-making, participation.

1 Introduction

Constitution-making can be broadly defined as a set of activities intended to produce a constitution, the highest law of a state. To the UN, constitution-making "covers both the process of drafting and substance of a new constitution, or reforms of an existing constitution" [1]. Klein and Sajo have also defined it as a "decision-making process carried out by political actors, responsible for selecting, enforcing, implementing, and evaluating societal choices" [2]. Given that constitution-making may only happen once in a generation, it is often seen as a unique moment shaping both the present and the future of a country. As Elster has put it, "if there is one task for which 'wisdom' would seem highly desirable, it is that of writing a constitution" [3].

This paper reviews a few examples of how the wisdom of the crowd has been tapped in recent constitution-making processes across the world and proposes a new approach to write a constitution based on micro-tasking, a particular form of crowdsourcing.

Section 2 provides definitions of crowdsourcing and micro-tasking and additional background knowledge on recent examples of constitutional crowdsourcing. Section 3 briefly reviews ontology-based micro-tasking workflows and presents Onto2Flow, an ontology designed to retrieve structured and semantically enriched data from micro-tasks. Section 4 applies this framework to a prototype platform that enables the micro-tasking of a constitutional text. Section 5 discusses both the potential and limitations of this approach. The conclusion, finally, suggests future work in this area.

2 Background

The word crowdsourcing was coined by Jeff Howe and Mark Robinson in 2006 to represent "the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call" [4]. This broad conceptualization has been followed by a myriad of definitions of crowdsourcing drawn from different but connected approaches: collective intelligence (CI), human computation, social intelligence, and social computing. It also has been noted that "while human computation (HC) is a term that is mostly used by the scientific community, crowdsourcing (CS) is a term highly employed in the business world [5]. Despite the variety of perspectives, all approaches highlight three key elements in crowdsourcing: crowds, tasks, and mediating technologies.

Micro-task crowdsourcing, in particular, is a special kind of human computation where relatively complex tasks are divided into smaller and independent micro-tasks [5]. These micro-tasks are then modelled and published through a computational platform (e.g. Mechanical Turk and CrowdFlower), which distributes them through a crowd of workers.

Micro-tasks are often employed for solving large-scale problems that are often too complex for computers to solve on their own [6]. These problems usually require a degree of creativity (or just common sense), plus some background knowledge [7, 8]. In our view, the drafting of a constitution: (i) can be represented as a large-scale problem that can be divided into smaller tasks; (ii) these micro-tasks can be completed by a crowd of heterogeneous citizens with different degrees of legal expertise (from none to expert).

2.1 Crowdsourced constitution-making

In the political and legal domains, crowdsourcing methods and tools have been used as a means to collect input from citizens on a variety of areas, such as legal drafting, legal reform, legal education, policy-making and human rights advocacy [9–12]. Crowdsourced constitution-making, in particular, was famously displayed in Iceland in 2011 with the use of social media to collect peoples' views and opinions on the

constitutional draft [13]. Similar initiatives were taking place almost simultaneously in Kenya (2010), Ghana (2010-2011), Somalia (2011), Egypt (2012), and Libya (2012), among other countries [14]. Likewise, Morocco announced a constitutional reform in early 2011 and, shortly after, a citizen-based initiative launched reforme.ma, a dedicated crowdsourcing platform fully integrated with Facebook and Twitter where citizens could like or dislike the proposed articles and comment on them [15].

In the effort to make constitution making as participatory as possible, these initiatives have all taped on social media (and, in some cases, e-mail and text messages) to elicit comments from the public. In all cases, and regardless of the final number of participants, thousands of comments were posted and eventually collected. The analysis of how these contributions were classified a posteriori and their eventual impact on the final drafts would require a case-by-case approach. Yet, it seems clear that in all mentioned examples the public was invited to comment, answer questions, vote, or "like", but not to "write" the constitution itself. To date, crowdsourced constitution-making has heavily relied on online deliberation, but the impact of such deliberative processes on the final outcome is yet to be fully assessed. While deliberative processes are core to constitution-making, we aim at a complementary approach where the constitutional draft is also the product of coordinated micro-tasking via the participation of a large number of participants.

2.2 Ontologies in description logics

Our approach adds a new layer to constitution-making by considering a micro-task workflow-based approach to the drafting and refinement of the document. Drafting and refinement workflows are modelled using ontologies, which allow a formal, explicit and shared conceptual representation while maintaining machine interpretability. Ontologies are formal because they are supported by unambiguous formal logics; explicit since they make domain assumptions explicit for reasoning and understanding; and shared for its ability to provide consensus.

Ontologies "represent the best answer to the demand for intelligent systems that operate closer to the human conceptual level" [16]. Thus they are an appropriate representation mechanism for environments where both human and machine agents must interpret the data and perform a particular set of actions. Furthermore, the inherent extensibility of ontologies allows the growing set of domain ontologies in the Semantic Web to be re-used in the representation of workflows.

3 Ontology-based Micro-Task Workflows

Micro-tasks (or simply "tasks" from now on) can be seen as atomic operations that produce a specific set of data. These atomic operations occur within a specific domain of operation involving certain domain knowledge. Given a task, its domain of operation is defined by its input and output specifications.

Onto2Flow is an approach to the representation, instantiation and execution of workflows that represents workflows of tasks as extensions of other domain ontologies. These extensions are called workflow-definition ontologies. Workflow-

definition ontologies assemble two different data dimensions: (a) the static domain dimension (corresponding to the domain ontology) and (b) the dynamic task and workflow dimension (corresponding to the Onto2Flow ontology). In this perspective, task-definitions (or task representations) are extensions of the domain ontology, which add an operational dynamic dimension. **Fig. 1** illustrates these two dimensions and their assemblage.

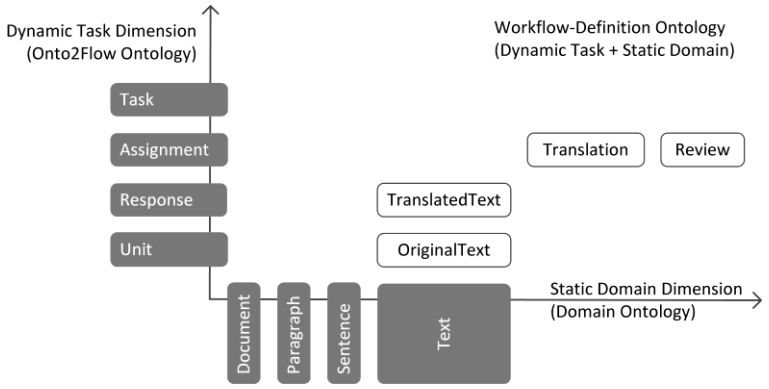

Fig. 1. Static and dynamic dimension in a workflow-definition ontology.

3.1 The Onto2Flow process

Onto2Flow assumes that domain ontologies represent the structure and semantics of the data presented to (and retrieved from) workers. Accordingly, the approach considers two steps (outlined in **Fig. 2**): (i) task-definition and workflow-definition (the ontology of the workflow), and (ii) the instantiation and execution of the workflow on a particular input dataset.

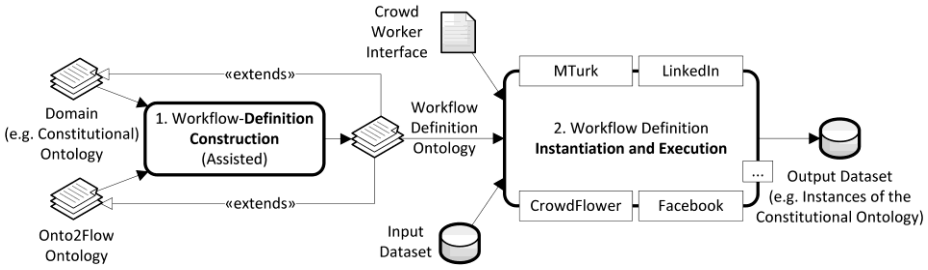

Fig. 2. Overview of the Onto2Flow approach.

At the stage of workflow-definition (1), the requester must clearly define the activities involved in the workflow through a semantic model of the input and output data and create a workflow-definition. For workflow-definitions containing task-definitions that human workers have to solve, crowd (user) interface templates must be supplied

along with the workflow-definition ontology. The interface templates present the task data to the worker and retrieve the submitted response.

At stage 2 (instantiation and execution of the workflow-definition), workflow-definition ontologies can be instantiated multiple times and executed by any workflow engine that is able to interpret the Onto2Flow ontology and apply the ground rules established by the proposed method. Furthermore, Onto2Flow-based workflow engines may dispatch the execution of the tasks to external micro-task execution communities such as Mechanical Turk and CrowdFlower, or provide their own task resolution interfaces that may interact with external social networks.

3.2 The Onto2Flow ontology: concepts and roles

The Onto2Flow ontology defines the basic concepts and roles required to represent workflow-definitions (see **Fig. 3**). It captures concepts and lessons learnt from workflow-definition languages and approaches such as the XPDL (XML Process Definition Language) and BPMN (Business Process Modelling Notation) [17]. Furthermore, it incorporates concepts that support the crowdsourcing, distribution, and delivery of tasks.

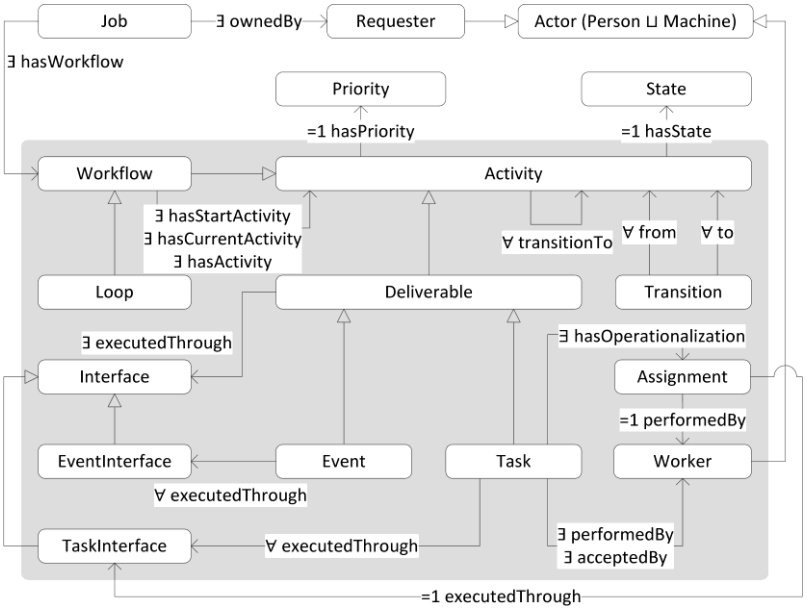

Fig. 3. Overview of the Onto2Flow ontology.

The concept *Job* represents a workflow execution environment created by a *Requester*, which may contain more than one *Workflow*.

Activities are the interconnected components that form a workflow. There are three main types of activities: the *Workflow*, the *Task* and the *Event*. Among these,

Deliverables, which include *Task* and *Event*, represent a group of activities that require worker or external interaction through some kind of *Interface*.

Two main types of actors are considered by the Onto2Flow ontology: the *Requester* (the one requesting the execution of a workflow) and the *Worker* (the one solving the tasks of the workflow), which are either *Human* or *Machine*.

Each *Actor* may belong to several *ActorGroup*. Actor groups allow requesters to associate and filter groups of actors for participation in particular tasks. An *ActorGroup* may include a wide set of attributes, including social network analysis clustering measurements (e.g. clusterability), improving the control of the requester over the selection of workers. Inclusively, each *ActorGroupMembership* may feature a wide set of actor specific attributes and measurements (e.g. centrality and prestige).

Workflows are graphs of activities linked through transitions, which establish a process that delivers a specific result dataset given an input dataset.

The flow of activities in a workflow is established through *Transitions*. There are six types of transitions, depending on the set of (i) incoming activities (*BasicTransition*, *MergeTransition* or *SynchronizationTransition*), (ii) outgoing activities (*ParallelTransition* or *DisjunctTransition*), (iii) whether there is one or more conditions to be fulfilled in order to continue its execution (*ConditionalTransition*).

An *Event* is an external occurrence that either triggers the continuation of a running workflow (*RunningEvent*) or triggers the execution of a new workflow (*InstantiationEvent*).

A *Task* is a set of assignments and operations on top of input data, which must be performed by workers. The representation of a task involves multiple concepts and roles in the Onto2Flow ontology. These concepts are:

- The *Assignment* concept, representing the actual operationalization of the task;
- Input concepts:
- The *Unit* concepts, which represent the input unit of work given to the worker;
- The *UnitContext* concepts, which represent relevant contextual input data that must be presented along with the unit (and possibly related to it);
- Output concepts:
- The *Response* concepts, which represent the top-level response or output given by the worker;
- The *ResponseContext* concepts, which represent additional output given by the worker, usually related to the response.

Each work unit (represented by the *Unit* concept) is assigned to a worker through an *Assignment*. The same unit may be assigned to different workers, resulting in different solutions to the same problem.

The execution of a workflow requires interaction with external actors and services during the execution of *Event* and *Task* activities. While an *Event* is typically listened for, and arrives through an *EventInterface*, a *Task* must be delivered to and retrieved from workers through a *TaskInterface*. Thus, interfaces represent logical and/or physical components through which the interaction with workers (machine or human) is performed (e.g. a Web service interface, a graphical user Web interface).

The ability to represent different types of interfaces enables the specification of distinct interfaces, commonly used on user-centric environments [18]:

- Simple, where a single medium or modality is used. For instance, tasks can be delivered to workers through a visual interface, a sound interface, or simply through a web interface (the common case for crowdsourcing applications);
- Multi-modal, i.e. capable of merging and coordinating multiple mediums and modalities as a single interface.

Accordingly, and of particular interest in the crowdsourcing scenario, different types of user interface implementations, such as a game interface or a mobile interface, can be used to distribute tasks through human workers.

4 Catalan Constitution-Making Scenario

The Catalan constitution-making scenario is a prototype of a micro-tasking platform to crowdsource the elaboration of a constitutional text. This scenario uses the Constitute project ontology as the static domain dimension. The Constitute project is a database of constitutional texts to search and compare constitutions across the world [19]. On top of the Constitute project ontology, a workflow-definition following the Onto2Flow method was built. The resulting workflow-definition, as shown in **Fig. 4**, aims to take the ontology-based representation of a proposed Catalan constitution and crowdsource its elaboration, stemming from a basic initial text [20].

The process contemplates the following tasks, all performed by human workers:

- T1 - evaluates sections of the current constitution document and is performed by any worker;
- T2 - revises and updates sections of the current constitution document marked in the previous task and is performed by expert workers;
- T3 - selects the best version of a section from the set of proposed sections in the previous task and is performed by any worker.

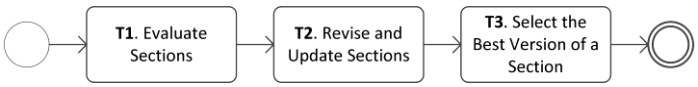

Fig. 4. Overview of the Catalan constitution-making workflow-definition.

The Constitute project ontology represents the constitution document through sections. A partial illustration of the Constitute project ontology is presented in **Fig. 5**. An additional set of concepts was added to the static domain dimension in order to represent the opinion and the assessment of the constitution sections.

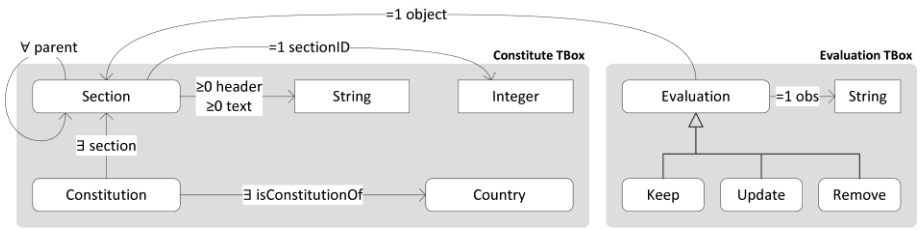

Fig. 5. Partial Constitute project ontology and additional assessment concepts.

4.1 The Workflow-Definition

The constitution-making workflow-definition was built using both a construction framework prototype implementation and the Protégé ontology editor. The Protégé ontology editor was used to establish some common axioms that are not yet featured by the construction framework, such as the union of input and output concepts, and inverse roles. A detailed illustration of the workflow-definition is presented in **Fig. 6**. Notice how each task-definition contains a complete representation of all the concepts and relationships involved. Also, this representation is directly mapped to the Constitute project ontology.

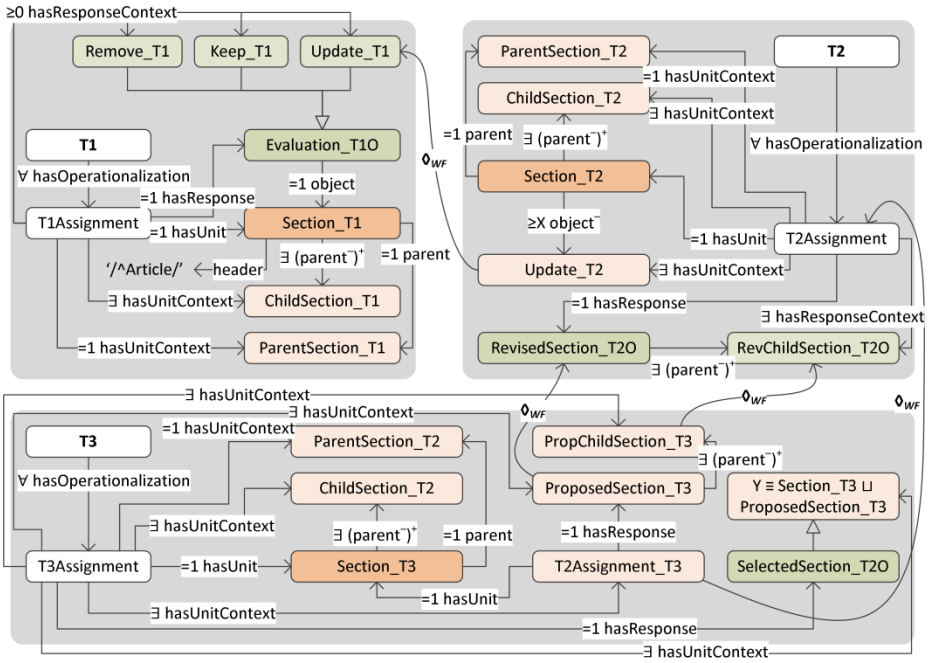

Fig. 6. Task-definitions in the constitution-making workflow-definition ($\Diamond_{WF}$ represents a dependency relationship, which can be reduced to a subsumption).

In T1, the amount of assignments per unit will correspond to the amount of evaluations given to each section. Thus, T1 must have an amount of assignments per unit greater or equal to X, where X is the amount of evaluations that request an update of the section. This amount (X) is used in T2 to assess which sections must be revised and updated.

The use of the role transitive closure onto the *parent* role allows all descendant sections of the unit section to be included in the assignment and shown to the worker.

Also, regular expressions may be used to restrict the value of data-type roles. Such is the case of the value of the *header* role in T1 (*Section_T1* ⊑ *header : "/^Article/"*).

4.2 The Task-Definition UI Templates

In the Catalan constitution-making scenario all tasks are solved by human workers (volunteers). Volunteers contribute by adopting two different profiles: non-experts or experts. Non-experts are the large majority of citizens who sign into the platform to complete tasks in T1; experts are those volunteers designated by the requesters with an editing role of the outputs produced by non-experts (classification, collation, amendments). In both cases, the workflow-definition includes an UI (User Interface) template. The UI template of T1 presents the unit section, its parent section, and all its descendant sections to the non-expert volunteer. The volunteer is then invited to evaluate the contents of the section (an article of the constitution) and assess whether it needs to be: (i) updated (rewritten), (ii) removed or (ii) accepted as it is. Volunteers can access the complete initial constitutional draft at any time to situate their assignment into the broader picture of the full text.

The UI template of T2 presents the unit section to expert workers in the same way as T1, including any modifications of the constitutional text by non-experts in T1. The expert volunteer is then asked to submit a new revised section with all outputs collected T1 classified and, if necessary, edited and collated.

Finally, the UI template of T3 presents each of the previously submitted sections (during T2), along with the original section. In T3, all volunteers are requested to select the best version. **Fig. 7** below offers an example of the UI template of T1 as presented to non-expert volunteers.

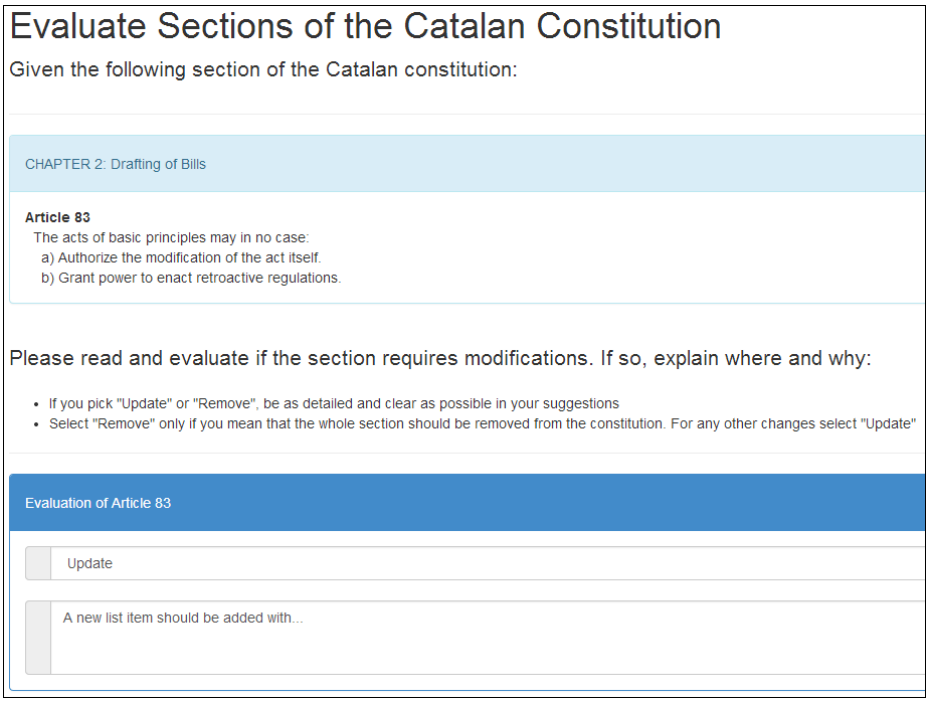

Fig. 7. Example assignment with the UI template of T1.

5 Conclusions and Future Work

Crowdsourcing the writing of a constitution to a large number of citizens is a complex task that can be addressed by subdividing it to smaller units (micro-tasks). While there are a number of examples of participatory constitution-making that involve online deliberation, none of them offers a platform for citizens to edit the articles of the text. Rather, their focus on eliciting and collecting opinions from public deliberation, generally via social media, makes crowdsourcing initiatives accessory to the drafting process developed elsewhere (e.g. in constitutional commissions). Ultimately, this contingent aspect of crowdsourcing makes it difficult to assess the impact of online participation on both the drafting process and the final outcome.

In our approach, writing a constitution becomes the core task. We rely here on two well-researched conditions in the literature on the "wisdom of the crowd effect": (i) independence of judgment and (ii) heterogeneity of the crowd [21–23]. When these two conditions are met, the crowd can perform better than individual experts.

To date, the platform has been tested by a reduced group of 8 experts who have provided useful feedback. Future work involves expanding the testing to larger groups of volunteers and refine the following issues: (i) identification of sub-topics within an article and further division of micro-tasks; (ii) credentials and role of experts; (iii) aggregation mechanisms in T3 (e.g. ratings, rankings) to avoid inconsistencies, and

(iv) generally, mechanisms to detect and resolve conflicts between different sections in a constitution.

Beyond addressing these different issues dealing with coordination mechanisms, further research will also be required to tackle substantive issues on how to coordinate the crowd itself: (i) motivation; (ii) incentives to participate; (ii) relevance and quality of the contributions; (iii) monitoring spam and sabotage attempts, etc. The ultimate challenge is how to engage the crowds' collective wisdom in drafting such a high-impact legal document as a national constitution.

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