

Research Article

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Causal mechanisms of common barriers to national adaptation policy processes and practical solutions in South Korea and the UK

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Non-technical Summary

As adaptation deficits become increasingly evident and widespread, barriers to adaptation draw more attention as a key reason. However, the current understanding of the barriers is limited, making it challenging to provide practical solutions for real-world adaptation policy processes. This study aims to identify the origins, influences, and relationships of common barriers to national adaptation policy processes, and to analyse their causal mechanisms. The findings present a barrier map that illustrates potential causal mechanisms of common barriers to national adaptation policy processes and, based on it, suggest a systematic approach for practical solutions.

Technical Summary

Despite progress in national adaptation policies in the last two decades, the adaptation deficit is getting wider and barriers to adaptation are regarded as a key reason for it. However, our understanding of barriers to adaptation does not help improve real adaptation processes. Based on South Korean and UK cases, this study identified 17 common barriers to national adaptation policy processes and placed them in four categories. It also identified the barriers' origins and influences, drew a common barrier map underlying national adaptation policy processes and identified causal mechanisms of the common barriers, which were limitedly addressed in the earlier literature. The results highlight that understanding the causal mechanisms of barriers to national adaptation policy processes is important to devise practical solutions to overcome barriers and improve the effectiveness of real adaptation processes. The findings also offer a practical understanding of common barriers to national adaptation policy, which can help adaptation policy stakeholders and practitioners to diagnose policy problems, analyse what barriers and origins are related to the problems, decide what should be addressed first to solve the problems, and ultimately make efforts to reduce the current adaptation deficit.

Social Media Summary

New study identifies causal mechanisms of 17 common barriers to national adaptation policy processes & suggests a systematic approach to overcome the barriers.

1. Introduction

Adaptation is getting more attention given the inevitable climate change caused by the already emitted greenhouse gases (Adger et al., 2009; Berrang-Ford et al., 2011, 2014; IPCC, 2007, 2014; Klein et al., 2017). The role of national adaptation policy is increasingly emphasised (Biesbroek, 2014; Mullan et al., 2013; OECD, 2009; Russel et al., 2020) as (1) national adaptation policies define the roles of different stakeholders, provide standardised information about climate risks and projections, establish legal and institutional frameworks, distribute resources, support vulnerable groups and coordinate financing mechanisms (IPCC, 2014), (2) national adaptation policies include multiple policy sectors beyond the environmental domain (Bauer et al., 2012; Braunschweiger & Pütz, 2021; Brown et al., 2018). Since the Intergovernmental Panel on Climate Change's (IPCC) fourth assessment report (2012), there has been clear progress with national adaptation policies (IPCC, 2014), and the momentum has increased after the Paris Agreement in 2015 (UNEP, 2018a, 2018b). However, adaptation policies are not keeping up with the increasing need to adapt. This has led to an 'adaptation deficit', a gap between the current state of human/natural systems and a state that minimises negative climate change impacts (Eisenack et al., 2014; IPCC 2022; Lonsdale et al., 2017; McClure & Baker, 2018). There is an increasing demand for solutions to address

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the reasons for the adaptation deficit and to reduce adaptation deficit situations (Clissold *et al.*, 2020; Gawith *et al.*, 2020; Dupuis and Knoepfel, 2013; UNEP, 2018a, 2018b, 2022).

'Barriers' are regarded as a key reason for the adaptation deficit (Clissold *et al.*, 2020; Lee *et al.*, 2022; Simoes *et al.*, 2017; Wise *et al.*, 2014). A barrier to adaptation is defined as a factor that may prevent or hinder adaptation efforts but can be overcome with additional efforts (Barnett *et al.*, 2015; IPCC, 2014; McNamara *et al.*, 2017; Moser & Ekstrom, 2010). Barriers can explain why adaptive capacity is not translated into action or why low adaptive capacity exists (Eisenack *et al.*, 2014). Thus, identifying and overcoming barriers to adaptation is essential to reduce the adaptation deficit as well as to enhance adaptive capacity (Bednar *et al.*, 2019; Clissold *et al.*, 2020; Jones, 2010; Liu *et al.*, 2020; Moser & Ekstrom, 2010; Wise *et al.*, 2014). The research community has identified and catalogued a large number of barriers to adaptation (Adger *et al.*, 2009; Berrang-Ford *et al.*, 2011; Biesbroek *et al.*, 2010; Clissold *et al.*, 2020; Hulme *et al.*, 2007; IPCC, 2007, 2014; Wise *et al.*, 2014). However, three major limitations make the results of previous studies unpragmatic for national adaptation policy processes.

The first limitation is the lack of practical understanding of barriers to adaptation. Earlier studies on barriers to adaptation offer a limited understanding of the barriers, rarely helping to address the barriers (Eisenack *et al.*, 2014; Lee *et al.*, 2022; Wise *et al.*, 2014). The existing approach to adaptation has two features that contribute to the current limited understanding of the barriers: (1) the existing approach has focused on identifying and describing the barriers themselves, not explaining them (Biesbroek, 2014; Braunschweiler & Pütz, 2021; Fayazi *et al.*, 2020; Liu *et al.*, 2020; Wise *et al.*, 2014), and (2) as adaptation has a context-specific nature, the barriers to adaptation reflect contextual factors, which has led to a long list of barriers (Dupuis & Knoepfel, 2013; Waters *et al.*, 2014). To address the identified barriers systematically and effectively, an understanding is needed of how/why the barriers occur, how the barriers impact adaptation policies and actions, and how barriers are interrelated is necessary. However, previous studies have not addressed this satisfactorily (Biesbroek, 2014; Esteve *et al.*, 2018; Fatorić & Biesbroek, 2020; Lee *et al.*, 2022; Moser & Ekstrom, 2010). The existing literature has largely failed to identify concrete and practical solutions for overcoming barriers (Clar *et al.*, 2013; Eisenack *et al.*, 2014; Liu *et al.*, 2020). It has remained unclear what we need to do and what needs to be addressed to overcome the persisting barriers.

The second limitation is the lack of generally applicable knowledge in previous research on barriers to adaptation. Research has been conducted at different levels using different research methods and approaches. Because of this, the results are fragmented, and it is difficult to compare and generalise the findings for each actor, sector, or scale (Biesbroek *et al.*, 2011, 2013; Valente & Veloso-Gomes, 2020). This also prevents addressing the barriers systematically (Waters *et al.*, 2014). There is a need for generalised knowledge of barriers to adaptation from a broad set of cases to address them effectively (Eisenack *et al.*, 2014).

The third limitation is the lack of studies in the literature on barriers to adaptation at a national level. Although the roles of national-level adaptation policies have drawn more attention, most research on barriers to adaptation has been conducted at the local, community or individual level, and thus our understanding of barriers to national adaptation policy remains somewhat limited (Biesbroek *et al.*, 2015; Lee *et al.*, 2022; Waters *et al.*,

2014). Some studies on national adaptation policy have been conducted in the implementation research, but it is moving away from the notion of barriers to adaptation (Biesbroek *et al.*, 2015). Official documents from developed countries do not identify barriers to their adaptation policy. For example, there is no evidence of barriers to adaptation policies in the United Nations Framework Convention on Climate Change (UNFCCC) Annex 1 countries' National Communications. However, research indicates that developed countries face barriers such as uncertainty of climate change, the lack of resources and fragmentation between horizontal and vertical actors (Bauer *et al.*, 2012; Biesbroek *et al.*, 2010; Helgeson & Ellis, 2015; Kato & Ellis, 2016; Mullan *et al.*, 2013; OECD, 2009, 2012; Prabhakar *et al.*, 2014; Russel *et al.*, 2020). Although some barriers to national adaptation have been identified and categorised by some studies, no study has examined why common barriers occur across national adaptation policies or their characteristics. Eisenack *et al.* (2014, p. 870) emphasised that 'identifying common causal patterns, interdependency and the dynamics of adaptation will significantly advance our ability to explain the occurrence of barriers and find promising ways to overcome them'.

Considering the above three limitations, four urgent research gaps need to be filled to foster national adaptation policy processes: (1) explanatory research based on analysis of barriers' origins, influences, and dynamics; (2) research bridging the conceptual understanding of barriers and actual adaptation processes; (3) research explaining common barriers of multiple cases to produce generally applicable knowledge using a consistent research approach, and; (4) research focusing on understanding national-level barriers and providing practical insights into addressing them.

This research aims to address the research needs by using a comparative analysis of national adaptation policy in two cases. Lee *et al.* (2023) suggest a research approach that can show barriers' origins, potential causal mechanisms, influences, and relationships, which makes it possible to explain the characteristics of barriers to national adaptation policy processes. By applying the research approach to the national adaptation policy processes of South Korea (Korea) and the United Kingdom (UK) to compare them, it proposes to offer a deeper and practical understanding of common barriers to national adaptation policy processes and to generate general and practical insights into overcoming the common barriers. The research questions we seek to answer are: (1) what are the common barriers to national adaptation policy processes in Korea and the UK? (2) what are the characteristics of the common barriers and their influence and origin? (3) how can barriers at the national level be reduced and overcome potentially?

2. Case selection

Most comparative analyses on national adaptation policy have been conducted on cases that have similar economic, political, cultural and climatic backgrounds, such as the Least Developed Countries (Kuruppu & Willie, 2015), European Union (Biesbroek *et al.*, 2010) or Western countries in OECD (Bauer *et al.*, 2012). However, it is necessary to compare cases across economic, political, cultural and climatic backgrounds to go beyond the limitations of previous studies and to draw lessons that can be applied to a broader set of national-level adaptation policy cases. We used the following criteria for case selection: (1) Countries that establish and implement national adaptation policies with a clear legal basis, (2) Countries that have sufficient

experience in national adaptation policies and related barriers of at least two policy cycles, (3) Countries that provide sufficient official data on national adaptation policies, including policy documents, legislation, and related research reports, (4) Comparing countries in different continents to capture differences in responding to climate change in different economic, political, cultural and climatic backgrounds, and; (5) Comparing a UNFCCC Annex1 country and a non-Annex1 country for different levels of climate change responses.

Korea and the UK were selected. The two countries satisfy the criteria well (Table 1), and there are also many reports and a wealth of data about the legal and administrative aspects of the policies and policy processes. However, it is harder to find research and data on barriers to each national adaptation policy, as official government documents do not identify or describe barriers to their adaptation policy.

The two countries have clear and robust legislation for national adaptation policy. Korea's National Climate Change Adaptation Plan (NCCAP) is based on the 'Framework Act on Low Carbon, Green Growth (2010)', and UK's policy is based on the 'Climate Change Act 2008'. Under the leadership of the Ministry of Environment (MoE), Korea has implemented its national adaptation policy since 2010, with the third cycle in progress. The UK conducted its first national Climate Change Risk Assessment (CCRA) in 2012, and the first National Adaptation Programme (NAP) was published by the Department for Environment, Food and Rural Affairs (Defra) in 2013 based on the CCRA. The Third CCRA was published in early 2022, and the third NAP will be published in 2023. There are several official and publicly available documents related to national adaptation policies published by the Korean and UK governments, government departments, official advisory organisations, official supporting organisations or government research institutes. With the world-leading Climate Change Act and ambitious climate action, the UK is regarded as one of the world leaders in climate change mitigation and adaptation (Fankhauser et al., 2018). The UK's approach to adapting to climate change has had a great influence on other European countries and is a model for national adaptation policy for other countries (Biesbroek et al., 2018; Massey & Huitema, 2013; Swart et al., 2009). Korea has also played a leading role in tackling climate change in Asia since 2008 when the Korean government adopted 'Low-carbon green growth' as its national vision. Korea was the first Asian country to establish a legislative framework for climate change, publish a detailed national adaptation policy and created a government department for adaptation strategies (Park, 2013). Korea held the first UNFCCC Global Adaptation Week in 2019 and joined the Global Commission on Adaptation in 2020. Under the UNFCCC, the UK is in the Annex1 country group and has significant responsibility for climate change responses from the Kyoto Protocol (1997), whereas Korea is in the non-Annex1 country group and has less responsibility for climate change responses than the UK. The Korean government founded the Korea Adaptation Centre for Climate Change (KACCC) to support NCCAPs. It is an affiliated institute of MoE which supports the formulation and implementation of the NCCAPs, the development and dissemination of adaptation programmes and information, and cooperation on climate change adaptation with international and domestic stakeholders.¹ Under the Climate

¹kaccc.kei.re.kr

Table 1. National climate change adaptation policy in the UK and Korea

	United Kingdom	South Korea
Location	Europe	Asia
UNFCCC category	Annex 1	Non-Annex 1
National adaptation policy	National Adaptation Programme	National Climate Change Adaptation Plan
Legal basis	Climate Change Act 2008	Framework Act on Low Carbon, Green Growth 2010
Policy periods	1st: 2013–2018 2nd: 2018–2023	1st: 2011–2015 2nd: 2016–2020 3rd: 2021–2025
Main department	Department for Environment, Food & Rural Affairs	Ministry of Environment
Supporting institute	Adaptation Committee, Climate Change Committee	Korea Adaptation Centre for Climate Change

Change Act 2008, the UK's Climate Change Committee (CCC) and Adaptation Committee (AC) were established to support the implementation of CCRAs, preparation of NAPs, and the independent assessment of the NAP.

3. Methodology and materials

Comparative and actor-centred methods are well-suited for advancing our understanding of the barriers and for generating findings that help overcome barriers (Eisenack et al., 2014). This research applies the methodology suggested by Lee et al. (2023) to two cases. Lee et al. (2023) introduce an approach to explaining why a barrier occurs (origin), how the barriers affect adaptation policy (influence), and how barriers interact with each other (relationship). A barrier to adaptation is defined as the factors that stop, delay, or divert the development and implementation of adaptation actions but which can be overcome. 'Origin' refers to factors that give rise to adaptation barriers, and 'influence' refers to the consequences of the barriers to adaptation. 'Relationship' refers to causal chains and links between factors, including the relationships between barriers, origins, and influences (Lee et al., 2023). The key features of the approach are outlined in Figure 1. The methodology identifies barriers to adaptation and the barriers' origins and influences based on the experience and expertise of stakeholders of adaptation policies and analyses relationships between the barriers, origins and influences based on stakeholders' views. Although several methodologies for analysing relationships between barriers have been suggested recently (Fatorić & Biesbroek, 2020; Fayazi et al., 2020; Mercado et al., 2020), we considered the methodology of Lee et al. (2023) superior to other methodologies for four reasons: (1) because it is based on actor-centred data, it is intuitive and easy to understand, (2) it helps analyse relationships between social factors that cannot be quantitatively analysed, (3) it helps analyse causal mechanisms between factors such as origins, barriers, and influences, not only relationships between barriers, and; (4) it can help identify systematic and logical approaches to address barriers to adaptation.

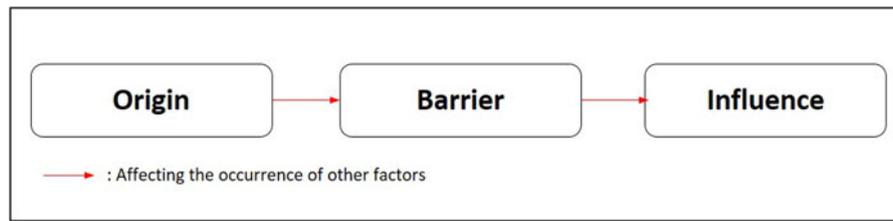


Figure 1. Basic concept of a relationship between factors.

We identify barriers, origins, and influences by drawing from semi-structured interviews with the stakeholders of adaptation policies and visually map the relationships to show potential causal mechanisms of barriers and problems of the national adaptation policy processes. By applying the same research approach to Korean and UK cases, this research focuses on the experience of actors who participate in the national adaptation policy processes in Korea and the UK, to compare common barriers and their characteristics.

To identify actors to recruit for interviews, we used the participant lists of NCCAPs (Korea) and CCRAAs (the UK) and contacted 95 participants over email and phone. A total of 41 semi-structured interviews were undertaken: 23 in Korea and 18 in the UK. Thirty-two interviews were conducted face-to-face, five were paper interviews through emails, and four interviews were conducted over telephone calls. Interviewees included (A) civil servants of the managing departments (MoE, Defra); (B) civil servants of other governmental departments; (C) experts of official supporting institutes (KACCC, CCC), and (D) sectoral experts. Also, (E) local-level adaptation policy experts were interviewed to analyse more diverse and realistic evidence of barriers to national adaptation policy and their characteristics. The interviewee group sizes were as follows: Korea (KA = 5, KB = 2, KC = 3, KD = 10, KE = 3); the UK (UA = 4, UB = 4, UC = 1, UD = 9).

Interviewees were asked about their experiences and opinions of working in the national adaptation policy process from risk assessment to monitoring and evaluation (see Appendix 1). The main questions were:

- (1) Based on your experience, what are the barriers to national adaptation policy?
- (2) What problems are caused because of the barriers?
- (3) What do you think are the reasons for the barriers?

All interviews were recorded and transcribed (Korean interview responses were translated into English). Following Lee et al. (2023)'s analytical approach, this research first identifies each country's factors related to barriers to national adaptation policy processes (barriers, origins, influences) and maps relationships based on the connections between the factors, through a qualitative content analysis of transcribed interview results. All factors that interviewees mentioned as a barrier are codified as a barrier (see Appendix 2). The origins and influences of each barrier are analysed based on transcribed interview responses to questions 2 and 3. For example, regarding the barrier of 'frequent rotating of civil servants', UC1 said 'Based on the regulation, most civil servants are encouraged to move post every two years. And, of course, they build up institutional knowledge and leave.' The origin of this barrier is 'civil servant regulation'. KD5 in turn said that 'expert knowledge and experience of adaptation have accumulated but adaptation is always a new topic for civil servants

in departments who lead on adaptation policy': 'limited expertise of practitioners' is an influence affected by the barriers. Following the results of the analysis and the concept of relationships (Figure 1), we draw a common barrier map of national adaptation policy that shows all barriers, origins, influences and relationships between them at once.

4. Results

Interviewees in the two countries identified many more common barriers than different and context-specific barriers. Many groups of barriers to adaptation have been suggested in the literature (Biesbroek et al., 2011; IPCC, 2007, 2014; Mullan et al., 2013; Waters et al., 2014; Wise et al., 2014), but based on the interviews, we categorise common barriers to those relating to: (1) national political and administrative system, (2) resources, (3) laws and regulations, and (4) nature of adaptation. Below we also indicate the influences and origins of barriers occurring in both countries.

4.1 Common barriers and their origins and influences

4.1.1 National political and administrative system

Six common barriers to national adaptation policy relate to the national political and administrative system in Korea and the UK. Interviewees identified *conflicts between governmental departments* as a barrier to their national adaptation policy. Inter-sectoral competition made it challenging to convince the departments to engage in the process (KA3, KA4, KD10). There were tensions between Defra and other departments about regulations, and although Defra tried to convince them to think about adaptation, there were many competing goals and sectoral objectives (UC1, UD9). The interviewees considered that this barrier is caused by four factors: unclear provisions in regulations about the range of participants in national adaptation policy, absence of regulations about the accountability of each department for adaptation, indifference of departments, and limited authority and role of the managing department. Interviewees from managing departments and institutes suggested that they do not have authority based on law or regulations to force other departments to engage. Only the Defra and the MoE pay attention to adaptation, as other government departments see adaptation as a side activity not directly related to their main tasks (KA3, KA4, KA5, UA1, UB4, UC1). This horizontal fragmentation barrier leads to two problems: lack of responsibility of each department for adaptation, and inability to deal with cross-cutting issues. Departments' adaptation policies usually consist of soft measures picking the low-hanging fruit with unclear responsibility for adaptation (KA3, UD9). UB4 also said, 'this barrier makes things disjointed. ... the current policies are not connected up to issues and departments'.

Lack of connection between national- and sub-national-level adaptation policy was another common barrier. The national

adaptation policy consisted only of central government departments' actions, and local authorities did not participate in the policy process. It is not clear to what extent the national-level policy informs sub-national adaptation. For example, KD8 emphasised that 'in policy processes of both levels, there is no concept of how we link national adaptation policy and local adaptation policy'. This barrier has its origin in two factors: unsystematic schemes (timeframes) of different levels of adaptation policy, and unclear range of participants in national adaptation policy. There are no provisions for the involvement of local authorities in national adaptation policy (KD2), and local and national level policies follow different timeframes (KD8, UB1). This vertical fragmentation barrier leads to two problems: no linkage between different levels of adaptation and omission of realities on the ground. As a result, national and local adaptation policies have been implemented separately, without a shared vision or goal for adaptation, and national adaptation policy is not grounded on and does not reflect adaptation actions on the ground. (KE1, KE2, KE3, UB1, UB2).

Lack of linkage between different scales' climate change risk assessments was also identified as a barrier. National and local risk assessments have been conducted separately, and there is no linkage between them. In the UK, although the latest CCRA contains risks for England and the devolved governments, the level of detail is not sufficient for devolved governments. They have had to conduct additional risk assessments, and there is no linkage between different governments' risk assessments (UA2, UA3, UB4). KD8 also stressed that 'there is no spatial concept in the current risk assessment. ... Risks need to be connected both spatially and contextually between different levels, but national risk assessments don't contain local level risks and vice versa'. Two factors originate from this barrier: lack of communication between different levels for adaptation and the unclear range of participants in national adaptation policy.

Limited authority and role of the managing department was raised as an administrative system barrier. National adaptation policy is managed by the department of the environment in the two countries (MoE, Defra). The interviewees considered that the department does not have enough authority and resources to influence other departments. The managing department is one of the least powerful departments in both countries, so it is hard to lead on adaptation which involves multiple departments (KD2, UC1, UD1). Also, because there are no regulations about responsibility and accountability for adaptation, the managing department cannot require other departments to make effort or dedicate resources for adaptation (KA2, KA4, KA5, KC3, UA1, UA2, UD3). This barrier has its origin in the limited support in the current institution. There is no legal basis for authority and resources for the managing department; thus, it is a challenge to mobilise other departments (UD6). The influences of this barrier include conflicts between government departments, lack of overarching policy and direction and high dependence on other departments' action and budget. UA2 said, 'It could not be overarching policy or direction, it is just a collection of policies because of our limited power'. The managing department cannot be involved in the implementation of other departments' adaptation policies, and it only collected the results that other departments sent with high dependence (KC3, UA3).

Frequent rotating of responsible civil servants was also identified as a barrier. Civil servants are rotated 2–3 times within a policy period. Rotating civil servants' varying understandings of adaptation introduces variation in the national adaptation policy

and its implementation (KC2, KD8, UC1). Civil servant regulation is the origin of the barrier and it has four key influences: additional time needed to educate new civil servants, low continuity and connectivity of adaptation policies, limited expertise of practitioners and limited accumulation of adaptation policy experience. Because adaptation is a relatively new concept, new civil servants have different levels of and sometimes limited understanding of it. Thus, time is needed to educate them and because of it the continuity and connectivity of adaptation policies cannot be guaranteed (KA3, KD7, KE2, UC1). KD5 emphasised that 'expert knowledge and experience of adaptation have accumulated but that adaptation is always a new topic for civil servants in departments who lead on adaptation policy'.

Interviewees indicated *lack of interest and support from the government (political will)* as a barrier. In both Korea and the UK, the national interest and support have decreased for the second national adaptation policy cycle. UC1 said, 'we have seen a lot of adaptation issues falling away because of political interest. ... Climate change has fallen off the agenda. So, all that institutional arrangement has fallen way over previous years'. KA2 said that 'it was hard to have a national momentum for adaptation policy in the process of establishing the second NCCAP'. Interviewees identified three origins for this barrier: low political salience of adaptation and resulting unimportance for winning votes, short time-horizon of politicians and high-level leaders and the difference between adaptation timescales and electoral cycles. This barrier had two key influences: lack of specific funds for adaptation and continuing low priority of adaptation. It was very difficult to secure funds for adaptation because of the low interest of the government, although the managing department had to spend time and effort to highlight the importance of adaptation policy and the funds needed for it (KA2, KA3, KA4, KA5, KC1, UA1, UC1).

4.1.2 Resources

Two resource barriers were identified. First, interviewees said that *no specific funds for adaptation* is a barrier to national adaptation policy. National adaptation policy in the two countries does not provide funds for adaptation policy to other departments, and the majority of provided funds for other departments' actions, not the managing department. Also, the government and departments in Korea and the UK do not have specific 'adaptation funds' and there is no adaptation funding scheme at a national or local level or in the private sector. UD9 stressed that 'departments are aware of adaptation and the reason why they need to do. However, because of a small budget, it is like anyone who is operating adaptation, at the moment, hand tight behind backs'. This barrier has three origins: the absence of institutions for adaptation funds, lack of interest and support from the government and continuous low priority of adaptation. It is difficult to make a case for funding for adaptation to departments because it is seen as a future issue that can be addressed later, financial resources are first allocated to emergency or high-priority issues (KA2, KC1, UA1, UA2, UB1, UC1).

Lack of human resources in the managing department was the other resource barrier. Just 4–7 people in the managing department operate the whole process of national adaptation policy, and it is too few to handle the policy effectively and monitor relevant parts of the policy. KA2 said, 'tasks related to GHG mitigation are carried out by several teams or departmental units, but only four people manage all climate change adaptation tasks'.

Although interviewees in both countries considered this barrier significant, no one identified the origin of the barrier. One

influence of the barrier was identified: difficulty of handling and monitoring the policy. UA4, e.g. mentioned that ‘more people of our division are needed to check everything and to make sure things are progressing’.

4.1.3 Laws and regulations

Two barriers were identified in this category. Interviewees found that *unclear range of participants in national adaptation policy in the current regulations* is a barrier. The current adaptation Acts and regulations in the two countries do not clearly indicate the range of horizontal and vertical participants in national adaptation policy. Thus, it is not clear who should be involved in the policy process and what the involved stakeholders’ accountability is. Interviewees considered it difficult to engage stakeholders and that some departments were reluctant to interact (KA2, KE3, UA4, UD6). Secondly, a national adaptation policy does not involve all relevant stakeholders as it is implemented by a small number of central government civil servants and experts in a top-down way (KD5, KD6, KD7, UC1, UD7). The barrier has one origin: complicated governance arrangements which arise from the nature of adaptation, which has unclear audiences, and because the responsibility for adaptation is not sufficiently defined. Thus, the range of participants in the policy process is also unclear (KD6, KE2, UB2, UB3, UA4, UC1, UD9). This barrier has five influences: conflicts between governmental departments, lack of connection between national and sub-national levels of adaptation policy, lack of linkage between different scales’ CCRA, inability to deal with cross-cutting adaptation issues and inconsistent range of participants (horizontal and vertical). The first and second policy cycles involved different stakeholders. In Korea, although the range of stakeholders engaged was extended, there are still questions about who should be involved – e.g. what should be the role of local authorities and the private sector. In the UK, as adaptation issues have lower priority and the adaptation team was trimmed down, the engagement in the second policy cycle was weaker than in the first one.

Unclear or absent monitoring and evaluation (M&E) provisions were also identified as a barrier. Although both countries have an M&E system for adaptation policy, the current system only evaluates administrative attainment, such as whether the planned projects have been executed, or the planned budgets used, rather than evaluating the effect on adaptation. In other words, we do not know whether the policy is effective for national adaptation (KD2, KD5, KD7, KD10 UA1). Also, interviewees said that feedback from the current system is not helpful for improving the policy going forward (KD9, UA4). The absence of a clear indicator for adaptation was considered the origin of this barrier. KC2 said ‘because there is no proper indicator, NCCAP cannot have a clear direction of monitoring and evaluation’, and UC1 also said, ‘we have 180 indicators that we used. ... but it is not saying risks are coming down with our indicators’. This barrier originates from and influences the uncertainty on the effectiveness of adaptation policy. For example, UD9 emphasised that ‘lack of legal measures means nothing is happening at the end’.

4.1.4 Nature of adaptation

This category involves seven barriers. Interviewees identified *continuously low priority of adaptation* as a barrier. Adaptation is never a priority that government departments invest effort and money in: it is a future task on top of their existing responsibilities. UB4 stressed that ‘adaptation has not been something at the front of people thinking. ... I think adaptation just has not

had focus’, and UB2 said ‘it (adaptation) is always just seen as kind of an added work’. There are seven origins for this barrier: adaptation does not win votes, short time-horizon of politicians and high-level leaders, competing priorities and interests of departments, lack of immediate and visible results of adaptation, lack of interest and support from the government, the difference between adaptation timescales and electoral cycles and lack of economic approaches to and research on adaptation. KD1 said, ‘The reason is that there is no immediate visible result. Civil servants and leaders cannot show the achievements of the policy; thus, they do not prioritise adaptation’, KE3 viewed that ‘climate change adaptation measures are a mid- to long-term plan, but leaders are changed every four or five years. So, it is important that leaders can show achievements right away and get votes’. UD8 said ‘it is not about vote winning. I think it is something that needs to be done, but actually, it does not make it into the higher levels of a priority compared to education, health service, security etc. ... Other priorities are coming first, and adaptation can get left out’. The barrier influences one factor in both countries: lack of specific funds for adaptation.

Interviewees identified *uncertainty of the effectiveness of an adaptation policy* as a barrier. It is difficult to demonstrate that the current general adaptation policy stakeholders are making the right adaptation decisions. KD2 said ‘there is a key question concerning the effect of doing adaptation projects, but we cannot find answers within a short time’, UA2 and UA3 said that we don’t know whether an adaptation policy is working or not. UB1 emphasised that ‘something we have to bear in mind when we work in this field is that we are not going to get those exact figures on impacts of the adaptation measures’. There is one origin that interviewees mentioned: the absence of clear indicators for adaptation. It is difficult to find suitable indicators; the national adaptation policy has some indicators in both countries, but we still don’t know if those are good to show the effectiveness of the policy (UA1, UA2, UC1). Three factors are influenced by this barrier: unclear results of national adaptation policy, difficulty in setting clear targets for adaptation and assumptions that have not been proved. UB2 mentioned that ‘you can read the national adaptation plan, but it can be quite vague of what it is asking people to do. So, what is asking government departments, for example, to do. It is not easily measured’, also UC1 said ‘we would love to be able to measure things (policy results) but we are not able to measure’. UA4 stressed that ‘we had to accept some assumptions of policies from other sectors. We worked with some assumptions that have not been proved and do not have enough scientific evidence’. In addition, as mentioned above, this barrier gives and takes an influence with unclear or absence of monitoring and evaluation regulation.

Difference between adaptation timescales and electoral cycles was also identified as a barrier. Climate change impacts and adaptation require long-term processes but the time horizons of politicians and leaders are short. Politicians and leaders don’t want nor need to plan very far into the future, and they want to achieve something within the election cycle (KE3, UA2, UB3). UB2 said, ‘the government is working on the election timescale ... but adaptation is the much longer time period over the election periods’. This barrier influences and is influenced by the short time horizon of politicians and leaders. It also influences three other factors: lack of interest and support from the government, continuous low priority of adaptation and difficulty in establishing long-term goals for adaptation. Interviewees emphasised that it is hard to set long-term goals for adaptation in the current

governmental system which changes every five years (KA2, KD9, KE3). Also, because of the barrier, asking politicians to sign up for adaptation actions is difficult (UC1), and adaptation is never really treated as a priority area. It never had many people working on it. It never had visibility or popularity. It was never something that government departments put much money into (UB2).

Interviewees pointed out that there is a *lack of understanding of adaptation*. The awareness of adaptation has increased, but the understanding of adaptation is still limited. Differences between adaptation and mitigation as well as between adaptation and disaster risk reduction are not well understood. Interviewees suggested that there are still three poorly answered questions: what is adaptation? what do we need to do for adaptation? what can we do for adaptation? Even practitioners and civil servants who lead the policy cannot answer the questions and have different levels of understanding (KA2, KC2, KD7). UB4 also said, 'even now, we don't know what to do for adaptation. ... I think we are still developing our understanding to answer what we need to try to deal with it'. The barrier originates from: lack of examples of adaptation, limited range of participants in the national adaptation policy process and lack of adaptation experts. There is a lack of examples of adaptation which could demonstrate what adaptation is and what each department can do (UA4, UD7). KC1 said, 'although departments secure budgets, they don't know what projects they can do. We don't have good and clear examples of adaptation projects'. Climate change adaptation is still an agenda for a selected few people (KD6, UA1, UA2), so only a small number of people share the understanding of it. This barrier's influences include indifference of departments, terminology gaps between stakeholders, lack of relevance for current issues and weak linkage between adaptation policy and CCRAs. A few departments did think adaptation is not their job and did not link adaptation with their current work. In other words, with the current understanding of adaptation, national adaptation policy does not appear relevant for the current issues, especially for other departments.

There is also a *terminology gap between stakeholders*. The definitions of key adaptation terms are not mutually agreed or clear: these include the terms adaptation, risk, vulnerability, and adaptive capacity, for example. Experts and civil servants who participate in the policy process differently interpret and use the terms based on their understanding, training and expertise (KA4, KD10, UC1). This barrier is influenced by lack of adaptation experts and lack of understanding of adaptation. Its influence includes misunderstanding or confusion between stakeholders.

Insufficient economic approaches and research on adaptation is a further barrier. Interviewees mentioned that the current general adaptation policy stakeholders do not know the cost of taking adaptation actions as well as the cost of not taking the actions. So, the costs and benefits of adaptation remain unclear. UD9 said, 'we have a quite clear climate science, but there is big uncertainty of climate policy and cost of adaptation, cost of not doing adaptation'. This influence of this barrier includes the continuous low priority of adaptation and low awareness of the urgency of adaptation. The national adaptation policy does not make financial implications; thus, it cannot attract attention from the public and politicians (KD5, UB2).

Lastly, the *lack of linkage between climate change risk assessment and current issues and ongoing tasks* is considered a barrier. The current general adaptation policy stakeholders are looking at the climate change risks in isolation, not making implications in the departments' work context, although the risk assessments are

very systematic (KD1, UD7). The government cannot demonstrate the importance of adaptation based on risk assessments, and civil servants of the departments cannot link their tasks with the results of the risk assessments (KA4, KA5, UD9). There is one origin for this barrier: lack of consideration of climate change risks by policy-makers. KD2 said, 'although adaptation policy should be based on climate change risks, there was no consideration of them. The current policy is a set of similar policies which were going on in departments'. UD3 said, 'They (civil servants) just put those things we are going to do; actually, it is not a plan: it is a wish list, not consideration of risks'. This barrier weakens the linkage between adaptation policy and CCRAs.

4.2 Characteristics of the common barrier map

We next present a map that indicates the relationships between barriers, origins, and influences as well as between barriers – we call it 'the common barrier map of national adaptation policy' (Figure 2). The map identifies 54 factors common between the two countries: 17 origins, 17 barriers, and 20 influences. Seven barriers relate to the nature of adaptation, six to the national political and administrative system, and two barriers relate to both resources and laws & regulations. As the nature of adaptation category has the largest number of barriers, it also has the largest number of origins (14) and influences (17). The national political and administrative system category has 13 origins and 13 influences. The arrows from the categories of nature of adaptation and laws and regulations head to influences, other barriers, and origins in a complex way. The majority of arrows from the national political and administrative system and resources point towards influences. Ten influences are related to the national political and administrative system barriers, eight are related to the nature of adaptation categories, three influence factors are linked with the laws and regulations barriers, and one is linked with the resources barrier.

4.3 Key barriers

Each barrier has a mean of 4.2 arrows, and there are eight barriers which have more arrows than the average: these can be considered key barriers (Figure 2). Although the number of arrows does not indicate the importance of the barriers, the eight barriers play a more prominent role than the other barriers as they have more connections with various factors across categories. The key barriers can be classified into three types.

Barrier type 1. Simple origins but multiple influences)

In the first type, four barriers originate from one or two sources but influence four or five factors. In the map, *frequent rotating of civil servants* is a barrier that is caused by only civil servant regulation, but it leads to four challenges to national adaptation policy. Also, *unclear range of participants in national adaptation policy in the current regulations* is derived from one origin, complicated governance of national adaptation policy, but it affects not only two policy challenges but also three other barriers. *Uncertainty of the effectiveness of adaptation policy* has one origin, absence of clear indicators for adaptation, and it relates to three problems. It also inter-influences with the unclear or absence of M&E regulation barrier. *Timescale difference between adaptation issues and election periods* causes a problem and gives affects two other barriers. The origin, short time horizon of politicians and high-level leaders, and inter-influences with this barrier.

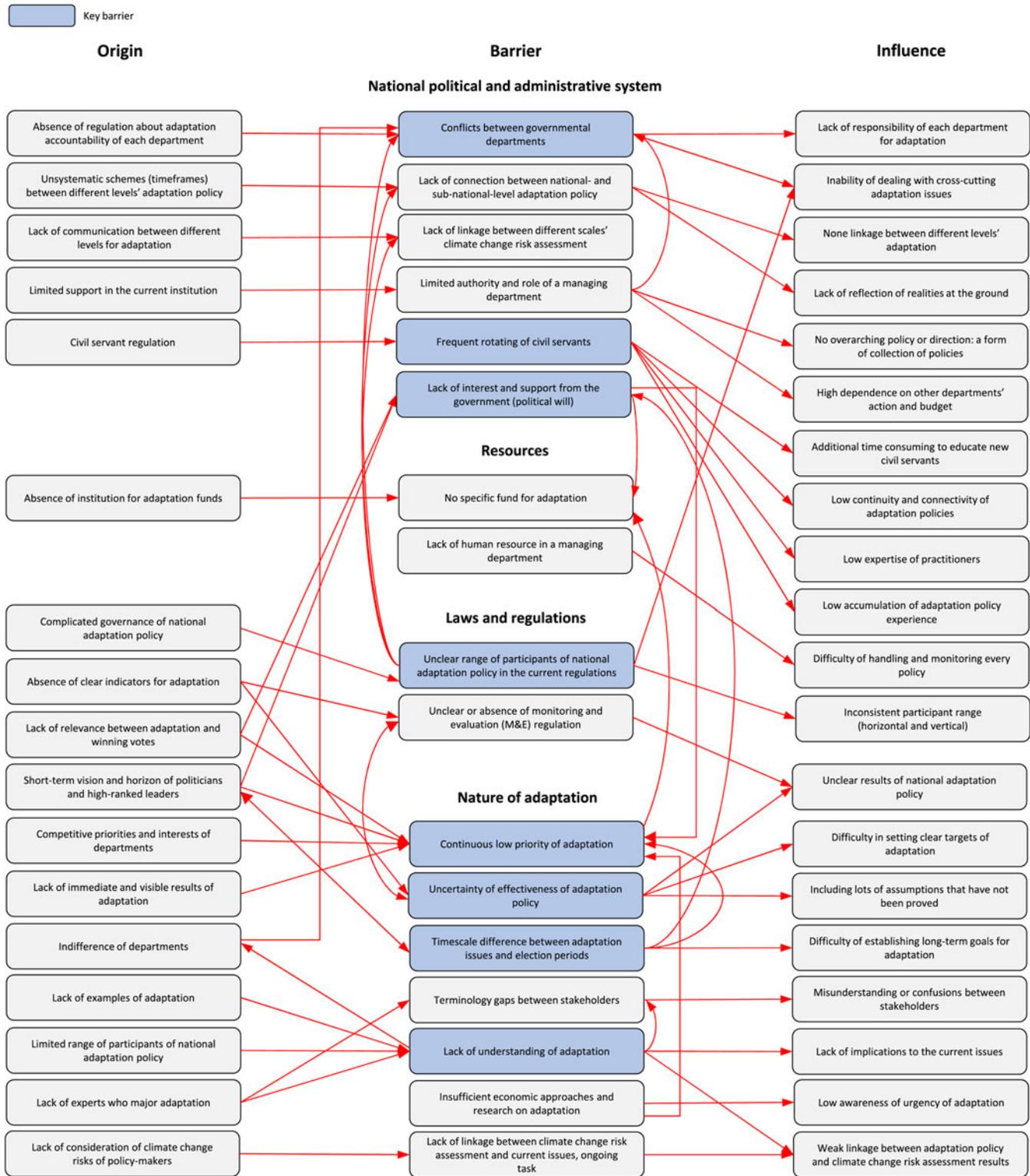


Figure 2. Common barrier map underlying national adaptation policy processes of Korea and the UK.

Barrier type 2. Multiple origins but simple influences

In contrast, two barriers have only one or two influences but many origins. *Continuous low priority of adaptation* has seven origins and one influence. Four origins and three other barriers cause the barrier, but it influences only the lack of specific funds for adaptation barrier. *Conflict between governmental*

departments is also derived from four factors: two origins and two barriers, and it has two influences.

Barrier type 3. Multiple origins and multiple influences

Lastly, two barriers have similar numbers of origins and barriers. *Lack of interest and support from the government (political will)* is influenced by two origins and one barrier, and it

influences two other barriers. *Lack of understanding of adaptation has three origins*, and it has an influence on three factors (two influences, one barrier, one origin).

The analysis suggests that each barrier type needs different approaches to overcome them. It is more straightforward to address barriers of type 1 because the number of their origins is small, making it clearer what is required to address the barrier. For example, lack of economic evaluations of adaptation could be addressed by funding a programme of research to improve the evidence base and to improve understanding of adaptation. But more comprehensive measures are needed to overcome the second and third barrier types. For example, uncertainties related to the effectiveness of adaptation may need research but also communication strategies, case examples of successful adaptation and new processes and solutions to enhance understanding of adaptation among key stakeholders. The approaches should cover multiple origins and barriers simultaneously and consider the relations between the barriers to clarify which barriers need to be handled first.

4.4 Context-specific barriers to each national adaptation policy

The interviews also indicated that Korea and the UK have experienced context-specific barriers to their national adaptation policy. In Korea, *an absence of a comprehensive and continuous communication system* is identified as a barrier. Although the NCCAP has a cross-departmental consultative group, the group has never operated or played a role in the policy processes. Only an ad-hoc working group to establish the NCAAPs was organised early in each policy period. This barrier causes awareness gaps between the managing department and other departments, as well as underappreciation at the national level of the needs at the local level and in the private sector (KA4, KA5, KD1, KD3). The Korean interviewees also identified *the unclear hierarchical status of the national adaptation policy* as a barrier. Its hierarchical relationships with other policies of other government departments as well as with subnational-level adaptation policies are not explicit. In other words, the current national adaptation policy does not play a role as a higher-level policy such as integrating policies with similar contents of other departments or subnational authorities or presenting consistent long-term visions or goals, which causes overlaps between similar policies and waste of resources (KC2, KD8). In the UK, *an ambitious national target of CO₂ mitigation* is considered a barrier to national adaptation policy, as the majority of resources and efforts for climate change are committed to mitigation, and adaptation receives less attention. Thus, adaptation is a lower priority and securing financial and human resources for adaptation policy is difficult (UA1, UA4). *An unsystematic timeframe between CCRA, NAP, ARP and local-level adaptation* is also pointed out as a barrier. Only the timeframes for CCRA and NAP work well. As UB2 said, 'as time goes, all adaptation schemes are becoming complicated and fragmented now'.

5. Discussion and conclusion

This research applied the approach suggested by Lee et al. (2023) to compare national adaptation policy in Korea and the UK in-depth to overcome the limitations of previous studies, and to offer a practical understanding of common barriers to national adaptation policy. The research confirmed that there are clear commonalities in barriers to national adaptation policy processes

between Korea and the UK despite their somewhat different political systems and climate change contexts. We examined what common barriers to national adaptation policy are, how they affect policy (influence), and why they occur (origin). An underlying 'dynamic web of barriers', which has been suggested only conceptually (Agrawala, 2005; Eisenack et al., 2014), was also uncovered empirically by mapping the relationships between factors. Therefore, this research could identify common relationships and dynamics of the barriers, which have been recognised as an 'unopened black box' (Biesbroek & Candel, 2019; Biesbroek et al., 2015; Eisenack et al., 2015).

Seventeen common barriers to national adaptation policy in Korea and the UK were identified and placed in four categories. Korea and the UK have more than 10 years of adaptation policy experience and offer rich data on it, but it was more difficult to find evidence on barriers to adaptation. By identifying barriers to the national adaptation policies, this research provides a deeper understanding of the problems and current status of adaptation policies in the two countries. In line with earlier results (Eisenack et al., 2014; Kato & Ellis, 2016; Lonsdale et al., 2017; Swart et al., 2009; UNEP, 2018a, 2018b), this research suggest that four types of barriers to national adaptation policy occur across contexts: 'low priority of adaptation', 'conflict between government departments', 'lack of political interest', and 'unclear related regulations'. It identified seven barriers which are specific to national adaptation policy too: 'frequent rotating of civil servants', 'unclear range of participants of national adaptation policy in the current regulations', 'lack of linkage between climate change risk assessment and current issues, and ongoing task'. In addition, 'lack of linkage between different scales' climate change risk assessment', 'lack of human resource in a managing department', 'uncertainty of effectiveness of adaptation policy', and 'timescale difference between adaptation issues and election periods' offer more detail than identified barriers in previous studies. In terms of a practical understanding, although a financial resource barrier has frequently been reported as an influential barrier (Agrawala, 2005; Biesbroek et al., 2013; IPCC, 2007, 2014; OECD, 2009; Waters et al., 2014), it was not influential in the cases. KC1 commented that 'even if the budget was secured, there were many cases where they don't know what to do for adaptation'. Therefore, we emphasise that it is necessary to reconsider the barriers that were taken for granted before for a practical understanding of them. Also, the importance of this research is that the barriers mentioned above were not explicitly shown in official documents in both countries, although stakeholders have experienced them repeatedly in their policy processes.

Origins and connections between barriers were also analysed and potential common causal mechanisms were identified in the national adaptation policy of Korea and the UK. An empirical understanding of social mechanisms has been emphasised to understand the nature of causality and explain connections between causes and effects (Gerring, 2008; Hedström & Swedberg, 1998; Mason et al., 2013), and the understanding of mechanisms is important to open up the 'black boxes' of barriers and to use the results of research on barriers in real adaptation process (Biesbroek & Candel, 2019; Wellstead et al., 2018). Also, understanding the mechanisms enables researchers and practitioners to collect diagnostic evidence, theorise variables and empirical examples, and test hypotheses (Kay & Baker, 2015; Wellstead et al., 2018). In this respect, this research identified potential causal mechanisms of common barriers to national adaptation policy processes. By following the arrows in the

common barrier map (Figure 2), factors are related to the occurrence of a barrier and connections between the factors are revealed. In addition, as it focused on commonalities, the research results can play a critical role as a milestone to theorise common causal mechanisms of barriers to national adaptation policy, if more studies using the same methodology are conducted.

This research also indicated the influences of the common barriers and identified their policy implications. A total of 20 influences were caused by barriers, which are common problems of national adaptation policy processes in the UK and Korea. Previous studies on barriers to adaptation have focused only on one barrier itself or relationships between the barriers, without considering the actual impacts on adaptation policy establishment and implementation (Clissold *et al.*, 2020; Fatorić & Biesbroek, 2020; Ghasemzadeh & Sharifi, 2020), and it led to a separation of the barriers from real policy processes (Biesbroek, 2014; Fayazi *et al.*, 2020). However, this research indicated how barriers are influencing the national adaptation policy processes by highlighting concrete influences so that barriers could be better considered within the adaptation policy process. Adaptation policy stakeholders and practitioners can diagnose policy problems that they are experiencing among the influence factors, analyse what barriers and origins are related to the problems and decide what should be addressed first to solve the problems (Lee *et al.*, 2023). In the interview, we asked about solutions for barriers to national adaptation policy (Appendix 3). However, the solutions are still too normative to devise practical and concrete actions, are not barrier-specific, or are hard to yield clear outcomes. Therefore, the approach including origins, barriers, and influence can contribute to toppling the current invisible but robust barriers to adaptation, suggesting practical solutions.

To effectively address barriers and reduce the adaptation deficit, this research argues that focusing on overcoming barriers that have simple and a small number of sources (origins and barriers) first would be practical. This research classified the key barriers into three types according to the number of their origins and influence, and this is a new approach to understanding characteristics of barriers to adaptation beyond only identifying and describing them. Also, it can be useful for the actual adaptation process; stakeholders can use this approach to devise concrete solutions. For example, in Figure 2, several problems caused by the 'frequent rotating of civil servants' barrier can be addressed with solutions that supplement the current civil servant regulation, for example, establishing a 'boundary organisation (Bauer *et al.*, 2012; Biesbroek *et al.*, 2010)' that can continuously manage, evaluate, and track adaptation policy in the whole policy process, as an official organisation but not consisted of civil servants, could be a good solution to supplement the civil servant regulation. By doing so, it could retain the continuity and connectivity of adaptation policies as well as the expertise and accumulated experiences of the policy. By legally specifying both horizontal and vertical participants of the governance of national adaptation policy, it would help to reduce conflicts between government departments, to improve not only connections between national- and subnational-level adaptation schemes but also the inability of dealing with cross-cutting issues. 'Uncertainty of effectiveness of adaptation policy' could be overcome by setting a clear M&E regulation and making appropriate indicators for adaptation. If making appropriate indicators is difficult now, governments could set clearly measurable goals for the policy to make sure of the effectiveness of the policy. By availing funds for research programmes, 'insufficient economic approaches and research on

adaptation' could be addressed. It will help improve low awareness of the urgency of adaptation and continuous low priority of adaptation problems through strengthening the evidence base on adaptation and providing examples of successful adaptation. In addition, these approaches will provide a basis for overcoming more complex barriers. Barriers having simple and a small number of sources do not always mean that it is easy to overcome. It depends on whether the sources require incremental or transformational approaches to overcome, and each country's abilities. However, the important implication is that paying attention to barriers having simple and a small number of sources first can clarify what is practically needed and what needs to be done in order to address the barriers, which was not possible in previous studies.

This research has some limitations, however. First, it focused on common factors related to national-level barriers, but it cannot be denied that context-specific factors can have a great influence on the occurrence of the barriers. This issue should be dealt with in each case study. The research drew on the interviewees' experiences and opinions, which may have not revealed all factors or aspects that affect barriers to national adaptation policy processes, although the interviewees are key adaptation policy stakeholders in the two countries. Also, two cases are too few to generalise the results of this research. To overcome the limitations, wider studies including broader stakeholder groups and more cases with the same research method are required.

The research results have implications for how to go about reducing the adaptation deficit in national adaptation policy in Korea and the UK, as Lee *et al.* (2023) suggested. First, civil servants and stakeholders should examine the problems that they have encountered in establishing and implementing the policy by focusing on the influence factors. Next, they should identify what barriers cause the influences and determine what are their origins by tracing the relationships backwards. Then, based on the characteristics of the barriers and the prevailing adaptive/policy capacity, they should prioritise barriers and find out an entry point to overcome the barriers. Doing so would help make adaptation to climate change more effective and efficient and reduce the adaptation deficit.

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References

- Adger, W. N., Lorenzoni, I., & O'Brien, K. L. (2009). Adaptation now. *Adapting to Climate Change: Thresholds, Values, Governance*, 1, 1–22.
- Agrawala, S. (2005). *Bridge over troubled waters: Linking climate change and development*. OECD.
- Barnett, J., Evans, L. S., Gross, C., Kiem, A. S., Kingsford, R. T., Palutikof, J. P., Pickering, C. M., & Smithers, S. G. (2015). From barriers to limits to climate change adaptation: Path dependency and the speed of change. *Ecology and Society*, 20(3).
- Bauer, A., Feichtinger, J., & Steurer, R. (2012). The governance of climate change adaptation in 10 OECD countries: Challenges and approaches. *Journal of Environmental Policy & Planning*, 14(3), 279–304.
- Bednar, D., Henstra, D., & McBean, G. (2019). The governance of climate change adaptation: Are networks to blame for the implementation deficit? *Journal of Environmental Policy & Planning*, 21(6), 702–717.
- Berrang-Ford, L., Ford, J. D., Lesnikowski, A., Poutiainen, C., Barrera, M., & Heymann, S. J. (2014). What drives national adaptation? A global assessment. *Climatic Change*, 124(1–2), 441–450.
- Berrang-Ford, L., Ford, J. D., & Paterson, J. (2011). Are we adapting to climate change? *Global Environmental Change*, 21(1), 25–33.
- Biesbroek, G. R. (2013). On the nature of barriers to climate change adaptation. *Regional Environmental Change*, 13(5), 1119–1129.
- Biesbroek, R. (2014). *Challenging barriers in the governance of climate change adaptation*. Wageningen University.
- Biesbroek, R., & Candel, J. J. (2019). Mechanisms for policy (dis) integration: Explaining food policy and climate change adaptation policy in the Netherlands. *Policy Sciences*, 53(1), 61–84.
- Biesbroek, R., Dupuis, J., Jordan, A., Wellstead, A., Howlett, M., Cairney, P., Rayner, J., & Davidson, D. (2015). Opening up the black box of adaptation decision-making. *Nature Climate Change*, 5(6), 493.
- Biesbroek, R., Klostermann, J., Termeer, C., & Kabat, P. (2011). Barriers to climate change adaptation in the Netherlands. *Climate Law*, 2(2), 181–199.
- Biesbroek, R., Peters, B. G., & Tosun, J. (2018). Public bureaucracy and climate change adaptation. *Review of Policy Research*, 35(6), 776–791.
- Biesbroek, R., Swart, R. J., Carter, T. R., Cowan, C., Henrichs, T., Mela, H., Morecroft, M. D., & Rey, D. (2010). Europe Adapts to climate change: Comparing national adaptation strategies. *Global Environmental Change*, 20(3), 440–450.
- Braunschweiler, D., & Pütz, M. (2021). Climate adaptation in practice: How mainstreaming strategies matter for policy integration. *Environmental Policy and Governance*, 31(4), 361–373.
- Brown, K., DiMauro, M., Johns, D., Holmes, G., Thompson, D., Russell, A., & Style, D. (2018). Turning risk assessment and adaptation policy priorities into meaningful interventions and governance processes. *Philosophical Transactions of the Royal Society A*, 376, 20170303.
- Clar, C., Prutsch, A., & Steurer, R. (2013). Barriers and guidelines for public policies on climate change adaptation: A missed opportunity of scientific knowledge-brokerage. *In Natural Resources Forum*, 37(1), 1–18.
- Clissold, R., McNamara, K. E., & Westoby, R. (2020). Barriers to adaptation: Insights from Laamu Atoll, Maldives. *Asia Pacific Viewpoint*, 61(2), 381–390.
- Dupuis, J., & Knoepfel, P. (2013). The adaptation policy paradox: The implementation deficit of policies framed as climate change adaptation. *Ecology and Society*, 18(4).
- Eisenack, K., Moser, S. C., Hoffmann, E., Klein, R. J., Oberlack, C., Pechan, A., Rotter, M., & Termeer, C. J. (2014). Explaining and overcoming barriers to climate change adaptation. *Nature Climate Change*, 4(10), 867–872.
- Eisenack, K., Moser, S. C., Hoffmann, E., Klein, R. J., Oberlack, C., Pechan, A., Rotter, M., & Termeer, C. J. (2015). Reply to 'Opening up the black box of adaptation decision-making'. *Nature Climate Change*, 5(6), 494–495.
- Esteve, P., Varela-Ortega, C., & Downing, T. E. (2018). A stakeholder-based assessment of barriers to climate change adaptation in a water-scarce basin in Spain. *Regional Environmental Change*, 18(8), 2505–2517.
- Fankhauser, S., Averchenkova, A., & Finnegan, J. (2018). 10 years of the UK Climate Change Act. Policy Paper. London School of Economics and Political Science, Grantham Research Institute on Climate Change and the Environment, Centre for Climate Change Economics and Policy.
- Fatorić, S., & Biesbroek, R. (2020). Adapting cultural heritage to climate change impacts in the Netherlands: Barriers, interdependencies, and strategies for overcoming them. *Climatic Change*, 162(2), 301–320.
- Fayazi, M., Bisson, I. A., & Nicholas, E. (2020). Barriers to climate change adaptation in indigenous communities: A case study on the Mohawk community of Kanestake, Canada. *International Journal of Disaster Risk Reduction*, 49, 101750.
- Gawith, D., Hodge, I., Morgan, F., & Daigneault, A. (2020). Climate change costs more than we think because people adapt less than we assume. *Ecological Economics*, 173, 106636.
- Gerring, J. (2008). The mechanistic worldview: Thinking inside the box. *British Journal of Political Science*, 38(01), 161–179.
- Ghasemzadeh, B., & Sharifi, A. (2020). Modelling and analysis of barriers to climate change adaptation in Tehran. *Climate*, 8(10), 104.
- Hedström, P., & Swedberg, R. (1998). Social mechanisms: An introductory essay. *Social Mechanisms: An Analytical Approach to Social Theory*, 1–31.
- Helgeson, & J. Ellis, J. (2015). *The role of the 2015 agreement in enhancing adaptation to climate change*. OECD.
- Hulme, M., Adger, N., Dessai, S., Lorenzoni, I., Naess, L., & Wreford, A. (2007). *Limits and barriers to adaptation: Four propositions*. Tyndall Center for Climate Change Research.
- IPCC (2007). *Climate change 2007: Impacts, Adaptation and vulnerability*, 4th assessment report. IPCC.
- IPCC (2014). *Climate change 2014: Impacts, Adaptation and vulnerability*, 5th assessment report. IPCC.
- IPCC (2022). *Climate change 2022: Impacts, Adaptation and vulnerability*, 6th assessment report. IPCC.
- Jones, L. (2010). *Overcoming social barriers to adaptation*. Overseas Development Institute, Background Note.
- Kato, T., & Ellis, J. (2016). *Communicating progress in national and global adaptation to climate change*. OECD.
- Kay, A., & Baker, P. (2015). What can causal process tracing offer to policy studies? A review of the literature. *Policy Studies Journal* 43(1), 1–21.
- Klein, R. J., Adams, K. M., Dzebo, A., Davis, M., & Siebert, C. K. (2017). *Advancing climate adaptation practices and solutions: emerging research priorities*. Stockholm Environment Institute.
- Kuruppu, N., & Willie, R. (2015). Barriers to reducing climate enhanced disaster risks in least developed country-small islands through anticipatory adaptation. *Weather and Climate Extremes*, 7, 72–83.
- Lee, S., Paavola, J., & Dessai, S. (2022). Towards a deeper understanding of barriers to national climate change adaptation policy: A systematic review. *Climate Risk Management*, 100414.
- Lee, S., Paavola, J., & Dessai, S. (2023). Deeper understanding of the barriers to national climate adaptation policy: the case of South Korea. *Mitigation and Adaptation Strategies for Global Change*, 28(1), 4.
- Liu, W., Liu, L., & Gao, J. (2020). Adapting to climate change: Gaps and strategies for Central Asia. *Mitigation and Adaptation Strategies for Global Change*, 25(8), 1439–1459.
- Lonsdale, W. R., Kretser, H. E., Chetkiewicz, C. L. B., & Cross, M. S. (2017). Similarities and differences in barriers and opportunities affecting climate change adaptation action in four North American landscapes. *Environmental Management*, 60(6), 1076–1089.
- Mason, K., Easton, G., & Lenney, P. (2013). Causal social mechanisms: from the what to the why. *Industrial Marketing Management*, 42(3), 347–355.
- Massey, E., & Huitema, D. (2013). The emergence of climate change adaptation as a policy field: The case of England. *Regional Environmental Change*, 13(2), 341–352.

- McClure, L., & Baker, D. (2018). How do planners deal with barriers to climate change adaptation? A case study in Queensland, Australia. *Landscape and Urban Planning*, 173, 81–88.
- McNamara, K. E., Westoby, R., & Smithers, S. G. (2017). Identification of limits and barriers to climate change adaptation: Case study of two islands in Torres Strait, Australia. *Geographical Research*, 55(4), 438–455.
- Mercado, J. M. R., Kawamura, A., & Amaguchi, H. (2020). Interrelationships of the barriers to integrated flood risk management adaptation in Metro Manila, Philippines. *International Journal of Disaster Risk Reduction*, 49, 101683.
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the National Academy of Sciences*, 107(51), 22026–22031.
- Mullan, M., Kingsmill, N., Kramer, A. M., & Agrawala, S. (2013). *National adaptation planning: Lessons from OECD countries*. OECD.
- OECD. (2009). *Integrating climate change adaptation into development co-operation: Policy guidance*. OECD.
- OECD. (2012). *Policy forum on adaptation to climate change in OECD countries summary note*. OECD.
- Park, K. (2013). *Political culture, governance and climate change adaptation: Case study of South Korea*. Exeter University.
- Prabhakar S. V. R. K (2014). Adaptation decision making frameworks and tools: Multi-criteria decision making tools for prioritising adaptation actions at community level. IGES.
- Russel, D., Castellari, S., Capriolo, A., Dessai, S., Hildén, M., Jensen, A., Karali, E., Mäkinen, K., Nielsen, H. Ø., Weiland, S., Uyl, R. D., & Tröltzsch, J. (2020). Policy coordination for national climate change adaptation in Europe: All process, but little power. *Sustainability*, 12(13), 5393.
- Simoes, E., de Sousa Junior, W. C., de Freitas, D. M., Mills, M., Iwama, A. Y., Gonçalves, I., Olivato, D., & Fidelman, P. (2017). Barriers and opportunities for adapting to climate change on the North Coast of São Paulo, Brazil. *Regional Environmental Change*, 17(6), 1739–1750.
- Swart, R. J., Biesbroek, G. R., Binnerup, S., Carter, T., Cowan, C., Henrichs, T., Loquen, S., Mela, H., Morecroft, M., Reese, M., & Rey, D. (2009). Europe adapts to climate change. Comparing National Adaptation Strategies in Europe (No. 1). PEER.
- UNEP. (2018a). Adaptation gap report 2018. UN environment programme.
- UNEP. (2018b). The adaptation gap report 2018. UNEP.
- UNEP. (2022). Adaptation gap report 2022. UN environment programme.
- Valente, S., & Veloso-Gomes, F. (2020). Coastal climate adaptation in port-cities: Adaptation deficits, barriers, and challenges ahead. *Journal of Environmental Planning and Management*, 63(3), 389–414.
- Waters, E., Barnett, J., & Puleston, A. (2014). Contrasting perspectives on barriers to adaptation in Australian climate change policy. *Climatic Change*, 124(4), 691–702.
- Wellstead, A., Biesbroek, R., Cairney, P., Davidson, D., Dupuis, J., Howlett, M., Rayner, J., & Stedman, R. (2018). Comment on “Barriers to enhanced and integrated climate change adaptation and mitigation in Canadian forest management”. *Canadian Journal of Forest Research*, 48(10), 1241–1245.
- Wise, R. M., Fazey, I., Smith, M. S., Park, S. E., Eakin, H. C., Van Garderen, E. A., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change*, 28, 325–336.

Appendix 1

Interview protocol

<p>Pre-interview checks</p> <ul style="list-style-type: none"> • Before we start, there are a few things that I'd like to confirm with you. • Purpose of research and interview <ul style="list-style-type: none"> – The aim of this study is to answer two questions (1) what national adaptation policies and their barriers are, and (2) how can the national adaptation policy processes be improved? – This interview is conducted to collect primary data related to the barriers to national adaptation policy process based on major stakeholders' experiences, opinions, and views. – Definitions of key terms – To prevent a confused understanding or use of key terms that are used in this interview, we define key terms as below. – 'National adaptation policy' refers to – 'Barriers to national adaptation policy' refers to – If you have any question about definitions or concepts of any terms that are used in the interview, feel free to ask it anytime during the interview. • General information of the interview <ul style="list-style-type: none"> – This interview will take approximately 30 min to 1 h. If it is needed to shorten, there is no problem, it can be tailor to suit – This interview will be recorded, are you happy to be recorded? – If you don't want to answer specific questions, you can freely reject to answer. In addition, you have the right to withdraw your participating within 2 months after this interview without giving any reason. Details about your right are in this consent from. – Before we start, please take a few minutes to read and sign it. You can also keep a copy of this consent form. If you have any concerns about this, do not hesitate to ask any question to me. – Ok, are you happy to start interview or do you have any question before we start?
<p>Introduction and Warm-up</p> <ul style="list-style-type: none"> • Tell me a little bit about your background. • Questions <ul style="list-style-type: none"> – What is your current job? – What was your role in the process of national adaptation policy? – Have you participated from the first national adaptation policy?
<p>Barriers to national adaptation policy</p> <ul style="list-style-type: none"> • Questions (Barriers) <ul style="list-style-type: none"> – Based on your experience, what were the barriers to national adaptation policy? – Can you tell me specific examples? (with stages of policy process) – These are seven clusters of barriers that have been identified in previous research. With these seven cluster, was there any other barrier that you can remember? – What was the biggest barriers among the barriers and why? • Questions (Influence and Origin of the Barriers) <ul style="list-style-type: none"> – You said A, B, C.... were the barriers to national adaptation policy. Then, what problems were caused or what problem did you experience because of the barriers? – Can you tell me specific examples? – You said A, B, C.... were the barriers to national adaptation policy. Then, why do you think each barrier occurred? In other words, what do you think the reason of the barrier? – Is there any reason you think so? – Do you think that the barriers occur because this is the national adaptation policy or other national policies have similar barriers too?
<p>Solutions for the Barriers</p> <ul style="list-style-type: none"> • Questions (Solution that were used) <ul style="list-style-type: none"> – To overcome or reduce the barriers that you encountered in the process of national adaptation policy, what did you do? – Were the solutions different depending on each barrier? – Why did you use the solution? (What made you use the solution?) • Questions (Results and Evaluations of the Solution) <ul style="list-style-type: none"> – By using the solutions, did you overcome or reduce the barriers? – The barriers were completely solved? – In your opinion, was the solutions good and why? – If not, is there more effective and efficient solution that you think?
<p>Ending</p> <ul style="list-style-type: none"> • Thank you very much for your time and answer for this interview. Your opinions are really helpful for my research. I have included my contact information on the consent form, so if you have any concerns or questions about this interview, or if you want to further clarity some of your comments, please do not hesitate to contact anytime. Also, please forgive me if I have any followed-up questions to ask and bother you again in the future. Thank you again for your help in this interview.

Appendix 2

Examples of interview responses related to each barrier

National political and administrative system
Conflicts between government departments
<p>(KA3) Due to the lack of understanding of adaptation, there is a very lack of activeness for adaptation by other departments. Even some refused to participate because they think their works don't have a direct relationship with adaptation.</p> <p>(UC1) So, the department for the environment has the adaptation portfolio. But the department for housing has a responsibility for building regulation and also planning (for overheating or flood risks), and they are one of the worst departments we have for taking adaptation seriously. So, there is always tension between Defra and housing departments.</p> <p>(UD9) And there is a lot of inter-sectorial competitions. So, when A sector, in this case environment department, it poses perceived imposes and there is kind of resistance.</p>
Lack of connection between national- and sub-national-level adaptation policy
<p>(KD8) In policy processes of both levels, there is no concept of how we link national adaptation policy and local adaptation policy. At the national level, there is no discussion on how to link local governments' adaptation and how to set common goals. All are conducted very separately.</p> <p>(UA2) In terms of adaptation, there is no registration for reporting local governments' adaptation. So, it was hard local governments to consider national adaptation programmes and plans, and we are limited to do it. But central government knows that they cannot do it alone.</p> <p>(UB1) One of the researches we done this local climate change adaptation at the local level, we didn't know how much the NAP is being used.</p>
Lack of linkage between different scales' climate change risk assessments
<p>(KC3) There is a lack of linkage between local-level and country-level risk assessments from the first. The assessments are conducted totally separately.</p> <p>(KD8) There is no spatial concept in the current risk assessment. ... Risks need to be connected both spatially and contextually between different levels, but national risk assessments don't contain local level risks and vice versa</p>
Limited authority and role of the managing department
<p>(KD2) The managing department does not have enough function, authority and budget to oversee and control other ministries at the implementation stage</p> <p>(UC1) I would agree all of these categories. The power of a main department, yes, that is definitely one that we see as well. Defra is not a powerful department of the government; it is one of the least powerful departments. So, they are not good at influencing other departments.</p> <p>(UA4) The power of a main department, the department like us we are very much relied on expertise of different business areas or other departments because we are limited for all things.</p>
Frequent rotating of responsible civil servants
<p>(KC2) The persons in charge at government departments keep changing, and new persons always have a low-level of understanding of adaptation.</p> <p>(KD7) Civil servants in the managing department and other departments participating in the adaptation policy are changed too frequently and it give negative effects to the practitioners' expertise and it is related to the continuity of the policy</p> <p>(UC1) We definitely have that (frequent turnover of civil servants) as well. Most civil servants are encouraged to move post every two years. And, of course they build up institutional knowledge and leave. And what you see, the result is always the same decisions being made....</p>
Lack of interest and support from the government (political will)
<p>(KA2) It was hard to have a national momentum for adaptation policy in the process of establishing the second NCCAP.</p> <p>(UC1) We have seen a lot of adaptation issues falling away because of political interest. ... Climate change has fallen off the agenda. So, all that institutional arrangement has fallen way over previous years</p>
Resources
No specific funds for adaptation
<p>(KD1) Adaptation policy does not have a specific budget. Adaptation budgets are made based on the funds for existing policies. New projects or policies focusing on only adaptation are rarely implemented.</p> <p>(UD9) Departments are aware of adaptation and the reason why they need to do. However, because of a small budget, it is like anyone who is operating adaptation, at the moment, hand tights behind backs</p>
Lack of human resources in the managing department
<p>(KA2) Tasks related to GHG mitigation are carried out by several teams or departmental units, but only four people manage all climate change adaptation tasks</p> <p>(UA4) Only 4 to 7 people manage the whole NAP. More people of our division are needed to check everything and to make sure things are progressive and for monitoring. For the monitoring, we really don't know what we need to check.</p> <p>(UB2) In the UK, local councils have one person or half person who works for adaptation.</p>
Laws and regulations
Unclear range of participants of national adaptation policy in the current regulations
<p>(KE3) The roles and responsibilities of participants are unclear. There is no regulation what local governments or national government department should do for adaptation.</p> <p>(UD7) In the absence of regulatory controls, it is just like a voluntary groups put together and really try to tackle the issues about collaborative working together at the moment.</p> <p>(UD9) Another thing is.... it is not accountable. I suppose that it is a regal question. Who is accountable for adaptations? The NAPs set to do things. But there is no..... if action is taken and something happens to weather related events which connect to climate change... no one is accountable.</p>

(Continued)

Appendix 2 (Continued.)

National political and administrative system
Unclear or absent monitoring and evaluation (M&E) provisions
(KC2) Because there is no proper indicator, NCCAP cannot have a clear direction of monitoring and evaluation. (UC1) we have 180 indicators that we used. ... but it is not saying risks are coming down with our indicators
Nature of adaptation
Continuously low priority of adaptation
(KD1) The biggest problem is the reality that neither the department in charge nor the relevant departments prioritise adaptation. (UB2) It (adaptation) is always just seen as kind of an added work (UB4) Adaptation has not been something at the front of people thinking. ... I think adaptation just has not had focus
Uncertainty of effectiveness of adaptation policy
(KD2) There is a key question concerning the effect of doing adaptation projects, but we cannot find answers within a short time. (UB1) Something we have to bear in mind when we work in this field is that we are not going to get those exact figures on impacts of the adaptation measures
Difference between adaptation timescales and electoral cycles
(KE3) Climate change adaptation measures are a mid- to long-term plan, and the election of the head of an organisation is four or five years. The head of the organisation changes every 4 to 5 years. Therefore, it is important for the heads of organisations to show the performance of a certain project right away and get votes from it. This is the biggest limitation of adaptation measures. (UB2) The government is working on election timescale ... but adaptation is the much longer time period over the election periods
A lack of understanding of adaptation
(KC1) Although departments secure budgets, they don't know what projects they can do. We don't have good and clear examples of adaptation projects (UB4) Even now, we don't know what to do for adaptation. ... I think we are still developing our understanding to answer what we need to try to deal with it
A terminology gap between stakeholders
(KD10) For example, words such as risk and vulnerability are used complexly. For these things, the Ministry of Environment should give accurate definitions of the key words and establish risk-based adaptation measures. However, because it is not, the problem of the complex use of words is inherent. (UC1) Yes, we have the same. So, a word, resilience means different according to people. There has been attempts in the past kind of bring that terminology together. But I would say it is almost impossible to do that
Insufficient economic approaches and research on adaptation
(KD5) There is no clear indication of how economically beneficial action to adapt is. This is a major difficulty in persuading decision makers to support policy formulation. (UD9) We have a quite clear climate science, but there is big uncertainty of climate policy and cost of adaptation, cost of not doing adaptation
A lack of linkage between climate change risk assessment and current issues and ongoing tasks
(KD2) Although adaptation policy should be based on climate change risks, there was no consideration of them. The current policy is a set of similar policies which were going on in departments. (UD9) That is the process you get that in fact, climate change risk assessment things like that it is a very systematic process but it is not really doing anything. There is no concrete action

Appendix 3

List of suggested solutions
Korea (Lee *et al.*, 2023)

Category	Solutions
Improving civil servants' understanding and expertise of adaptation	<ul style="list-style-type: none"> • Including climate change content in the education curriculum for civil servants above a certain level and high-ranked leaders • Conducting regular education for civil servants of government departments • Introducing an expert committee with special civil servants or experts, which can supplement the rotating system of civil servants.
Reducing uncertainty	<ul style="list-style-type: none"> • Continuous investment in climate change impact research • Expansion of government support for research on the difference between adaptation policy and other policies
Finding concrete results of adaptation policy/good examples	<ul style="list-style-type: none"> • Presentation and publication of specific results of adaptation policy to the public • Finding and sharing good examples of adaptation policy
Prioritising among adaptation policies	<ul style="list-style-type: none"> • Selecting and focusing core policies, projects, or issues • Establishing clear goals based on the risk assessments • Focusing on establishing a clear and long-term vision, not focusing on detailed short-term projects
Improving the current risk assessment	<ul style="list-style-type: none"> • Prioritising less but core risks through a systematic process of risk assessments • Including a spatial concept in risk assessment by linking with local level risk assessments
Improving communication between stakeholders	<ul style="list-style-type: none"> • Establishment and practical operation of an official adaptation consultative group • Clarifying participants of national adaptation governance and their roles • Holding regular meetings for civil servants who participate in the policy
Creating linkage between adaptation and practical tasks	<ul style="list-style-type: none"> • Linking evidence between climate adaptation research results and the current tasks of government departments • Making linkages between risk assessment results and departments' current tasks
Improving the M&E system	<ul style="list-style-type: none"> • Making a clear and regular M&E system with a legal basis • Research supporting for practical indicators • Clear presentation of policy achievements and failures • Conducting hands-on regular meetings for M&E with civil servants.
Expanding the range of participants of the policy including sub-national stakeholders	<ul style="list-style-type: none"> • Establishing the policy with a bottom-up way from local and private level adaptation • Including roles of local authorities for adaptation in the policy • Expanding the current participant range from risk assessment stage

UK

Category	Solutions
Improving connections CCRA and NAP	<ul style="list-style-type: none"> • Introducing systematic connections between risk assessment results and policy making and implementing process • Making clear priority of policies based on CCRA
Improving stakeholder engagement	<ul style="list-style-type: none"> • Conducting formal stakeholder mapping to make clear stakeholders of NAP • Holding regular meetings with stakeholders • Finding reasons why stakeholders need to be involved in the NAP • Suggesting an education system for stakeholders
Setting financial resource	<ul style="list-style-type: none"> • Engaging directly with Treasury to making 'Adaptation Funds' • Making adaptation funds which directly connected with taking actions
Making linkage between adaptation and practical tasks	<ul style="list-style-type: none"> • Considering adaptation issues and problems in terms of each sector's context • Making connection the sector's priorities and adaptation issues
Improving uncertainty of effectiveness of NAP	<ul style="list-style-type: none"> • Making clear targets of adaptation policy • Creating short-term requirements which are a part of process of review the climate risks • Making clear accountabilities of departments and making reporting mechanisms of results of the accountabilities
Improving communications (quality and quantity)	<ul style="list-style-type: none"> • More communicating about what or which is needed to managed • More join-up across governments and departments actions and more communication opportunity that brings people together to work and action together • Holding meetings with senior level civil servants of departments • Making a communication system between policy and private sectors for adaptation
Increasing human resource in the managing department	<ul style="list-style-type: none"> • Putting more people in the managing department for checking everything, tracing progress, and monitoring.
Others	<ul style="list-style-type: none"> • Making a learning model based on previous CCRA and NAP • Introducing a consistent position that has power to set priority, wrap up the whole policy, decide directions • Making strong directions and messages from the government, which emphasise the need of adaptation and its benefits • Making ways for collaboration with other policies (housing, health, etc.) • Finding links between national and local-, private, business-level adaptations