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Towards successful adaptation: a checklist for the development of climate change adaptation plans

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The earliest climate change adaptation plans emerged about ten years ago and are an increasingly important component of the international policy agenda. Because these plans by nature involve long-term objectives, some of the main questions raised in current adaptation tracking research studies are whether and how they will be implemented and what is required for these plans to successfully achieve their objectives? There is no consensus on how to define “successful adaptation” and there are multiple, sometimes competing, interpretations of success. In this working paper, we define three areas where climate change adaptation plans should focus on to successfully achieve their goals: policy and economy, science and learning and legitimacy. We develop a checklist that identifies required aspects for successful adaptation and sustainability in the long-term based on these three areas and related indicators. We suggest that plans follow this checklist as a guideline for plan development and institutional capacity building in the long term. We eventually discuss the adequacy of these metrics for assessing the credibility of developed climate adaptation policies.

Keywords: climate change, adaptation policy, adaptation plan, plan quality, successful adaptation, credibility.

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1. Introduction

Planning for adaptation to climate change has emerged as a central component of climate policy over the last decade. Climate adaptation planning addresses current and future vulnerabilities by acting on reducing risk and strengthening adaptive capacities and resilience. The Paris Agreement set an ambitious pathway for adapting to climate change that goes beyond national boundaries and urges nations, regions and cities, as well as other public and private stakeholders, to act (Lesnikowski et al., 2016b).

How can the opportunity to adapt be raised if we ignore whether actual adaptation efforts are indeed effective in reducing vulnerability and building resilience? This question calls for new methods and tools to track the actual progress on adaptation made on the ground (Ford et al., 2015; Chen et al., 2016; Magnan, 2016; Magnan and Ribera, 2016). To respond to this, new research on Adaptation Tracking (AT) has emerged in the last few years (Ford et al., 2015). AT seeks to characterise, monitor and compare general trends in climate change adaptation over time and across nations, regions, cities or private initiatives (Araos et al., 2015, 2016; Ford and Berrang-Ford, 2015). Only with this information, efforts can be well targeted and suited to the needs and be compared, funds can be effectively allocated, best-practices can be transferred and ultimately, adaptation science and practice can advance. However, conceptual and empirical studies to date have shown that AT faces some important deficiencies compared to mitigation, such as the lack of consistent definitions and practices, agreed metrics, comparable baselines, standardised approaches to data collection and robust guidance (Carmin et al., 2012; Dupuis and Biesbroek, 2013; Reckien et al., 2014b; Ford et al., 2015; Araos et al., 2016; Heidrich et al., 2016; Magnan, 2016).

In current adaptation tracking practice, the existence of climate change adaptation policies has been used as an indicator of progress. Relevant studies have documented, examined and compared adaptation policies at the national level (Berrang-Ford et al., 2014; Austin et al., 2016; Lesnikowski et al., 2016a) and lower government-level policies (Heidrich et al., 2013; Reckien et al., 2014b; Araos et al., 2016; Woodruff and Stults, 2016). Due to the early stage of adaptation planning and because these plans by nature involve long-term objectives and high uncertainty, some of the main questions raised in current adaptation tracking research are whether and how they will be implemented and what is required for these plans to successfully achieve their objectives. In mitigation, it is quite straightforward to estimate the relationship between the implementation of different policies and greenhouse gas emission reductions. However, establishing valid methods for measuring the outcomes of adaptation policies in a similar way (see e.g. Millard-Ball, 2012) is elusive (Dupuis and Biesbroek, 2013) as many of the impacts of climate change will occur in the very long term and therefore are not easy to measure or estimate. Consequently, a focus on measuring processual aspects of climate policy has emerged (Dupuis and Biesbroek, 2013).

In this regard, the identification of relevance aspects of plans and policies that provide higher effectiveness to reduce vulnerability and build resilience is critical to design better policies and to build more reliable adaptation tracking systems. In this paper, we develop a checklist that identifies required aspects for long-term successful and effective adaptation. Next section discusses relevant factors for successful adaptation according to current literature. Section 3 proposes a checklist for the development of adaptation plans according to the literature revised. Finally, Section 4 presents the discussion and future steps.

2. Relevant factors for successful adaptation

The definition of “successful adaptation” is an issue at stake. There is no consensus on how to define it and there are multiple, sometimes competing, interpretations of success (Sherman et al., 2016). Both in research and in practice, successful adaptation is interpreted differently (Ford et al., 2013), reflecting the messiness of the adaptation concept itself (Ford et al., 2015). If adaptation action can be interpreted in different ways, the definition of success is equally divergent and ambiguous.

‘Adaptation’ is defined in IPCC’s Fifth Assessment Report (AR5) as “the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects” (IPCC, 2014, p. 1758). Tomkins et al. (2010, p. 628) state that ‘anticipatory adaptation planning’ is the process that ensures “that the vulnerable are prepared, risk information is distributed, risk management plans developed and public goods are managed to account for climatic changes”. This means guaranteeing the preparedness to face climate change. ‘Adaptation management’ is defined by the IPCC (2014, p. 1758) as the “process of iteratively planning, implementing, and modifying strategies for managing resources in the face of uncertainty and change” and “involves adjusting approaches in response to observations of their effect and changes in the system”. These approaches require acknowledging the existence of tipping points after which an adaptation action no longer meets the specified objectives and an alternative adaptation pathway needs to be taken (Haasnoot et al., 2013). If success is measured based on the output, a successful adaptation action should be evaluated against the objective and in the context it was designed for (e.g. Lesnikowski et al., 2016a) and under multiple criteria of effectiveness, efficiency, equity and distributional impacts. Adger et al. (2005, p. 83) define ‘successful adaptation’ as the one that “balances effectiveness, efficiency and equity through decision-making structures that promote learning and are perceived to be legitimate” and argue that most adaptation actions diverge from this ideal definition. Preston et al. (2011) doubt the adequacy of an outcome-based evaluation of adaptation success as it would depend on values of evaluators, and they put in turn the emphasis on the robustness of the adaptation planning process.

So far, diverse approaches have been proposed in the literature to assess the abilities that a system may have (or have not) to plan for adaptation or the factors that may prevent adaptation action. The assessment of adaptive capacity, for example, provides information on which factors contribute to build capacity to face future climatic impacts. This information is key to assess whether the system has sufficient resources to adapt in terms of institutional structure, knowledge on management systems, infrastructure and technology, past experience, etc. Other approaches focus on the assessment of barriers to adaptation, are critical to identify potential deviations in the adaptation process, have been theoretically discussed (Adger et al., 2009; Moser and Ekstrom, 2010; Biesbroek et al., 2013; Ford and King, 2015; Huitema et al., 2016), and empirically examined (see e.g. Measham et al., 2011; Bierbaum et al., 2012; Reckien et al., 2015; Nordgren et al., 2016). Barriers to adaptation identified in the literature include: lack of knowledge, uncertainty about the impacts, long term periods over which impacts may occur, lack of leadership, lack of financial resources, institutional constraints (e.g. rigidity, lack of competencies), poor stakeholder engagement and participation, inadequate decision-making culture (not iterative or flexible), lack of public support, divergent risk perceptions and cultural subjective attachments. The assessment of adaptive capacities and assessment of barriers to adaptation both focus on the examination of factors that enable or prevent current or future adaptive processes; however, they do not provide information on how such processes should be built. Alternatively, the concept of adaptation readiness focuses on examining the adaptation process by considering what is actually being done to prepare for adaptation (Ford and King, 2015; Tilleard

and Ford, 2016). Determining whether a policy is intentional and substantial (Dupuis and Biesbroek, 2013) is also important. This involves assessing whether climate change impacts originated the need for policy development and assessing the level of contribution of such policy to problem resolution.

Finally, assessment frameworks based on plan quality standards are also important. In this regard, there have been a number of recent studies that have assessed the quality of climate change mitigation and adaptation plans at the local level (Baynham and Stevens, 2014; Woodruff and Stults, 2016). Plan quality assessments are generally performed in order to identify aspects of the plans that are assumed to be important to achieve the objectives pursued as well as the aspects that should be improved (Stevens, 2013). Woodruff and Stults (2016), for example, analyse 44 local adaptation plans in the United States using standard plan quality principles to assess the quality across plans and to identify community attributes (namely capacity, commitment, policy diffusion, and internal operations) associated with high-quality plans. They also analyse how these principles follow the adaptation planning stages proposed by Preston et al. (2011). Baynham and Stevens (2014) argue however, that the hypothesis that plan quality standards correlates with a reduction of GHG and a better preparedness for climate change impacts has not been evidenced so far and proves to be more complex for adaptation than for mitigation.

3. A checklist for the development of climate change adaptation plans: a review

We here present a general checklist that could be used as a guideline for the development of adaptation plans. The objective of this checklist would be to reduce political and economic incoherencies, increase effectiveness and learning rates and increase legitimacy of climate change adaptation plans. We define three areas to be assessed: policy and economy, science and learning and legitimacy. These three areas are divided in seven components: ‘Resources’ refer to the economic support and budget assignment defined for the implementation of the plan. ‘Reliability’ refers to current assignment of human resources for plan definition, approval and implementation. ‘Institutional, public and private support’ refers to the passive or active engagement of diverse public and private actors in the development of the plan. The area ‘Science and learning’ is further divided into 3 components: ‘Usable knowledge’ refers to the production and use of contextualised evidence according to local needs. ‘Monitoring, evaluation and reporting (MER)’ refers to the existence of systems that assess progress and outcomes according to a set of goals. ‘Adaptive Management’ refers to the process of learning through readjustment processes that allows revision, redefinition or change to alternative pathways. These components represent aspects that have been used to assess adaptation readiness (Ford and King, 2015) and adaptation plan quality (Woodruff and Stults, 2016). Eventually, ‘Legitimacy’ has been identified as an important pillar of (perceived) successful adaptation (Adger et al., 2005). This component refers to the consideration for equity and justice in policy and scientific processes. It includes factors related to the engagement of stakeholders and civil society in the development of the plan and the transparency of processes and information. The following table extends the reasoning behind the selection of each relevant factor and area in the checklist.

Table 1: Climate Change Adaptation plans: checklist proposal

MAJOR AREA	COMPONENTS	INDICATORS (I#)	#	Factor description	Y	N	Reasoning
POLICY AND ECONOMY	RESOURCES	#1. Funding and consistency	1	An overall budget has been assigned for the plan			According to Ford and King (2015, p. 513), adaptation funding relates to “the capital costs of interventions and their maintenance over time, and also the associated human resources necessary to successfully identify, implement, monitor, and maintain adaptation efforts, along with costs of funding research projects and programs”. Here, ‘Funding’ refers to the allocation of economic resources for the overall plan and also, for each of the specific measures contained in the plan (human resources are taken into account in the ‘Reliability’ component). An adaptation policy that does not assign economic resources to implementation and monitoring would not be credible. Woodruff and Stults (2016) also find that plans funded by higher governmental levels score lower in quality. We therefore assume that, if plans have been self-funded, the intentionality is higher and also, efforts put in objectives achievement. The number of adaptation initiatives identified in a plan has been used in the literature as a proxy of progress towards adaptation (see e.g. Araos et al., 2016). We argue that for a plan with N>17 can be considered as an “extensive adaptor”, according to the definition by Araos et al. (2016). We set 0.193% as the minimum extent of the adaptation economy in a city calculated as the average of the 10 cities assessed in Georgeson et al. (2016).
			2	Specific budgets have been assigned for each of the measures contained in the plan			
			3	The creation of the plan is funded with own resources			
			4	The plan fully or partially secures funding for the implementation of the measures proposed			
			5	Number of measures (N) contained in a plan is more than 17			
			6	The overall plan budget relative to the city's GDP is larger or equal to 0.193 % of GDP of the city.			
	#2. Prioritisation and timing	7	The plan sets a timetable for adaptation implementation			Because of the distribution of impacts in time, not all measures need to be implemented at the same time (Smith, 1997). There is a consensus on the importance of setting climate change adaptation priorities adequately to make significant improvements in adaptation (Smit et al., 2001). As put by Fussler (2007, p. 273) “deciding what to do first is often as important as deciding what to do at all”. We add that a plan that does not clearly say what is important and what is not, is not an effective plan. Prioritization is also useful to mainstream adaptation into existing policy and reduce competing interests. Here we adapt the approach defined by Lovell et al. (2008) and outline a list of three components that any prioritisation method should contained: timescale, criteria and evaluation capacity (e.g. resolution scale see Ciscar et al., 2011).	
		8	The plan sets criteria for prioritisation during the implementation phase				
		9	The plan demonstrates capacity to evaluate these criteria on each identified option				

MAJOR AREA	COMPONENTS	INDICATORS (I#)	#	Factor description	Y	N	Reasoning		
RELIABILITY		I#3. Assigned responsibilities	10	Plan creation: has the plan been written by the planning department?			According to the results obtained in the assessment of US local climate adaptation plans by Woodruff and Stults (2016), plans written by planning departments correlate with higher quality plans. As long as this may be caused by US specific institutional and planning culture, we here recognise that at least the involvement of the planning department in the writing of the document is critical. As earlier mentioned (see I#1), the provision of human resources that will implement planned actions is essential to prove readiness for adaptation (Ford and King, 2015) and in this case, it also provides credibility of the plan. Adding to this, we argue that not only assignment of responsible parties is important but also the level of specificity of such assignment. Depending on this, the whole plan or specific actions can be easily disregarded. For example: if a measure is assigned to a whole department and not to a smaller body/subdivision, it might have higher chances of being overlooked.		
			11	Does the plan assign a coordinator of the implementation phase?					
			12	Does the plan assign responsible parties for each measure contained in the plan?					
					13	The assigned parties have no smaller subdivisions			
				I#4. Legislation and regulatory nature	14	Is the plan a set of recommendations or does it compel (legally binding) implementation?			Climate policies are diverse in nature and because of the long-term nature of climate change, non-binding policies are growing much faster than legally-binding ones (Jordan et al., 2015). Many climate strategies are being now developed as a set of recommendations with no clear intention of being implemented. Climate plans need to organise action and actors to be credible and legally binding policies would help this to come to a reality.
				I#5. Networks membership	15	Is the city committed to any international or national climate network related to adaptation i.e. that includes adaptation-related knowledge transfer, commitment or capacitation?			To the extent of adaptation networking research so far, previous local adaptation tracking studies have shown the importance of international climate networks in engaging cities in climate action (De Gregorio et al., 2014; Reckien et al., 2015). Building on experienced urban sustainability agendas such as Local Agenda 21 and the influence of networks (Barrutia and Echebarria, 2012, 2015) could help to understand the complexity of the quality and quantity of such involvements. Either way, networking helps to build capacity and gain competence in climate change matters.
				I#6. Leadership and support	16	Is the plan framed in a higher-level (regional or national) plan/policy/program?			Climate adaptation plans need a strong political leadership by champions with authority (i.e. mayors, city engineers...) (Anguelovski et al., 2014). This also builds internal legitimacy (Anguelovski et al., 2014) (see Legitimacy component below). Additionally, Averchenkova and Bassi (2016) argue that, the existence of public and private bodies that support Climate change action is essential to build credible policies. A dedicated public climate change body will ensure the implementation of the policy and act as coordinator of climate-related activities. The support of the upper-tiers of
					17	Is the plan led by an institutional climate champion with institutional power?			
					18	Is there a dedicated local public climate change body?			

MAJOR AREA	COMPONENTS	INDICATORS (I#)	#	Factor description	Y	N	Reasoning	
SCIENCE AND LEARNING			19	Are there other supporting public bodies (e.g. regional authority)			government is also important to engage in climate action and to channel local strategies into higher spatial levels (Heidrich et al., 2016). Private actors need to be engaged in action as well, not only potential beneficiaries of adaptation but also as partners, promoters and funders (Bulkeley and Broto, 2013; Schwarze et al., 2016).	
			20	Are there supporting private lobbies (e.g. NGOs, business associations)				
	USABLE KNOWLEDGE		I#7. Impacts and vulnerability assessment	21	Does the plan develop a risk assessment?			According to the IPCC (Oppenheimer et al., 2014), climate change risks are the result from the interaction of vulnerability, exposure, and hazard. Independently of the approach taken to assess risks, vulnerable populations and assets and climatic impacts should be identified and assessed. Depending on the efforts put in this stage, or the resources available to produce this information, spatial level resolution can be more or less disaggregated, being the second the preferred option. The cross-scale and cross-sectoral nature of climate adaptation decisions is certain (Adger et al., 2005). Adaptation policy making has horizontal and vertical dimensions which are sometimes conflicting (Urwin and Jordan, 2008). Performing an analysis of cross-scale and cross-sectoral impacts would reduce potential new vulnerabilities (Adger et al., 2005) that may arise from decision taken on the sole basis of direct observable impacts, this way, reducing the emergence of maladaptive processes (Barnett and O'Neill, 2010; Juhola et al., 2016).
				22	What is the spatial level of the assessment? (house level, district level, city-level)			
				23	Does the assessment consider cascading impacts?			
				24	Are future climate scenarios taken into account?			
				25	Have urban social and economic scenarios been taken into account?			
				26	Has a preliminary list of adaptation alternatives been identified and evaluated?			
				27	Are adaptation actions connected to the impact and level of risk identified (i.e. they are defined to eliminate the unacceptable risks)?			
28	Is... considered as a criterion in the selection of adaptation options? (questions 33-40)			In order to guarantee that planned adaptation actions are adequate and reasonable (i.e. best available adaptation options are selected), a preliminary list of potential options should be identified and evaluated (see e.g. listed options by Stults and Woodruff, 2016 in the US). Also, it is important that adaptation actions are connected to climatic impacts and the different levels of risks identified in order to verify that planned actions are indeed adequate for expected changes. The criteria against which they should be evaluated may generally include effectiveness, efficiency, and feasibility. Here we have included those suggested in the IPCC report (Noble et al., 2014). Lastly, one important aspects of the plans is that if in the creational process and during the definition of strategic actions, barriers to adaptation or to its implementation are considered (Moser and Ekstrom, 2010). (Note that consideration related to stakeholder participation,				
29	...Effectiveness							
	...Cost-efficiency (benefits/costs)							

MAJOR AREA	COMPONENTS	INDICATORS (I#)	#	Factor description	Y	N	Reasoning
			30	...Integration with broader social goals			consistency with social norms and traditions, legitimacy and social acceptability are considered in the Component 'Legitimacy'. See below)
			31	...Environmental sustainability (e.g. by implementing SEA)			
			32	...Flexibility and robustness (against different scenarios)			
			33	...Timing (urgency)			
			34	...Mal-adaptation (inc. mitigation trade-offs or other issues not considered above)			
			35	...Resources available (including information, leadership, management capacity)			
			36	Does the plan include an assessment or consideration of potential barriers to adaptation?			
			37	Does the plan define a MER process?			
	MONITORING, EVALUATION AND REPORTING (MER)	I#9. Monitoring, Evaluation and Reporting processes	38	Does the plan specifically assign a responsible for the MER process?			In any planning system, MER mechanisms are necessary to govern implementation processes and assure plan objectives will be achieved. The monitoring of decision-relevant variables in climate adaptation planning is essential to link risk assessment and action (Kingsborough et al., 2016). However, in practice, Araos et al. (2015) have noted a lack of MER mechanisms in urban adaptation plans worldwide. In the evaluation of local climate adaptation plans, the existence of monitoring systems has been used as an indicator of plan quality (Woodruff and Stults, 2016) and climate preparedness (Heidrich et al., 2013) and has been claimed to be a key component in adaptation pathways approaches (Kingsborough et al., 2016).
39			Has the MER process been assigned a budget?				
40			Does the plan identify monitoring objectives and indicators?				
41			Does the plan set a method and/or process to evaluate outcomes of the monitoring process?				
42			Does the plan report to any higher-level authority or organisation through an official process?				

MAJOR AREA	COMPONENTS	INDICATORS (I#)	#	Factor description	Y	N	Reasoning
ADAPTIVE MANAGEMENT			43	Does the plan define a readjustment process i.e. an iterative process to manage existing adaptation strategies according to results of MER or new scenarios?			Learning and adaptive management are goals of the evaluation of climate adaptation processes and progress (Preston et al., 2011). Flexibility allows preparedness for unexpected events and efficiency of resource use. In order to allow flexibility penetrate in adaptation decision-making, effective MER systems and learning mechanisms need to be designed. MER systems are designed to provide information necessary to take decisions during the implementation phase and would not be useful if they do not serve adaptation management goals. 'Adaptation management' is defined as the "process of iteratively planning, implementing, and modifying strategies for managing resources in the face of uncertainty and change" and "involves adjusting approaches in response to observations of their effect and changes in the system" (PCC, 2014). This requires assimilating the existence of tipping points after which an adaptation action no longer meets the specified objectives and an alternative adaptation pathway needs to be taken (Haasnoot et al., 2013). Although closely linked to development pathways, pathways towards adaptation are diverse and need to be evaluated (Adger et al., 2005). Through different operationalizing approaches (see e.g. Kingsborough et al., 2016), climate adaptation policies can provide flexible and better embrace uncertainty. In adaptation decision-making, flexibility is a key component.
			44	Does this process include a set of indicators / warning metrics?			
			45	Does the plan specifically assign a responsible party for readjustment process?			
		46	Does the plan consider uncertainty in the design of the plan (e.g. by using a decision-method that includes uncertainty) and the assessment and selection of adaptation options (low regret measures, different scenarios, flexible approach)?		Finally, one important factor that should be taken into account when designing and planning for adaptation, is the uncertainty. There are different kinds of uncertainty in a climate change context and different strategies to deal with uncertainty in the design of projects and plans (Markandya, 2014). For example, developing a risk management process, taking into account different scenarios, and thus, adaptation options that work under the widest possible outcomes (no-regret or low-regret options) measures, evaluating the different options against various criteria, or adopting flexible management approaches. Here we create an indicator based on a combination of various existing metrics that are related to different strategies for uncertainty in a climate change context.		
		I#10. Learning mechanisms					
		I#11. Uncertainty					

MAJOR AREA	COMPONENTS	INDICATORS (##)	#	Factor description	Y	N	Reasoning
COMMON COMPONENT	LEGITIMACY	#12. Transparency and dialogue	47	Is the full process of screening, scoping and definition of the plan and later approval described in the plan or in an attached document or public site?			<p>“Legitimacy is the extent to which decisions are acceptable to participants and nonparticipants that are affected by those decisions” (Adger et al., 2005, p. 83). When it comes to adaptation management, different scholars analyse legitimacy from different perspectives: planning, legal, network (Buuren et al., 2014). Cosens (2013) brings a more in-depth analysis on the sources of legitimacy in administrative law in addition to democratic legitimacy. Policy transparency is critical to raise awareness and provide legitimacy to policy processes. Social acceptance of adaptation options and trust are also important characteristics (Adger et al., 2005) together with the clarity of the rules and availability of the information and the existence of public dialogue (Cosens, 2013). Because of the cultural connotations of this, there are no universal models to create legitimate policies (Adger et al., 2005). Notably, plans also need to be legitimate within the administrative entities responsible of the creation of the plan. For this, the involvement of different departments in the creation of the plan is important. Transparency in the scientific process i.e. the full accessibility of all materials produced to any interested party, is also imperative to allow external and independent evaluations.</p> <p>Participation of the public, communities, organisations and businesses is an important element in climate change adaptation decision making (Few et al., 2007; Collins and Ison, 2009; Sarzynski, 2015) because it can help to overcome barriers explicit to adaptation (Biesbroek et al., 2013) and, as part of a public policy process, it is important to create legitimate plans. However, it is also important to bring into the process stakeholders with legitimate reasons to be there. Legitimacy and power are different, and this must be taken into account (Mitchell et al., 1997). To ensure that accurate information is identified, participants, as sources of information and data, should bring multiple types of expertise relevant to the topic and should be trustworthy (i.e. should report information honestly) (Weichselgartner and Kasperson, 2010).</p>
			48	Are people involved in the process of plan creation (in any role such as developers, designers or participants) named in the document?			
			49	Does the plan or any attached documents related to it refer to which kind and how information (scientific or else) used to lead decisions has been produced and used?			
			50	Have different departments of the city been involved in the design of the plan?			
			51	Has the plan been formally exposed to a period of public information and debate?			
			52	Did the plan include a process of participation with stakeholders (including other departments) and civic organisations?			
		#13. Engagement of stakeholders and society	53	Did the process of participation include the public?			
			54	Is there a clear evidence on the multiple expertise brought by participants (in the process of participation)?			

MAJOR AREA	COMPONENTS	INDICATORS (##)	#	Factor description	Y	N	Reasoning
			55	Is there evidence that the plan addresses distributive impacts of climate change (e.g. by considering vulnerability in the most marginalized and disadvantaged groups) and develops adaptation measures accordingly?			Equity and justice is a central element in climate adaptation planning and therefore for successful climate change adaptation (Adger, 2001; Adger et al., 2005; Paavola and Adger, 2006). Adaptation to climate change is intrinsically spatial (Shi et al., 2016), however, factors related to equity and social vulnerability, which in many cases are reflected in space, are not equally taken into account in adaptation policy compared to physical aspects, as found by Hughes (2015) in a US study. To achieve equitable and just adaptation opportunities, there is the need to integrate justice criteria in the design of urban areas and its infrastructures (Shi et al., 2016), for which participation might be instrumental if communities or social justice advocacy groups are engaged (Shi et al., 2016). In order to integrate equity and justice criteria in adaptation planning, the developers of the plan must fully understand how the adaptation action is characterised (Eisenack and Stecker, 2012): who and what is exposed and who is the receptor of the action. Identifying who is directly or indirectly benefitting from the adaptation action can be helpful.
		##14. Equity and justice	56	Were communities or social advocacy groups involved in the framing and identification of those adaptation strategies?			
			57	Does the plan present a full understanding of the beneficiaries of the adaptation measures proposed?			

4. Conclusion and further steps

Most of the current adaptation tracking research to-date is based on the analyses of the policy content and policy process related to current adaptation initiatives, rather than on policy outputs. A general lack of policy implementation and of quality assurance frameworks built on best-practices evidence leads to a potential lack of reliability of the results, if one uses them to track the progress of adaptation. In this paper, we develop a checklist that can be used as a base for climate adaptation plan development and long term institutional capacity building. The checklist has been developed based on an intensive review of current literature that examines the progress towards successful adaptation. We recognise the ambiguity and blurriness of the term ‘successful’ when it comes to adaptation (Ford et al., 2015) as other factors apart from policy processes affect the success of global climate change adaptation across scales and time. However, the proposed checklist identifies some of the main factors determining effectiveness in reducing vulnerability and building resilience in the long run, as this checklist relies on factors describing resources, reliability, institutional, public and private support, usable knowledge, monitoring, evaluation and reporting (MER), adaptive management and transparency, equity and justice. This assessment, that we suggest to implement during and after the adaptation planning process, may enable understanding the strengths and weaknesses of adaptation plans, and its implementation might be very helpful in adaptation tracking studies. Future steps would include testing this checklist in a set of cities or regions.

We finally suggest the adequacy of this checklist as a base for the development of an adaptation policy credibility index to be applied to policies and plans being implemented as a proxy for successful adaptation. With exceptions (e.g. Averchenkova and Bassi, 2016), empirical studies dealing with credibility in the context of climate policy are scarce, especially with regards to adaptation (Dupuis and Biesbroek, 2013). A credibility index could turn into an extremely helpful indicator for decision-making so that efforts can be well targeted, funds can be effectively allocated, best-practices can be transferred and ultimately, adaptation science and practice (especially adaptation tracking research efforts) can advance. Our current work goes in this direction.

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