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RESEARCH ARTICLE

REVISED Matching cities by their climate change measures and blockages profile for mutual-learning.

[version 2; peer review: 3 approved with reservations, 2 not approved]

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Abstract

More and more cities are working on climate resilience by adding climate adaptive measures to their mitigation programs, but choices must be made and barriers must be overcome, as shown by the extensive research in this area, including our own previously conducted exploratory research (Sanders & Oliveira, 2020). The motivation for new follow-up research has been to develop an instrument with which cities can compare each other's climate programs, to find the right city partner to start a process of joint learning from each other. After studying current research classifying cities' climate adaptive measures, implemented or in planning, most research is into processes to help cities find the right measures, it has been concluded that the level of detail on which this research generally focuses is too detailed to help cities comparing to find their matching city partner. That is why it was ultimately decided to extent our own diagram from the aforementioned exploratory research, which is less abstract, with the aim of providing cities with this improved instrument. It should be noted that given the higher level of detail, we should speak of blockages rather than barriers. The recent results of the H2020 Marie Curie 'SOS Climate Waterfront' study were used to test this improved diagram, as data on climate adaptive measures from six European coastal cities recently became available. A test diagram was then generated for each of these cities and matching has been selected to evaluate the diagram, in order to make a well-functioning instrument available. The final conclusion is that the diagram provides a recognizable matching for the six SOS cities, but that improvement of the diagram is recommended during further use.

Plain language summary

Most of the world population live in cities (56% in 2022 growing towards 68% in 2050) and most of these cities (70% in the EU) are situated in low-lying areas less than ten meters above the sea. Most of

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them face the increasing threats associated with climate change. Coastal cities are also growing the fastest, which make millions of people their life's extra vulnerable for climate change (UN-Habitat, 2022). This increasing threat occurs in special in these coastal zones more intensely when sea level rises, compounded by heavy rainfall and high river levels occurring simultaneously (Sanders, 2020a). The trend is that these changes will continue and that means that these cities, must increase their resilience by taking adaptive measures in addition to their contribution to reversing climate change through mitigation measures. In practice, it appears that many of these cities run into barriers/blockages against the implementation of their planned measures (McKinseyGI, 2021). That is why it makes sense and could be stimulated to these cities to compare each other's situation to learn about which measures are sensible and how to prevent or overcome such barriers/blockages. The former diagram (Sanders & Oliveira, 2020) has therefore been improved and tested to offer cities an adequate facilitating tool to reflect their own situation and to enter into dialogue with comparable cities according to their climate change situation and the resistance they encounter by implementing climate adaptation measures.

Keywords
climate change, adaptation measures, coastal cities, operational blockades

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REVISED **Amendments from Version 1**

With our paper update we make clearer that our research is a spin-off of the H2020 Marie Curie 'SOS Climate Waterfront' program, and therefore contains case studies from this program, by which the results of this program are saved and passed on. From this point of view, we made clearer how this research builds on the previous research and its position in the field of climate adaptation scientific research. Also, we explained that the detail-level of 'blockages' was chosen instead of 'barriers' for better comparing and matching cities with their climate adaptation measures. We added local climate adaptive planning reports for each of the cities by explaining the filled-in diagrams. We haven't changed the layout of the diagram though. The DCBA method has been removed from the title and from the explanation of the diagram, we left that behind to the former publication. Therewith the first chapter, some passages and the summary are totally rewritten, with thanks to our reviewers.

Any further responses from the reviewers can be found at the end of the article

1. Research methodology, and the former diagram improved

Based on the diagram presented at the 2020 WSBE conference for identifying the climate change measures approach of cities (Sanders & Oliveira, 2020), the suggestion of the audience has been worked out to upgrade this diagram for matching cities that they can learn from each other climate change adaptation approaches. This should be done was the suggestion, by adding to the diagram concerning the city mitigation and adaptation measures profile, the underlying causes that the intended adaptation measures are not being implemented.

For the record, with this spin-off research of the 'SOS Climate Waterfront' project as published in 2020 (Sanders & Oliveira, 2020), three comparable locations were investigated at an early stage of the 'SOS Climate Waterfront' program, which were not part of the project because the cities involved in the program were not yet investigated at that time: the island of Texel in the Netherlands, Madeira in Portugal, and Malta in the Mediterranean Sea. The later H2020 'SOS Climate Waterfront' project worked with the following six founding cities across Europe: Lisbon (Portugal), Venice (Italy), Thessaloniki (Greece), Gdansk (Poland), Stockholm (Sweden), and Amsterdam (Netherlands) (SOS climate waterfront|H2020-MSCA-RISE-2018|823901). Over the past five years, these cities have been visited simultaneously by groups of secondees from various backgrounds, focusing on coastal cities and climate change adaptation measures (http://sosclimatewaterfront.eu).

However, by exploring the available scientific literature in the field of climate adaptive measures that could not be implemented, it turned out that the results generally provided a very fine-grained picture with a wide diversity of reasons unsuitable for comparing and matching cities. That is why additionally is searched for a less fine-grained level that could be used to compare cities in the field of adaptive climate measures. To this end, reflection was sought from the participants in the 'SOS Climate Waterfront' program, of which the original research conducted in 2002 was a spin-off of. that the diagram should not be developed at the detailed level of barriers, but at the more general level of blockages. which resulted in the subdivision: financial, physical and societal blockages. Referring back to the factors mentioned in various scientific publications, 'financial' includes both budgets that are too limited and solutions that are relatively expensive, while 'physical' can be understood as existing buildings that cannot be demolished or monumental heritage, where 'societal' includes both the resistance from the population as slow political decision-making, and everything that falls within these bandwidths. see further explanation in chapter 3

With this input and knowledge, the diagram was updated resulting in the diagram in Figure 1.

1. The Measures/Actors diagram has been simplified by reducing the number of columns from three to two, whereby the combination column between 'mitigation' and 'adaptation' has been deleted. This is because combined measures in the diagram can be placed on the boundary between the two columns, which is a better choice as shown by the preliminary study (Sanders & Oliveira, 2020). Based on the DCBA model (a commonly used model in the Netherlands to rank the sustainability value of measures: D is the situation encountered, C is the improved situation, B is the almost sustainable situation, and A is the maximum sustainable situation that can be achieved, https://www.boomdelft.nl/index.php?id=116), measures with an indication of their impact are shown by using this DCBA scale in the diagram using these four rankings: shown in four shades of red, from light to dark.

2. The diagram has also been expanded to include a blockage identification section. This can be used to indicate whether an identified blockage is of a financial, physical, or social

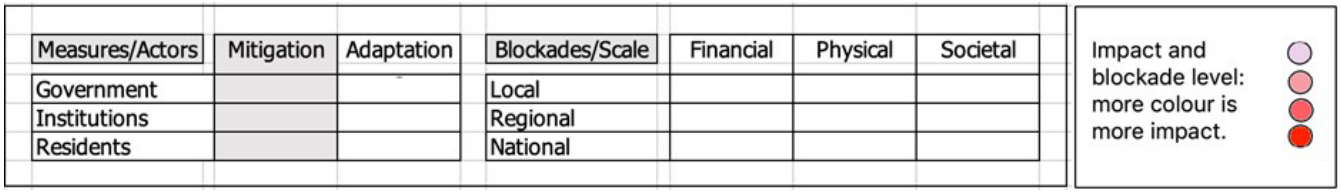

Figure 1. Schematic representation of climate change measures and blockages for a graded location 1) 2).

nature (horizontal axis), as well as of a local, regional, or national scale (vertical axis). The blockage is identified by placing a dot on the diagram with its impact grade.

This upgrade diagram made is possible to start testing the usability, by which the final research question for this follow-up research became: can the modified diagram help cities to be matched with similar cities to learn from each other for the removal of blockages, if the linking of cities is done by comparing their set of measures and using the same profiles as a basis for matching? As a logical continuation of the preliminary phase the six cities of the 'SOS Climate Waterfront' program. Are used to test the diagram. For the testing of the diagram all the Dutch researchers that participated in the 'SOS Climate Waterfront' program, delivered their material of the cities they visited during a month during which they participated in multi-disciplinary workshops with the other participants and local experts. The improved diagram was then tested on the six cities involved in the programme, based on the research results and data of these researchers: reports, vlogs, blogs and social media announcements, all recorded under FAIR conditions, involving local policy to capitalize on the researchers' insights and experiences. The complete research results were used to fill in the improved diagram, for which the results were then discussed in the group, checked and adjusted where necessary. Whereby the mutual matching of these cities based on their diagram profile was also tested, see chapter 4. The conclusions regarding the research and final advice for the use of the diagram are set out in Chapter 5.

2. The context: climate change at coastal areas

The overall picture of the impact of climate change and its increasing urgency is becoming clearer from IPCC's sequential reports since its inception in 1988. The 2019 report makes it clear that the accumulation of water-related threats to coastal cities, such as clustered rainfall, droughts, and the increasing danger of sea level rise makes cities more vulnerable (IPCC 2019, https://www.ipcc.ch/srocc/). As The Economist wrote in response to this report: "The water is coming, the world is not ready" (Economist, 2019). An annoying circumstance here is that it proves difficult to accurately predict all changes, such as sea level rise, considering all trends and local differences between cities, as elaborated for the Dutch situation, for example, in the annual climate report of the Dutch KNMI institute (KNMI 2021, https://cdn.knmi.nl/knmi/asc/klimaatsignaal21/KNMI_Klimaatsignaal21.pdf). It has also become clear that cities on the coast are experiencing the most problems from climate change, with the largest cities in the world located on the coast, and that these cities are also growing fastest in terms of population, a development that seems to continue to strengthen. This situation of large cities, and with it the situation of most of our planet's growing population, makes the effects of climate change the main concern of coastal cities (McKinseyGI, 2021). According to the six IPCC reports, from the first report from 1990 and including the most recent report from 2022, it is becoming clear that the initial focus on mitigation measures should be broadened to include adaptation measures, with the vulnerability of coastal cities logically receiving increasing attention (GCA2020 2020, https://gca.org/wp-content/uploads/2021/03/GCA-State-and-Trends-Report-2020-Online-3.pdf) (IPCC 2022, https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf).

Despite the fact that it is a global development, and that many coastal city administrations are planning adaptation measures (Measham *et al.,* 2011, Valente & Velo-so-Gomes, 2020), with local citizens' initiatives also having their own small-scale projects, separate from urban planning (Sanders, 2014), few tools have been developed to support these cities in analysing their situation and making their choices. One of the first tools is for example the 'coastal hazard wheel' developed by Deltares, the Dutch government institute for ocean research (Deltares report 2013 and update in 2022: https://coastalhazardwheel.org/media/1388/executive-summary_coastal-hazard-wheel.pdf), that helps coastal cities to generate their hazard situation to consider adaptation measures for better resilience. Since then, cities seem to be considering more and more adaptive measures, for which more and more instruments are becoming available for finding suitable measures and making choices.

With the focus on adaptation measures, according to the various reports of the past few decades, plans are constantly being developed to reduce the vulnerability of coasts and coastal cities, for places all over the world and not least in the Netherlands, with as examples: the drawings of the Das brothers (Das & Das, 1999), urban design for cities against inner-city flooding and heat stress (TUE, 2019), strategies to make the delta's adapt to the predicted sea level rise by giving rivers more space, strengthening the sea defences and giving cities extra situational protection (Deltares 2019: https://publications.deltares.nl/11203724_004.pdf) (WUR 2019, https://www.wur.nl/en/dossiers/file/the-netherlands-in-2120-1.htm) (TUD 2020, https://www.tudelft.nl/2022/tu-delft/vijf-toekomst-strategieen-voor-de-nederlandse-delta-in-2120) and applied to the Dutch situation (Deltares 2021: https://publications.deltares.nl/11206890.pdf).

3. Background: how local circumstance can block measure

In January 2019, the H2020 'SOS Climate Waterfront' project started with the six founding cities across Europe mentioned and lead a number of reports books and scientific publications with the results of scientific multidisciplinary workshops focusing on coastal cities and the struggle and successes of these cities of planning and implementation of their climate change adaptation measures (http://sosclimatewaterfront.eu). In addition to enthusiastic stories, the participants also gave signals that many climate-adaptive policies were not always easy to implement. the reasons were very different, but each city appeared to have a dominant reason for such difficult implementation. For example, in Thessaloniki (Greece) it turned out that the need to construct the first dikes on the sea side to prevent water retention as a result of more intense

thunderstorms and the expected future sea level rise, was impossible due to the many UNESCO world heritage sites present, not only above ground but also by preserved heritage underground. During the project, the Dutch team, in addition to the measures (mitigation and adaptation measures), also inventoried these obstacles, as recorded in reports, blogs and flogs as well as through publications in the project books. Reading these reports, there are small and more large obstructions in the six cities involved, referred to as 'barriers' in the scientific publication.

A scan of adaptation measures practice taken by coastal city municipalities shows that they all encounter barriers, practical obstacles that slow down or block implementation (McKinseyGI, 2021), making comparison interesting for mutual learning. Such an instrumental approach should compare the situation of cities, including their plans, their adaptation measures and barriers encountered, that cities in the light of climate change become comparable for mutual learning for making the reducing of the vulnerability of cities within reach. As proved by the former study comparing the situations of three European islands (Sanders & Oliveira, 2020), as confirmed in other scientific publications.

Moser and Ekstrom for instance, present a framework to identify barriers for every phase of the developing process of climate change measures (Moser & Ekstrom, 2010). Barriers led to less effective, inefficient and missed opportunities often for higher costs, as they present. As the IPCC give the definition of 'barriers to climate change adaptation measures': factors that make it harder to plan and implement adaptation measures and that restrict options. Only, an inventory of barriers examples this research does not give. Research of Maesham and colleagues give more content: climate change barriers are related to actors, the social or economic context of are failures of the creating system, but the examples remain superficial (Measham *et al.*, 2011) (Eisenack *et al.*, 2014). More recent research present more detail of such barriers: barriers may arise due to conflicting time tables, substantive strategic and institutional uncertainty, institutional crowdedness, institutional fragmentation, lack of awareness and communication, motived and willingness to act, and lack of resources (Biesbroek *et al.*, 2013), by local heritage (Casey & Becker, 2019), faltering social and cultural stakeholder engagement, by institutional and political aspects, by technical failure and lack of resource availability (Aniche *et al.*, 2024) or financing (Favero & Hinkel, 2024).

Feedback on these results to the Dutch SOS Climate Waterfront team led to respect for the increasing focus of research on barriers that hinder climate change measures, including how detailed this research turns out to be, even using living-labs (Aniche *et al.*, 2024). On the other hand, the conclusion in the group was that all these suggestions of barriers can help municipalities and other levels of government to force breakthroughs, but that it makes situations difficult to compare. For this, a higher, more general level of detail must be sought, in which the examples provided by research are combined. The conversation led to three groups of barriers, which were characterized as 'blockages' for the purpose of distinction: financial, physical and societal, where, for example, societal includes public resistance, ignorance and faltering political decision-making. It was therefore decided to use these three groups of barriers to map the climate change situation of cities, as if through climate DNA for, in this case, coastal cities.

4. Results: the resilience of the six EU 'SOS Climate Waterfront' cities

The participating cities in the 'SOS Climate Waterfront' project are Lisbon in Portugal, Rome in Italy, Thessaloniki in Greece, Gdansk in Poland, Stockholm in Sweden, and Amsterdam in the Netherlands, and for each the diagram has been filled in for an initial comparison and the testing its usability.

Lisbon in Portugal

Lisbon, located on the Atlantic Ocean in the delta of the Tagus River, is an old city (1200 CE) with about 550,000 inhabitants in the city and 2.72 million inhabitants in the region. The city is affected by climate change, such as by flooding of the city centre due to overloading of the sewage system with the increasing number of heavy rain showers, increased risk for the expensive apartment complexes on the ocean side in the event of sea level rise and also the resulting threat to bird diversity, also quantitatively in the river area south of the Tagus. The draining of water from the river on the Spanish side of the border for the irrigation of the southern Spanish provinces results in extra low water levels in the summer, which puts southern Portugal's own irrigation at extra risk and makes the riverbed a foraging area for the birds and the fresh water is endangered in the Lisbon region.

The earthquake and tsunami of 1755 reminds the inhabitants of Lisbon that the sea is close by and can strike. That is why the municipality has made the contour line up to the place where the tsunami struck visible with a line in the city centre, to alert residents to their vulnerability to climate change. According to the municipality, this visual reminder should also encourage residents to cooperate in the necessary measures to be taken. In the meantime, physical measures have already been taken to improve the drainage of the city centre, for which new underground sewage pipes have been installed to the sea. For the drainage of the city's surroundings, the plan has been developed to make old rivers that are completely dry in summer wider and deeper, so that the drainage is secured again. These interventions also create accessible recreational zones, for support among local residents. The most far-reaching measure is that the municipality has decided that no more homes may be built below this tsunami limit, and that the homes that are there will gradually be replaced by less vulnerable buildings. In this way, the municipality wants to reduce the financially negative effect of the sea level rise in coming decades. Homes will then be replaced by public buildings of a more temporary nature, such as schools and hospitals, because practice shows that such buildings have to be replaced regularly. The drinking water company is also constructing water depots upstream of the

Tagus for dry periods. Due to the heat in the summer in the city, which especially affects the elderly, green zones are already being created to counteract the heat build-up in the summer. The city of Lisbon is not very active in taking measures against greenhouse gas emissions. For example, there are no solar panels in the city or in the surrounding countryside, and the number of wind turbines is scarce. The reason is that energy consumption is low in winter due to the mild climate and the coolness of the ocean in summer.

The municipality does not experience any particular obstacles in implementing the aforementioned inner-city measures, because the measures immediately reduce the negative effects of climate change. The planned transformation of the city by the sea below the tsunami line is experiencing a lot of resistance, because the residents don't want to change the historical image of the downtown area and because they don't understand their vulnerability. Consultations with Spain about the unilateral draining of the river are also progressing badly. These blockades hinder efforts to make the city and the region resilient to the effects of climate change [source: interview with research institutes and municipal representatives by F. Sanders] (Sanders, 2020a). Most of the climate change measures mentioned in this report based on interviewing key-people are updated recently in the 'Lisbon resilience action plan 2020–2030' (Lisbon, 2020), with more focus on water-management, rainfall and dry periods, and making the city greener for more liveability, without losing the mentioned details. These two reports characterize the city of Lisbon, with the measures taken against the effects of climate change and the blockages that occur, with its measures and impact and blockage levels, as elaborated in the diagram of Section 2, see Figure 2.

Rome in Italy

The Rome of 753 BCE, located on seven hills along the Tiber River with about 3,000,000 inhabitants, is located on the sea thanks to its sister city Ostia. Over the centuries, the city has been expanded on both sides of the river and is still expanding. Land for the urban expansion is scarce, so it has to be built close together. Only the old centre is spared because the historic city is largely protected as a UNESCO world heritage site. As a result, climate change has a major impact on life in the city, partly because the river is getting increasing water levels due to the upstream canalisation, and in summer the heat in the city lingers for a long time, which especially affects the elderly. A start has therefore been made with greening the city, parks are being refurbished, facades are clad with new architecture, and the buildings along the riverbed are being pushed back. However, effective measures are not forthcoming due to monumental limitations. whereby the population is mainly called upon to behave greenly, to separate waste and to travel more electrically. Adaptive measures are still missing from the municipal plans (Rome, 2021).

Despite the fact that Rome is not on the Mediterranean Sea, it is predicted that the sea level rise will still cause problems, because the river will experience more backwater at a higher sea level. That makes the situation more critical. Nevertheless, the population does not sit still and shows its involvement in the sustainable task by participating in many small-scale initiatives: increasing purchases of sustainable products in the field of food, clothing, and participation in recycling projects such as repair cafes, and an accelerated increase in electric driving. In the field of 'mitigation', on the other hand, the city still has few solar panels and wind turbines, because that is only possible to a very limited extent due to the protection of the cityscape's monuments. As based on the information of the blogs of Karel Mulder and the drawings of Germaine Sanders (Mulder, 2022; Sanders, 2022), both secondees from CPONH NGO who participated in the spring 2022 Rome event of the 'SOS Climate Waterfront' project. For the characterization of these climate-related measures and local blockades of the city of Rome, see Figure 3.

Thessaloniki in Greece

Thessalonica of 315 B.C. is on the river Vardar and has about 350,000 inhabitants, located along the rivers Axios and Vardar on the Thermaic Gulf in the north-western corner of

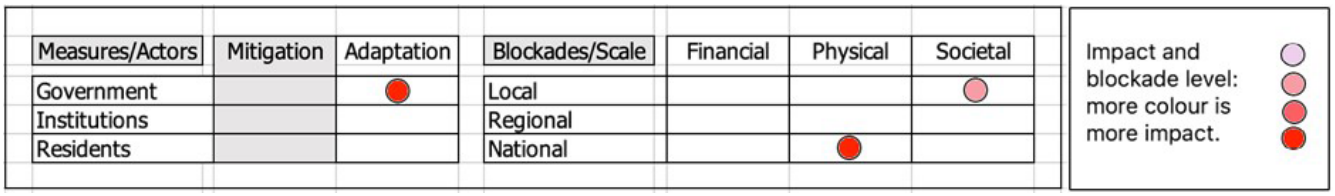

Figure 2. The completed diagram for Lisbon in Portugal.

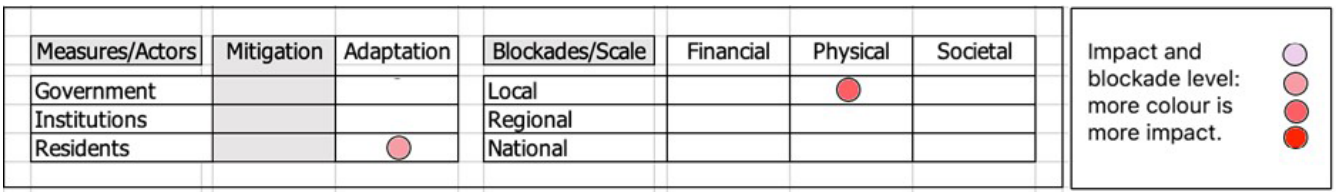

Figure 3. The completed diagram for Rome in Italy.

the Aegean Sea in open connection with the Mediterranean Sea. Sea level rise in the Mediterranean is still small and the prospects are not alarming. However, due to the wind, the water level in the Aegean Sea occasionally rises to higher levels, leading to flooding situations in the city in case of simultaneous high river level due to increasing occurrences of days of heavy rainfall. In addition, the population suffers increasingly from heat stress during the long summers because the heat lingers in the city. A plan of measures has been made to address these problems, unfortunately not only the aboveground city but also the underground city falls under the status of UNESCO world heritage. In fact, the city has been built on the historic remains of former cities. As a result, the implementation of necessary measures is almost impossible. As based on the information of the blogs of Jelle-Jochem Duits, secondee from CPOH NGO (Duits, 2019). Recently, the municipality of Thessaloniki started planning mitigation measures that should not be blocked by heritage regulations. It started reducing the city's carbon footprint by participating in the EU-wide '2050 Climate-friendly Mobility in Cities' project to encourage residents to purchase more e-cars, and despite local restrictive UNESCO terms, it began adaptation planning through the 'Strategic Plan for Sustainable Urban Development of the Metropolitan Area of Thessaloniki' (Thessaloniki, 2021). As a result, citizen adaptation initiatives have been started around green architecture. For the characterization of the climate-related measures and local blockages of the city of Thessaloniki, see Figure 4.

Gdansk in Poland

The city of Gdansk, with a population of 500,000 inhabitants, is located at the eastern end of the Baltic Sea, west of the wide Vistula delta. The western tributary of the Vistula River that flows through the city of Gdansk, called Martla-Wistla, has been cut in the past to reduce the river height downstream in the city. Nevertheless, the water level in the river is higher during the rainy season due to the inflow of small tributaries. The second river Motlawa also has a considerable rise in level during periods of heavy rainfall because it is also fed upstream by many small rivers. As a result, the inner city of Gdansk regularly experiences major flooding, past and present, the effect of which is amplified when the water level in the Baltic Sea is raised by backwater in the eastern funnel-shaped outlet on which the city is located. The expectation is that the sea level rise resulting from climate change will exacerbate this situation. To reduce the inflow of river water, flood plains have been constructed upstream of the Motlawa River to mitigate high water levels. Unfortunately, the effect of this is still too limited for the time being, as a result of which, flooding occurs regularly, especially in the city centre (Kalbarczyk & Kalbarczyk, 2020) (Sanders *et al.*, 2021). The floods of 2001 opened the eyes of the local population and the municipality, but effective solutions are not yet in sight. The major blocking circumstance is that Gdansk as a city receives little or no financial contribution from the national government because of differences in political views. Meanwhile, the expansion of the city and renovation of large-scale housing facilities restoring the old warehouses are in development along the riverbank. The harbour port in the delta on the Baltic Sea is also in development due to new economic prospects. Mitigation measures, on the other hand, receive relatively little attention. As based on the information of the blogs of Hugo Sanders, secondee of CPONH NGO (Sanders, 2020b). For the characterization of these climate-related measures and local blockages of the city of Gdansk, see Figure 5.

Stockholm in Sweden

Stockholm on the Baltic Sea, which is located on an archipelago of islands, has a population of 900,000 residents in the city and 2 million in the region. Even though the city is active with regard to sustainability issues, it will not be affected by sea level rise because the Scandinavian soil rises faster by bouncing back after the melting of the kilometre-thick ice pack of the last ice age. Stockholm became a European green capital in 2010 and has been free of carbon energy sources since 2020. which has resulted in a huge reduction in greenhouse gas emissions, bringing the target of net zero emissions by 2040 in sight. The higher temperatures in the city in the summer are also not a real problem because they

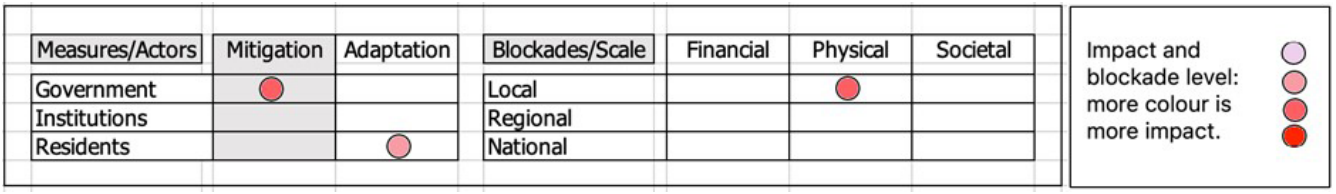

Figure 4. The completed diagram for Thessaloniki in Greece.



Figure 5. The completed diagram for Gdansk in Poland.

are still relatively low. The population takes responsibility for city sustainability on its own, which is evident from the enormous increase in shared cars. The task that remains is to make the buildings and apartment complexes more sustainable and to realize green new construction to keeps the green area in the city up to standard (Stockholm stad, 2020). Partly in view of the fact that Stockholm has many green energy resources, and is a relatively rich country, there are actually no special obstacles to the measures taken. Based on report by Karen Jonkers, secondee of CPONH NGO (Jonkers & Bregman, 2022). For the characterization of these climate-related measures and local blockages of the city of Stockholm, see Figure 6.

Amsterdam in the Netherlands

The Amsterdam region with about 1,500,000 inhabitants, and the same number of tourists every year, faces all the problems associated with climate change (sea level rise, heavy rainfall, heat stress in the summer, and subsidence of 0.01 metres per decade). This subsidence is the effect of the settlement of the 10 meters of peat on which the city is built. Nevertheless, the city is working on the enormous housing need (of a more than 50% increase) because, with the tourists, the city quickly becomes overcrowded in the summer. The nuisance caused by the rising summer temperature in the city is therefore all the greater. In the Netherlands, a national project is underway to significantly reduce greenhouse gas emissions, which is mainly due to the many hundreds of wind turbines that are being installed in the North Sea. Possibilities for fields of solar panels and the installation of wind turbines on land are met with a lot of resistance due to the lack of available space. Individual households and companies, on the other hand, invest in solar panels and heat pumps, partly thanks to a national subsidy project. The Netherlands has a relatively large population for a small country and also has a large agricultural sector. Every square meter of soil can be given multiple uses due to the great need of land. Due to the increasing rainfall in the winter period, water collection must also be ensured in the city, for which there is little space. In the region around Amsterdam, collection, and storage (of fresh drinking water) is going better, but the lack of free space is also an obstacle to satisfactory results there. Measures due to the rise in sea levels have not yet been taken, mainly because, since the flood disaster of 1953, there has been every confidence that the Netherlands would be protected against any danger from the sea for the time being. It is slowly becoming clear among the population that the sea level will continue to rise and that with the added subsidence it will be necessary to intervene in coastal defences. Still the climate resilient planning of the Amsterdam city focusses on the energy transition mainly (Amsterdam, 2019). Additionally, the new Amsterdam Metropolitan Sustainability institute connected to MIT, Wageningen and Delft universities support more climate adaptation programming, but implementation is still fragmented of course because the old city and newer housing areas are in wetland areas mainly. The Dutch universities involved in the meanwhile have presented climate adaptation plans for the whole Dutch delta as a whole, but the relevance has not yet been embraced by the government adviser, the Delta Commissioner. Meanwhile, the agricultural sector has to contend with salinization and the country is struggling with flooding due to the increase in rainfall in short periods and with longer periods of drought in the summer. Based on the EU paper (Sanders *et al.*, 2021). For the characterization of these climate-related measures and local blockades of the city of Amsterdam, see Figure 7.

5. Conclusions, the analysis of the research results included

According to the 'UN Atlas of the World', eight of the world's ten largest cities are located on the coast and 56% of the world's population lives in vulnerable coastal areas. This means that the resilience of coastal cities and their inhabitants to climate change is becoming increasingly important. The importance of adaptation measures is also implicitly becoming more important, now the IPCC has recently issued a signal that the 1.5C standard of the Paris Agreement (CoP2015 2015,

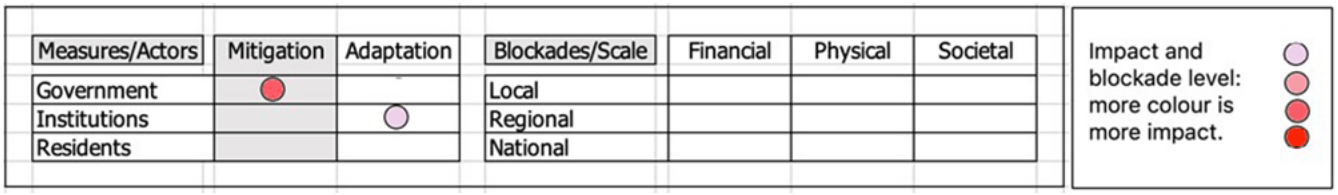

Figure 6. The completed diagram for Stockholm in Sweden.

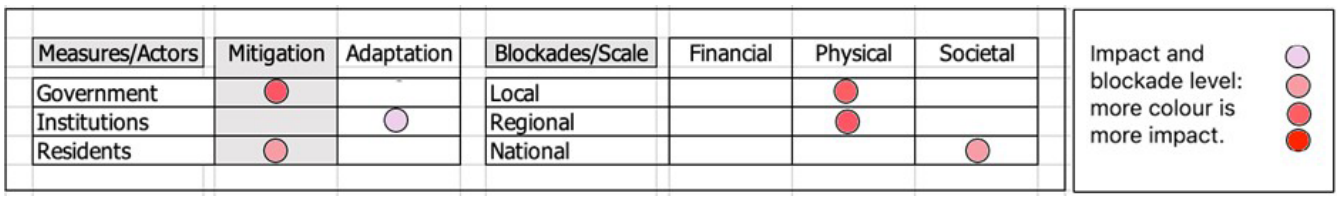

Figure 7. The completed diagram for Amsterdam in the Netherlands.

https://unfccc.int/sites/default/files/english_paris_agreement.pdf) will not be met in 2030 as urgently recommended give (KNMI 2021, IPCC 2023, https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf). It is therefore implicitly important that adaptive measures are taken in the most vulnerable coasts and coastal cities to increase resilience. The need to pay more attention to the resilience of coastal cities is the main reason why the H2020 Marie Curie project 'SOS Climate Waterfront' was started in 2019. Now that the project has largely been completed, it seems logical to use the observations from the cities researched as a basis for the further development and testing of the diagram instrument that maps local measures, and to do it in such a way that cities can be matched with each other with the intention of comparing any obstacles to implementation of these measures. This will give cities the opportunity to learn from each other in dealing with these obstacles. This will be mainly to test whether the diagram is sufficient on the basis of these six cities. Secondly, it will give the cities participating in the project the opportunity to immediately learn from the results.

For this purpose the diagrams (as they have been worked out for the six above-mentioned cities and regarding measures taken locally) have, by analysing these in the group of program participants (read 'methods' Section 2), been placed in relation to each other, resulting in matches which are the most obvious as explained in 'analyses', see Figure 8.

Analysis

By comparing the six elaborated diagrams for the six cities of the EU project 'SOS Climate Waterfront', four obvious combinations can be made of comparable cities based on the cities' mitigation measures and their adaptation measures. Amsterdam and Stockholm are both (1) in a phase where adaptation measures are being presented by research institutions, including universities, and both have mitigation measures taken by the government, including the municipality. Only in Amsterdam do the residents take their own mitigation initiatives. Second (2), Stockholm and Thessaloniki are similar because in both situations the municipality is the initiator of mitigation measures, although the adaptation measures initiatives do not match. Third (3) Lisbon and Gdansk have, in fact, a very similar situation where the government is the only one taking adaptation measures and mitigation measures are lacking. For Rome and Thessaloniki (4), it is the residents who take adaptation measures. These combinations can be used by the cities to learn from each other about their approaches to stimulating mitigation and adaptation measures and to achieving local goals. The blocking factors can then also be exchanged and discussed in order to learn from each other how to deal with them.

Based on these combinations, the situational reasons for the identified blockages may become clear or can be effectively investigated. For instance: 1. Amsterdam and Thessaloniki can learn from Stockholm's adaptation and mitigation measures, already developed without blockages, 2. Thessaloniki and Rome run into similar serious blockages, which would be a good reason to discuss these in relation to each other to find solutions and mobilize adaptation measures more successfully, and 3. Lisbon and Gdansk should learn from each other by comparing their mitigation and adaptation measure combinations, but their blockages are so different that it is

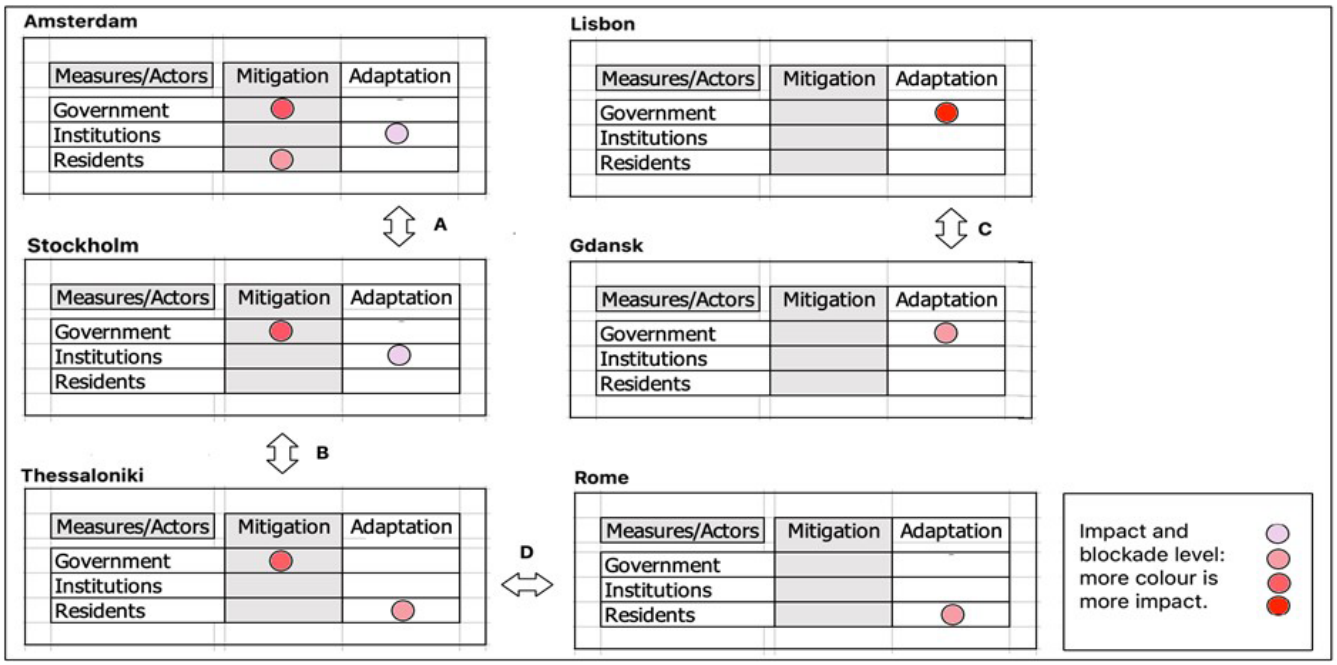

Figure 8. The combinations of cities according to their comparable mitigation and adaptation measures.

to be doubted whether a comparison would make sense. As the results show, by observing the cities that were part of the 'SOS Climate Waterfront' project, a conclusion could be that many blockages could have been identified and resolved (possibly) earlier through communication with other cities in comparable situations. This could also have led to more well-prepared measures being implemented faster and more easily, thereby making these cities more resilient.

Conclusions

It can be cautiously concluded that the improved diagram helps to connect comparable cities on climate measures and start a process of mutual learning. Learning from each other to remove obstacles to the development and implementation of mitigation and adaptation measures, and to implement the measures themselves, becomes faster and better. With the limiting factor (and therefore the caveat) that the diagram has only been tested on the basis of these six cities, and the number of combinations being limited. It is therefore advisable to further test the diagram as an instrument on other groups of cities to develop it further and not overvalue it as a tool in the short term. Nevertheless, as a tool it can already be helpful to cities because it can help them enter into a selective conversation with each other. These conversations themselves can lead to a deeper understanding of the climate challenges facing them but also better ways of finding solutions to them.

Data availability

The data used to test the diagram from Section 3 is the result from the Dutch participants in the 'SOS Climate Waterfront' project, being deliveries as there are created reports and blogs. In all these deliveries names of the interviewed, if this was the case, are de-identified following the Safe Harbour guidelines. Researchgate has been used as a database because it is easily accessible to researchers and a DOI can be added, and only a few documents have to be stored. To improve the diagram itself, scientific peer-reviewed publications, including publications of our own hand, were used and these are mentioned in the list of references. Reports from institutions used for the background information, methods and context explanation (Section 1, Section 2 and Section 3) are placed with a hyperlink in the text.

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Publisher Full Text

Open Peer Review

Current Peer Review Status: ✗ ✗ ? ? ?

Version 2

Reviewer Report 13 December 2024

https://doi.org/10.21956/openreseurope.19596.r44317

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Emilio Laino
University College Cork, Cork, Ireland

The article presents an interesting and relevant methodology for comparing cities based on climate change measures and identifying associated blockages. This approach appears valuable and applicable for the intended purpose. However, I have some suggestions that could improve the overall quality of the manuscript.

General comments:

- **Writing quality:** The overall writing needs improvement, as there are numerous grammatical issues throughout the manuscript. I strongly recommend using a grammar-checking tool to help enhance the clarity and readability of the text.
- **Typos and corrections:** Several typos need attention. For example:

1. In Section 1, “Research methodology,” the following sentence contains a typo:

"As a logical continuation of the preliminary phase the six cities of the ‘SOS Climate Waterfront’ program. Are used to test the diagram." This should be corrected to: "As a logical continuation of the preliminary phase, the six cities of the ‘SOS Climate Waterfront’ program are used to test the diagram."

1. Another sentence in the same section also contains a grammatical error:

"For the testing of the diagram all the Dutch researchers that participated in the ‘SOS Climate Waterfront’ program, delivered their material of the cities they visited during a month during which they participated in multi-disciplinary workshops with the other participants and local experts." This should be corrected to: "For the testing of the diagram, all the Dutch researchers who participated in the ‘SOS Climate Waterfront’ program delivered the materials of the cities they visited during a month, during which they engaged in multidisciplinary workshops with other participants and local experts."

1. In Section 3, “Background: how local circumstances can block measures,” the following sentence has a capitalization error:

"the reasons were very different, but each city appeared to have a dominant reason for such difficult implementation." This should be corrected to: "The reasons were very different, but each city appeared to have a dominant reason for such difficult implementation."

Section-specific comments:

- **Section 2, "The context: climate change at coastal areas":** It is advisable to clarify the terminology related to the IPCC reports. The first report mentioned is a Special Report, specifically the "Special Report on the Ocean and Cryosphere in a Changing Climate." However, later in the text, you reference the "six IPCC reports," which should be more accurately referred to as the "Assessment Reports."
- **Section 3:** The paragraph starting with "A scan of adaptation measures..." is complex and difficult to follow. I suggest rewriting it for better clarity. The sentence "Only, an inventory of barriers examples this research does not give." is unclear and needs significant revision.
- **Section 4, "Results":** This section could benefit from adding references to relevant climate-related hazards, as there is substantial literature available that addresses these topics. Additionally, the results should be more directly linked to the scoring of the cities. It is important that the results not only provide contextual information but also justifies the scoring system applied to the cities.

A comparison with existing studies could further strengthen the discussion section by situating the findings within the broader academic discourse.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Coastal cities; Risk assessment; Climate-related hazards; Climate change

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 10 October 2024

https://doi.org/10.21956/openreseurope.19596.r42543

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Halvor Dannevig
Western Norway Research Institute, Sogndal, Norway

The article has seen some improvements as response to review. But the article is still in need of major revisions, as there are several major shortcomings. The authors have provided more detail and justification for the article, by adding references to its origin in a research project. But justification in terms of societal needs and knowledge gaps are still very broad and general, and not in line with state of the art in the field. The authors have improved the theoretical framework by adding references to literature on barriers to adaptation. But they have not complied with the request in the first round of review to provide justification for how the «DCBA» scores are assigned - what level of adaptation it should take to move from D to C etc.

The first line in the abstract «More and more cities are working on climate resilience by adding climate adaptive measures to their mitigation programs, (..)». What do the authors mean by mitigation programs? Also this sentence is cumbersomely phrased: «After studying current research classifying cities' climate adaptive measures, implemented or in planning, most research is into processes to help cities find the right measures, it has been concluded that the level of detail on which this research generally focuses is too detailed to help cities comparing to find their matching city partner.» Authors should strife for making the abstract an easy read, this sentence is not easy to understand. This type of language issues permeats the article, and indicate a need for language editing.

In the previous review, I commented on the use of the concept «diagram» as in need of being explained before it can be used. It is still employed in the abstract, and it still does not make sense as in how it is used in the abstract. The reference to a specific diagram continues in the introduction, whiteout explaining what the authors mean by a «diagram» in this context or what this existing diagram that they are improving is or what it does.
The authors have made an attempt to add a minimum of literature review to contextualize their work in the field of research, which is commendable. But it is still unsatisfactory, with rather generalizing sentences like this: «With the focus on adaptation measures, according to the various reports of the past few decades, plans are constantly being developed to reduce the vulnerability of coasts and coastal cities, for places all over the world and not least in the Netherlands, with as examples: the drawings of the Das brothers (Das & Das, 1999), (..)» Am the reader supposed to know what these drawings are?

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Climate change adaptation governance; environmental governance; co-creation of knowledge; social dimensions of climate and environmental change in the Arctic

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 27 September 2024

https://doi.org/10.21956/openreseurope.19596.r42544

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Joao M. Dias
Universidade de Aveiro, Aveiro, Aveiro District, Portugal

In my opinion the authors haven't addressed my comments, considering that I cannot find any answer from them to my specific comments, neither any change in the manuscript that overcomes my concerns, so my evaluation of this manuscript keeps unchanged.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Assessment of climate change impact on coastal areas

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 18 September 2024

https://doi.org/10.21956/openreseurope.19596.r42541

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Tineke van der Schoor
Research Centre for Built Environment NoorderRuimte, Hanze University of Applied Sciences, Groningen, The Netherlands

The authors have improved the document and implemented part of the suggestions I made in my previous review. I see that there isn't any response to my review. I would like to say to the authors that a response would have been a great help. Nevertheless, I recognize that the article is better grounded in scientific literature.

What is still not satisfactory, is the explanation of the method and data. First, the scoring of the 'blockages' remains unclear, how are they evaluated and how do they 'add up'? For replication purposes this should be explained in more detail.

Secondly, it seems the report is based on secondary data, such as blogs and reports of visitors to the discussed cities. This should be made explicit. Now, these blogs are added to the reference list, but it would be better to put them in a separate list, apart from the scientific references.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: energy transition, social movements, citizen participation, energy governance, sustainability & heritage

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 16 August 2024

https://doi.org/10.21956/openreseurope.19596.r42542

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Peter Eckersley
International Centre for Public Services Management, Nottingham Trent University, Nottingham, England, UK

The authors have not responded adequately to the reviewers' comments and this paper is still not at a indexing standard. My suggestions to improve the previous version (which focused on clarifying the context in which this paper was written and its ultimate purpose, as well as on presenting the results in a more user-friendly format and improving the language for readability) appear to have been completely ignored. This also goes for many of the other suggestions from the other reviewers (with which I wholeheartedly agree), which highlight its lack of theorisation and descriptive nature. The authors only responded to the comments of one reviewer and have not improved the manuscript significantly: this means I cannot approve the current version it for indexing, even with reservations.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: local climate policy, local governance, public policy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 20 Aug 2024

Fred Sanders

Dear Peter Eckersley from Nottingham Busines School and dear reviewer in this second round, its true that we not changed the form of our ORE paper and that we left the data concerning EU coastel cities in the paper. At the other hands also based on your reviewing if the first round, we have rewritten the focus of our research with an refreshing of the research-question, the scientific conetx of the paper and we added the local manucipality reports for each of the cities to check the observations of the Dutch SOS project participants, through which we rewrote the summary en gave the paper a better fitting title. This all we wrote out in a letter special for our reviewers and it feels that this has not reached you, so that you could not yet read how we used your reviewing instructions and that of the other reviewers carefully. According to our stubbornness keeping the data in the paper, we really think that this improves the readabilty to bring the result of the SOS program further among scientist, and secondly our English will never become that of a native speaker, but its checked and checked for the better. We feel reading your reaction that your judgement will not change easily. But we prefer to let you and other know, that we updated this paper carefully with respect to all the comments of all reviewers, Fred and Ana.

Competing Interests: No competing interests were disclosed.

Version 1

Reviewer Report 26 March 2024

https://doi.org/10.21956/openreseurope.17076.r37754

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Tineke van der Schoor
Research Centre for Built Environment NoorderRuimte, Hanze University of Applied Sciences, Groningen, The Netherlands

This article targets an important subject and informs the reader about a multi-case study of six EU-cities. However, the article has several shortcomings and needs a more thorough study of the available material. More work is needed on literature study, description of methods and analysis of data.

Adding to the remarks of the previous reviewers, here are some remarks and suggestions:

1. There is a serious lack of academic resources in the article, so it is not well situated in the literature. Take for example the paragraph on climate adaptation measures by coastal cities (in the introduction): there surely are many more relevant articles to find than the authors' own articles and a report by a consultancy firm, McKinsey. Chapter 3 could be integrated with chapter 1 and can then function as an introduction. However, although the chapter title refers to 'international related scientific research', no thorough literature study is provided, as noted above. Furthermore, there is no referral to academic references or theoretical framework in the conclusion, so it is unclear what the theoretical contribution of this article is.

2. It is unclear why the three case studies Malta, Texel and Madeira are mentioned, as they do not figure in the analysis at all.

3. Methods: The DCBA-model is mentioned, but not adequately introduced. The provided link to a book is not working. Furthermore, the model is not integrated in the analysis.

4. Materials: The material that the article rests on seems rather thin. Apparently, the article solely rests on personal communications, such as blogs. Also, a list of gathered data, such as interviews, focus groups, plans and/or policies, should be added to the list of references and described in the method section. There is no mention of a thorough qualitative analysis of the available material, either. How is this analysis done? It is unclear what data have been gathered for each city.

5. The diagram is not sufficiently explained and is applied in a rather superficial manner. Who is meant by 'government' or 'institutions' and in what way were they active? It is also unclear how the scoring has been done.

6. An (expanded) diagram could in principle have been used to guide a qualitative analysis of interview transcripts, focus groups or a collection of plans and policies, however, as said above, it is unclear how the material is analyzed. Which concrete policies or project have been analysed? What actual blockades are found in for example Gdansk or Rome? In what projects did these blockades (or barriers) arise?

7. The results remain very descriptive. A careful analysis of the gathered data for each city would increase the depth of the analysis considerably. It is advised to include a description of one or two actual plans or projects for each city in sufficient detail, and the (preferably expanded) diagram for these projects or plans, with reference to the material that this is based on.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
No

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
No

Are the conclusions drawn adequately supported by the results?
No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: energy transition, social movements, citizen participation, energy governance, sustainability & heritage

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 19 February 2024

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Joao M. Dias
Universidade de Aveiro, Aveiro, Aveiro District, Portugal
Carina Lurdes Lopes
Universidade de Aveiro, Aveiro, Aveiro District, Portugal

This study discusses the challenges that coastal cities encounter in dealing with climate change. It presents the climate challenges faced by 6 European cities and discusses the obstacles to implement mitigation and adaptation measures in each city, based on the definition and application of a tested DBCA-diagram to support the connection and comparison between different cities on climate measures and start a process of mutual learning.

We consider this topic very relevant, actual, and interesting, and in the scope of Open Research Europe. The manuscript is generally well organized, although presenting some limitations regarding the novelty and impact of the results obtained, as well as on the presentation of clear aims and goals. So, in our opinion some problems must be overcome before indexing.

So, although considering this study interesting, we believe that the structure of the work could be improved to enhance understanding:

1. Abstract: in the present form this not does not fulfill its function and should be completely rewritten. As a significant example it does not present the main aim and goals of this work. So, in our opinion it is advisable to improve the entire abstract, following the conventional structure, namely summarizing the major aspects of the entire paper in the prescribed sequence: the motivation, question(s) under investigation and its international relevance; the mains aims and goals of the manuscript; the experimental design and methods used; the major findings including key quantitative results, or trends; a short summary of interpretations and conclusions clearly stating the general implications of the answers that results gave.

2. The first sentence of the abstract must be modified or include references that support it. The first statement should be modified or supported by a reference since it is estimated that there are around 2.5 million cities in the word, and we believe that most of them are not coastal cities. Moreover, it is also unclear that most coastal cities are threatened by climate changes, so the second statement should also be supported by a reference or modified.

3. A map of Europe should be included indicating the study areas, to give readers an initial idea of the location, threats, and climate of each city.

4. Section 4 presents results (diagrams) and a description of each case study. Consider moving the description of the study areas to another section (methods) and support the description with appropriate references.

5. Consider integrating the diagrams from Figures 2 to 7 into a single figure that encompasses the different case studies. Figure 8 duplicates part of the diagrams already presented.

These modifications would enhance the clarity of the paper and facilitate a comparative analysis of the findings for the different cities, thereby making it easier to apply this discussion in other coastal cities worldwide.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Assessment of climate change impact on coastal areas

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.

Reviewer Report 04 January 2024

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Halvor Dannevig
Western Norway Research Institute, Sogndal, Norway

The topic of this article is highly relevant, and the case studies (cities) that are included in the study that the article reports are also highly relevant to the topic of urban coastal climate change adaptation. The article does however have a number of major shortcomings and I am in doubt whether it should be in a peer reviewed journal. The first major shortcoming is that the research reported is not situated in the field of research. There are very few references to other studies or state of the art on urban adaptation to sea level rise, or barriers to adaptation, and there is a large literature on this topic. The authors claim that *few tools have been developed to support these cities in analysing their situation and making their choices. (Page 4).* This is plainly wrong, the last 15 years has seen a proliferation of research into urban and coastal adaptation to climate change.

The study applies a «DCBA» framework for ranking the state of resilience or sustainability of cities to sea level rise.
The concept «blockage» is not elaborated. It's a self explanatory concept used in everyday language, but here it is also used analytically, so I must ask why the authors have chosen this concept rather than "barriers", which is commonly used in policy implementation studies and adaptation governance studies (see for instance
(Moser SC et al,2010) [1] ; (Measham TG et al, 2011)[2]; (Eisenack et al ,2014) [3]. If the authors are able to develop "blockage" as a proper analytical concept - by grounding it in relevant literature, and also justifies why it differs from "barriers" - it could be a major contribution.

The diagram (and what is a "diagram" exactly?) could be a useful contribution of the article, but this requires that the dimensions in the diagram is properly justified and anchored in literature. Furthermore: What are the qualifiers for the different shades of «blockade level»? How does this relate to the «DCBA» ranking?

Specific comments: For the Lisbon case: the text could more explicitly say that resistance to implementing change constitutes a social blockade. Why the issue with drainage of the river on the Spanish side is categorized as a «physical blockade»— and not a political or regulatory blockade is not elaborated. Why is mitigation measures included in the diagram- if the issue is sea level rise and resilience? E.g the case description of Rome: why is it relevant that residents install solar panels, engage in recycling etc? It's also hard to believe that neither Lisbon or Gdansk is engaging in any mitigation efforts.

To base the selection of climate risks to address solely on workshop input is excluding several other more reliable data sources, such as the municipalities own land use plans and climate risk assessments or assessments and research done by other organizations. The flaws in the data material and superficial analysis with the diagrams again make the comparisons between cities and subsequent potential for mutual learning seems random and poorly justified.

References

1. Moser SC, Ekstrom JA: A framework to diagnose barriers to climate change adaptation.*Proc Natl Acad Sci U S A*. 2010; **107** (51): 22026-31 PubMed Abstract | Publisher Full Text
2. Measham T, Preston B, Smith T, Brooke C, et al.: Adapting to climate change through local municipal planning: barriers and challenges. *Mitigation and Adaptation Strategies for Global Change*. 2011; **16** (8): 889-909 Publisher Full Text
3. Eisenack K, Moser S, Hoffmann E, Klein R, et al.: Explaining and overcoming barriers to climate change adaptation. *Nature Climate Change*. 2014; **4** (10): 867-872 Publisher Full Text

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
No

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Climate change adaptation governance; environmental governance; co-creation of knowledge; social dimensions of climate and environmental change in the Arctic

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 08 Jan 2024

Fred Sanders

Dear Mr Halvor Dannevig from Western Norway Research Institute,
Not into defence but into reflection we like to share a few comments in the hope you will change you will change your reviewing into 'approved with reservations', because we think you gave feedback that can make our research article better, if you can accept our two choices related to your reviewing.

First, we chose for 'blockades in four levels following the DCBA model' because that's more clear for comparing cities than 'barriers', because 'barriers' indicates diversity each with its own circumstances and constraints which cannot be approached as a group, by which in our approach using the more detached understanding of 'blockades' is more pure to compare cities.

Secondly we did add observable blockade to the diagram (financial, physical and societal) and not political, because that should add actors to the diagram, and not only than we should add more actors like institutions, interest groups and enterprises, we also should prematurely intervene in the discussion that comparable cities may have about the causes and solutions to remove blockades.

Third, although the focus of the research related to the H2020 Marie Curie project 'SOS Climate Waterfront' had the focus on adaptation measures, we added mitigation besides adaptation measures to the diagram for a better comparison of cities, for the use of cities, because this concerns where the money is spend on. Of course we better had explained these choices in the paper in chapter 2. how improve the former diagram. At the other hand that's why we choose for ORE the EU open-access publishing so that we and others can learn openly about how to make a publication better. We hope hereby have given a

constructive response on your reviewing, we surely will add the aforementioned to our paper, and maybe with respect for your outstanding experience, will consider your conclusions to a milder one. Thanks for the time you gave our publication, Fred and Ana

Competing Interests: no competing interests

Reviewer Report 27 September 2023

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Peter Eckersley
International Centre for Public Services Management, Nottingham Trent University, Nottingham, England, UK

This paper addresses an important and timely topic, namely how different coastal cities in Europe are seeking to adapt to climate change. I particularly like how the authors differentiate between the various types of blockages that cities might encounter when trying to introduce adaptation measures, and apply this information to suggest how they might match and learn from each other. This includes incorporating physical blockages into the framework, such as buildings that are placed under monument or UNESCO protection: this is an issue that both academics and practitioners have only recently begun to grapple with. With this in mind, their typology could represent a useful heuristic for both practitioners (who are trying to identify what they might be able to learn, and from whom) and also academics (who may wish to examine how adaptation strategies reflect local and multilevel conditions, and develop appropriate theoretical perspectives on how these shape decision-making).

Nonetheless, the authors should make quite a few changes to improve the quality of the manuscript. Most importantly, they need to be much clearer about what the paper is actually seeking to achieve. I feel that this would give the manuscript much greater focus and enable readers to follow the argument more easily. It seems to me that the authors' conceptualisation of measures/actors and blockages/scale, along with how they have populated this table from their empirical study, represents a useful contribution, but it is not clear from the text whether this paper is an update on previously published research or not – and, therefore, how novel this paper might be. The introductory section (which is titled "Background: how local circumstance can block measure" but doesn't really address this point) doesn't give the reader much sense of what the authors are trying to present in the paper and why it is important. Instead, it talks about the history of the H2020 project and a bit of methods, before mentioning three new cases in the spin-off research project (Malta, Madeira and Texel), which hardly get a mention subsequently. A sentence along the lines of 'this paper will show x' would be really useful in helping to signpost the reader towards the rest of the content. It may also assist in focusing the authors' minds when they go through the paper again to revise it: some sections are quite descriptive and could be

streamlined a bit.

In addition, the authors could present all six of their case studies in a single table to create space for more analysis, rather than having a separate representation for each one. I would have been interested to get more insights about how the different actors and scales were involved in adaptation initiatives, but the authors do not currently have sufficient room to include this. As the authors will be aware, there have been many studies into the multi-level and multi-sectoral nature of climate adaptation, but they don't draw very much on academic literature to illuminate and strengthen their analysis.

Finally, the 'diagram' appears to be central to their contribution, but this wording threw me a bit – it is a table or a practical tool, rather than a graphical representation of their theoretical approach and/or empirical findings. I suggest that they use a different term to avoid confusion and also proof-read the paper for clarity. Indeed, there are several places where the language could be streamlined and improved (they should also stick with using 'blockage' rather than 'blockade' – these terms are not synonymous).

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and does the work have academic merit?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
No source data required

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: local climate policy, local governance, public policy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.