

ADAPTECC: A Role-Play Game about Adapting to Climate Change

Josu Lucas*, Ibon Galarraga*, Marta Escapa+

*Basque Centre for Climate Change, BC3

+Universidad del País Vasco, UPV/EHU

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ABSTRACT

The ADAPTECC Climate Change Adaptation Game is a role-play game designed to enable players to experience the difficulties that arise at local and regional levels when authorities have to implement adaptation measures. Adaptation means anticipating the adverse effects of climate change (CC) and taking measures to prevent and minimise the damage caused by its impacts. Each player takes the role of the mayor or a councillor of a town affected by CC who must decide what adaptation strategies and measures to take, or of a member of the Regional Environment Department which must distribute funding for adaptation among the various towns. At the end of the game, players should have a greater understanding of the challenges posed by adaptation to CC.

Key words: Role-play games, Climate Change, Adaptation to Climate Change

Introduction

There are many scientific studies that assure that climate change is real, and that although its impacts may vary from one geographical area to another and according to levels of development, they will make themselves felt to some extent in the coming decades (IPCC, 2015). Researchers therefore hold that a range of actions need to be taken – and soon – to combat climate change. In general terms, those actions can be divided into mitigation measures and adaptation measures. Mitigation measures seek to reduce emissions of greenhouse gases (GHGs) so as to stabilise their concentrations and keep the increase in average worldwide temperature in the 21st century at reasonable levels (no more than 2°C). Adaptation measures seek to minimise the negative impacts of climate change on different parts of the planet, and to make use of any opportunities that may arise. These two types of action are not mutually exclusive but rather complementary, and well thought-out policies for combating climate change need to take them both into account.

However, the differences in the goals pursued by mitigation and adaptation actions (which in turn are determined by the problems that each seeks to resolve) mean that the decision-making processes for the two types of measure are different. Thus, given that reductions in GHG levels are a public good (and all countries can benefit from reductions made elsewhere without incurring costs), it is tempting to act as a free-rider. Similarly, if one country increases its GHG emissions the consequences will be suffered by all countries as a whole. Mitigation measures aimed at reducing GHGs therefore require the cooperation of all countries in negotiating emission reduction targets and determining how reduction efforts are to be shared out among them (Escapa, 1994, Escapa & Gutiérrez, 1997).

Adaptation, however, takes place on a more local and/or regional level. Even within a single country, areas with different characteristics experience different consequences of climate change -- positive or negative -- and different levels of impact. A report drawn up by the Spanish Climate Change Office (OECC 2005), for instance, highlights a variety of geographical areas within Spain and the impacts associated with them. Decision-making concerned with adaptation is therefore often different from that concerned with mitigation, in that it tends to take place at a more local or regional level, and may therefore be affected by significant budgetary constraints and by other political and electoral factors.

This document presents an educational activity in the form of a role-play game which is intended to foster the study and understanding of adaptation to climate change, and more specifically to help players understand at first hand the difficulties and opportunities involved in making decisions concerned with adaptation: the Climate Change Adaptation Game, or

“ADAPTECC”. Given the nature of role-play games, our intention is for players to benefit from their active, risk-free participation in situations where CC and adaptation to it are core factors and thereby learn significant lessons that are of practical use.

In Lucas et al. (2015) we present a role-play game aimed at helping players understand the process of international negotiations concerned with CC mitigation. Here we seek to supplement this view of the struggle against CC with another original, practical role-play game.

Section 1 below introduces the main concepts and problems entailed by adapting to climate change. Section 2 then presents the Adaptation Game, explains its use as an educational tool and sets out its content and the goals pursued. Section 3 shows the basic rules and workings of the game. Section 4 explains the various stages of the game and the recommended times. Section 5 presents and explains the resources and materials required to set up the game. Section 6 outlines some of the lessons that can be learned from the game and subsequently applied in real-life situations. Finally, Section 7 discusses our experience in implementing the game and outlines potential future applications. The document concludes with a summary of our conclusions.

1. Adaptation to Climate Change

It must not be forgotten that even if the target of keeping temperature increases to below 2°C is obtained, the planet will still suffer major impacts due to inertia in the climate system. There is therefore a need for adaptation policies that can reduce those impacts and help to increase the resilience (i.e. the ability to recover) of our economic, environmental and social systems (Galarraga & Markandya, 2009). For example, records show that sea level is rising at an average global rate of 3 mm per annum, and this rise will continue for a number of years even if emissions are drastically reduced (Sainz de Murieta, Galarraga & Markandya, 2014).

Adaptation is defined as a set of policies, practices and projects aimed at containing or reducing damage and/or making use of any opportunities associated with climate change (IPCC, 2001). It can be classified in various ways that give an idea of the broad possibilities that exist. For instance, it can be classified according to the nature of the actors involved (public or private), the stimulus for taking action (planned or autonomous), spatial considerations (localised, dispersed), the type of measures taken (behavioural, infrastructure-related, institutional, financial, regulatory or informational) or even ability to handle the associated uncertainties and/or act on social, environmental and financial benefits (win-win, low-regret and no-regret options). A detailed description of these ways of classifying adaptation measures can be found in Sainz de Murieta et al. (2014).

In any event, it is important to emphasise that even in the economically wealthiest countries and regions these efforts are unlikely to suffice to tackle all impacts. From the perspective of financial rationality it therefore seems sensible to focus on those measures whose marginal cost does not exceed the marginal benefits that result from them, though without ruling out other prioritisation criteria. In other words, all else being equal, the most cost-effective measures need to be selected.

One interesting example is the case of the opening up of the Deusto Canal in Bilbao, which is expected to considerably reduce the damage in financial terms caused by any future floods in the city. Specifically, Oses et al (2012) estimate that:

- A considerable reduction in expected damage is expected following the opening up of the canal. In particular, floods with a return period of 10 years would no longer cause any significant damage (100% reduction).
- For floods with a return period of 100 years damage is expected to be reduced by 67.42% (from €241.34 million to €78.62 million) in the most conservative estimates.
- In floods with a return period of 500 years, damage is expected to be reduced by 30.7% (from €444.3 million to €307.91 million) in the most conservative estimates.

Other examples include the implementing of early warning systems in areas where there is a danger of extreme climate events (hurricanes, floods, etc); the recovery of natural areas that can act as natural barriers to hold back impacts caused by sea level rises in coastal areas; shifts in crops towards species more resistant to drought; or more effective water management to guarantee supplies to the population¹.

Adaptation-related concepts in regard to which understanding might usefully be increased include the following:

- “Mal-adaptation”: This refers to situations in which the cost of the measures taken outweigh their expected benefits, and to situations in which measures have a negative effect on (or reduce the resilience of) other systems, sectors or social groups (Barnett and O’Neill, 2010).
- "Residual damage": It may not be cost-efficient to seek to avoid all residual damage or impacts, so there may be some level of damage that cannot or should not be avoided.

¹Many other examples can also be consulted on the platform <http://www.adaptecca.es/>

2. The Climate Change Adaptation Game

AdapteCC is a role-play game in which players take the role of the mayor or a councillor in a town affected by CC, or the role of a member of the Regional Environment Department. Unlike other role-play games which have a predetermined, closed ending, a random factor (the future impact of CC) is introduced here which means that different final outcomes are possible each time the game is played. This means that a variety of important conclusions can be obtained concerning decision-making processes in regard to adaptation to CC in real-life.

2.1. The use of role-play games as educational tools

As pointed out by Lucas et al (2015), role-play games provide a powerful teaching tool that fits well into current approaches to education, in which students are the focus of learning and required to take a proactive role in the learning process. On the one hand, the use of role-play games is conducive to significant learning, insofar as students obtain first-hand experience of the situations that they must tackle and the lessons learnt are thus fixed more permanently in their minds. On the other hand, the situations that they face are risk-free (unlike real life), so players can try out different strategies and possibilities without fear of failure or loss and can thus draw conclusions and lessons from their actions. Moreover, activities of this type help to motivate students in regard to the subject matter because they are able to make a clearer connection between the theoretical content taught and its practical usefulness in real life. The fact that it is a game is also a motivation. Finally, the use of role-play games fosters the development of other communication and social skills and empathy, because players have to adopt points of view different from their own.

AdapteCC is designed to take into account the full potential of this method.

2.2. Goals

AdapteCC pursues the following goals:

- Emphasising the difficulties that arise when actors must decide what CC adaptation measures must be adopted.
- Highlighting the different factors that must be weighed up in political decision-making (political cycles, funding available, uncertainty, etc).
- Enabling players to experience the decision-making process in regard to adaptation to CC.

2.3. Content

The following content can be covered via AdapteCC:

Concepts	- Adaptation to CC - CC adaptation measures - Budgetary constraints - Electoral constraints
Procedures	- Involvement in a decision-making process concerned with adaptation to CC - Use of bargaining instruments to reach agreements
Attitudes	- Assessing the importance of adaptation to CC - Thinking about the obstacles and difficulties encountered in the process of making decisions concerning adaptation to CC

3. Basic rules of the AdapteCC game

AdapteCC posits an imaginary region comprising six towns and an Environment Department (ED) that functions as a regional body. The players take different roles: some are assigned the role of mayors or councillors (responsible for finance, the environment or communication) with a duty to safeguard the best interests of their towns, while others take the roles of ED officers and must concern themselves with the welfare of the region as a whole.

There is a given likelihood that each town will experience a certain extreme event caused by CC by the year 2050 (rising sea levels, river floods, heat-waves, droughts, hurricanes, forest fires) (Table 1). The occurrence of each of these extreme events is associated with material damage and personal harm, which is assessed financially (in “pesetos”, the fictional currency used in the game). The town council representatives must therefore make a number of political decisions concerning how their towns are to adapt to face up to the likely problems so as to reduce the impact on them of CC.

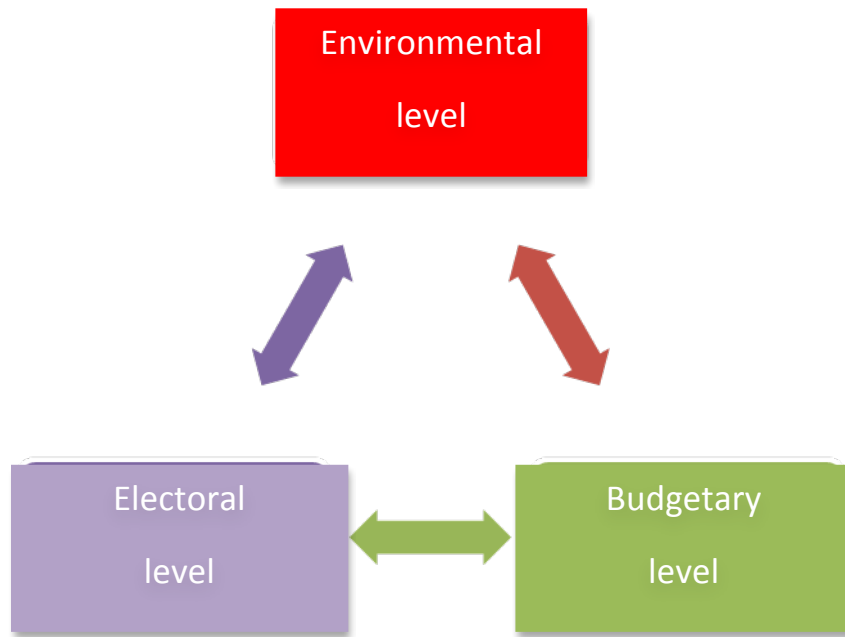
Table 1. Characteristics of the towns in the game

TOWN	POPULATION	EXTREME event
1.- Bluetown	10,000	Rise in sea-level
2.- Redville	50,000	River floods
3.- Greyborough	25,000	Heat-wave
4.- Yellowtown	2,000	Drought
5.- Orangeville	7,500	Hurricane
6.- Greenborough	1,500	Wildfire

Decisions concerning adaptation are subject to certain constraints in the game. First of all, from an environmental viewpoint there are several adaptation measures that could be adopted to tackle each problem, each with its own cost of application and level of effectiveness,

from which a choice must be made. Furthermore, towns have limited budgets which prevent them from undertaking a large number of measures. Finally, mayors are subject to a political cycle in which they must stand for re-election every four years, which means they must also concern themselves with the demands and interests of the electorate. This establishes links and limitations between the environmental, budgetary and electoral levels, as shown in Figure 1.

Figure 1. Decision-making Triangle



Conflicts may arise between goals at different levels (adaptation to climate change versus budgetary stability, versus winning the next election), so each town council must decide which goal or goals to focus on, or whether to try and maintain a balance with their strategies. Voters are distributed differently in each town, and the municipal budgets are also different, so each mayor and his/her councillors face different problems and circumstances, and are presented with different opportunities and obstacles.

3.1. The environmental level

Each town has a choice of five adaptation measures that can be taken to deal with the extreme event that threatens it. Each measure has a different financial cost and, should the event actually take place, will reduce the damage by a different percentage. Mayors must decide whether to apply one, more than one or none of these adaptation measures. The options available include "hard" measures, "soft" measures and other green measures. Figure 2 below shows an example of the adaptation measures available. Once the mayors and other councillors

have made their decision concerning their CC adaptation policy they must complete the measure selection form as shown in Figure 3.

Figure 2. Examples of adaptation measures


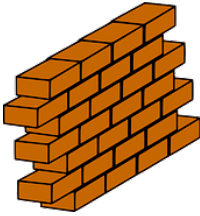
<p>1. Implement Integrated Management System</p> <p><i>By using an IT system and changing your management model the emergency prevention protocols can be improved.</i></p>  <p>APPLICATION COST. 100 pesetos</p> <p>REDUCTION IN DAMAGE: 5%</p>	<p>2. Building a Sea Wall</p> <p><i>A sea-wall 1-2m high can be built to prevent floods in case of rising sea levels.</i></p>  <p>APPLICATION COST. 650 pesetos</p> <p>REDUCTION IN DAMAGE: 20%</p>
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Figure 3. Example of the table for selecting measures at towns

Rise in sea-level	1. Implementation of an integrated management system	
	2. Construction of sea-walls	X
	3. Implementation of an Early Warning System	X
	4. Restoration of natural coastal habitats	
	5. Changes in town development regulations to move away from the coast	X

3.2. The budgetary level

Each town has a specific budget earmarked for adaptation to CC. The amount of this funding is different in each town, and therefore represents a budgetary constraint when it comes to choosing what specific adaptation measures are to be implemented in the town. However, political representatives can implement adaptation measures with costs in excess of their budgets, thereby incurring budget deficits that must be financed by the town itself via tax increases. In other words, it is ultimately the people of the town who end up financing any adaptation measures that go beyond the funding earmarked.

3.3. The electoral level

Each town has three types of voter: the green, the average and the undecided. Voter types are distributed differently in each town, and have different interests and needs. There are votes are conditional upon the extent to which those needs are met. Voter distribution does not vary over time, but the level of support initially obtained from each type may vary depending on the decisions made by mayors and councillors during the game. For the sake of simplicity it is assumed that there are only two political parties, and that the only policy that affects or interests the public is that concerned with adaptation to CC, so their support and their votes vary in line with that policy. At the start of the game the mayors have just been elected with 51% of the ballot. The distribution of each type of voter in the town and the support specifically received from each known (see Table 2 as an example)².

Table 2. Example of voter distribution and initial support

Voter type	% of electorate	Initial support	Election
GREEN	40%	22.5%	9%
AVERAGE	45%	80%	36%
UNDECIDED	15%	40%	6%
TOTAL			51%

A brief description of each type of voter follows:

- Green voters: These voters are highly concerned about climate change and its potential consequences for the town. They therefore demand a substantial reduction in potential damage. They are worried about the budget deficit, but since it is funded by taxation they take on board their own responsibility and are willing to incur additional costs to tackle adaptation to CC in the town. The greater the reduction in potential damage obtained with the adoption of adaptation measures, the more their support will increase with respect to the initial level and the greater the percentage of green voters who vote for the current mayor in the next election will be. By contrast, if the level of damage reduction obtained is low the support given by this group of voters will drop below the initial level, and fewer green voters will vote for the party currently in charge.³

² To obtain the relevant percentages of the total for each type of voter in the elections it suffices to multiply the percentage of voters via their initial support and divide by 100.

³ In practice (though the players are unaware of this) the game is designed so that support increases or drops in comparison with the initial level as from a 25% reduction in the total potential damage as a result of the measures selected. Moreover, support will drop still further from the initial level if the reduction in damage is less than 15%.

- Average voters: These voters are highly concerned about the financial situation of the town. They are somewhat sceptical and ignorant concerning climate change, and are willing to support funding for adaptation to CC only if no deficit is incurred. If the town incurs a deficit, the support given by this group of voters will decrease from the initial level by an amount proportional to the scale of that deficit, so fewer voters of this type will vote for the party currently in charge at the next election. By contrast, if the town has a budget surplus the support given by this group of voters will increase from the initial level by an amount proportional to the scale of that surplus, and more voters of this type will vote for the party currently in charge at the next election.

- Undecided voters: These voters share the concern of green voters for the environment but, like average voters, they do not wish the town to incur a deficit. They decide how to vote as follows. If the policies for adaptation to CC approved in the town manage to reduce potential damage substantially in case of an extreme event and no deficit is incurred then their initial level of support is between 70 and 90%. However if the reduction in damage is small and there is a deficit their level of support is between 10 and 30%. Finally, if one goal is achieved but not the other, i.e. there is a substantial reduction in potential damage but also a budget deficit (or a small reduction in damage and a budget surplus) their initial support is between 40 and 60%.

The constraints that exist in the three levels presented can thus be seen. On the one hand there is an incentive to implement a great many adaptation measures to reduce the potential damage in case of an extreme event, but the funding available and the distribution of average and undecided voters mark limits when budget stability targets and the likelihood of being re-elected are taken into account. On the other hand the existence of green voters makes it easier for mayors to implement adaptation measures, even measures that exceed the budget available, and thus help get themselves re-elected.

3.5. Department of the Environment

Some of the players take the roles of members of the Regional Environment Department (ED). The job of the ED is to attain the highest level of welfare for the region as a whole, which in this case entails minimising the damage suffered by the region as a whole as a result of climate change. The ED has a regional budget allocation earmarked for adaptation to CC, which it must distribute among the various towns. In this game the remit of the ED is to decide the criteria to be used in distributing that funding. However, it does not have full information on the terms of their problems so it must meet town councils and attempt to gather the information that it needs. At these meetings the mayors and councillors negotiate with the ED with a view to maximising the proportion of the regional budget allocation that they receive. They may follow

whatever strategy they consider most appropriate to that end as regards what information to disclose and how to disclose it.

Receiving funding from the ED is an important issue for mayors, because the more they receive the more money they will have available to spend on adaptation measures without incurring deficits, and therefore the more votes they will obtain.

4. Basic rules of the AdapteCC game

The game takes approximately 2 hours to play, though playing time varies in line with the specific needs of the players. It comprises a single round, i.e. no opportunity to repeat the process is given. It is divided into the following stages,

1. Presentation of the CC adaptation game. In this presentation the instructor explains the basic rules and procedures of the game, focusing on those points which are most important and hardest to grasp, and answers any questions that may be raised by players. This stage is expected to last 15-20 minutes.

2. Reading of information. Following the presentation, players are asked to read the general instructions for the game to ensure that they understand them and have no doubts. They are then provided with specific instructions for the roles allocated to them (political representative of a town or member of the ED). This stage is expected to last 5-10 minutes.

3. Discussion of strategies. Players meet first with their fellow team members (the mayor and councillors of each town and the members of the ED team) so that they can jointly analyse the information available and talk about what strategies should be implemented. This stage is expected to last 10-15 minutes.

4. Meetings between political representatives of towns and the ED. The ED must decide what meetings are needed to gather information on the towns before deciding how to distribute the funding, and must schedule those meetings accordingly. There may be a single meeting or several, attended by a single member of the ED or by several members at the same time. The ED members themselves, taking time limits into account and striving for efficiency must decide this. This stage is expected to last 20-25 minutes.

5. Distribution of the regional budget allocation. Following the meetings with the town representatives, the ED members have 10 minutes to check out the information gathered and decide what criteria are to be applied in distributing the funding. Once those 10 minutes have elapsed, the ED must hand in its file showing the distribution of the regional funding allocation among the towns. The instructor then enters the said data in the Excel file set up for the game, and informs the town representatives of how much funding has been allocated to each of them.

6. Deciding on adaptation measures. Once they know how much of the regional funding the ED has allocated to them, the mayors and councillors of each town discuss and decide on what adaptation measures they are to implement (none, one or more than one) and complete the relevant form. This stage is expected to take around 10 minutes, after which the players hand the form in to the instructor, who enters it in the Excel file, marking with an X the boxes corresponding to the measures selected on the form provided by each town.

7. Reading of results, discussion and conclusions. Finally, once all the information is entered on the Excel file for the game (see details and step by step instructions in the annex) the players are shown the results via the pages marked "Results" and "Tables" in the Excel file. This process could begin by showing the results of elections held after four years, spending on adaptation and the resulting budget balance (deficit or surplus). It can then be checked whether an extreme event is deemed to have occurred in the town or not 50 years later, and if so what damage has been caused. The information provided automatically by the Excel file also includes figures for the damage avoided per "peseto" spent on adaptation, and per "peseto" allocated from the regional funding allocation.

Once the results have been read out, the discussion stage begins. In this stage players are asked about how they performed in the game, what feelings they have, what conclusions they have drawn, what lessons they have learned and what facilities and difficulties they have found in their respective roles. This is a crucial part of the game. There is no point in a role-play game if there is no proper discussion stage in which players reflect on their gaming experience. No set time is therefore allocated to this last stage, because its duration depends on the needs of each group of players.

5. Materials and resources required⁴

The materials needed to play the game include the general instructions, the specific information for each type of player, the forms on which players note down their strategies (i.e. choose the adaptation measures to be implemented or, in the case of the ED, decide how to distribute the funding available) and an Excel file where the strategies chosen by the players are recorded. This file must be fillable, and must show the final results (see the annex for an explanation of how it works). Before the game begins there must be an initial presentation to explain the basic rules and the stages in which it is played.

When setting up the game it is advisable to use a large classroom with desks and chairs laid out in a manner conducive to the formation of independent groups while allowing for individual mobility. To give the game more atmosphere, individual visiting cards could be prepared indicating the roles that they play (ED, mayor or councillor of a specific town) so as to help identify each player.

6. Lessons for real life that can be learnt from AdapteCC

Although this is a role-play game set in a hypothetical situation in an imaginary world, a number of significant results and conclusions can be drawn for application in real life.

First of all, there is the importance of what information is available to players when they make decisions. In this specific game the information held by each player concerning the impacts of climate change and concerning adaptation and the way in which information is shared between them are both important factors. In the game the municipal authorities hold information on the likely impacts of CC on their towns, and on the costs and effectiveness of the adaptation measures that they can adopt. This information is not available to the ED. Information asymmetries of this kind occur between organisations in real life, leading to situations in which bureaucracies can use their power to obtain a larger portion of the overall funding allocation, as shown in Niskanen's bureaucracy model (Niskanen, 1971). The game can show players the importance of having more information and data to be investigated and

⁴ If you would like further information on the ADAPTECC Climate Change Adaptation Game or are interested in using the game as a teaching resource, please contact the authors: josu.lucas88@gmail.com; ibon.galarraga@bc3research.org; marta.escapa@ehu.es

assessed, and of providing mechanisms by which that information can easily be passed on between different organisations at all hierarchical levels locally (making use of best practices), nationally and internationally.

Another important point that the game illustrates is the role played by the barriers encountered when implementing adaptation policies. The two main barriers in the game are funding and elections. On the one hand funding is clearly tight, which means that some measures (and indeed some problems) must be prioritised over others. This can be seen in the game through the ED and the way in which it distributes the budget allocation. Players must also take into account the cost of borrowing too much and the danger of "mal-adaptation", in which spending on adaptation is inefficient and the costs outweigh the potential damage that they are intended to forestall.

The game also brings to light various dilemmas, such as the eternal economic dilemma of the trade-off between efficiency and fairness. This can be seen via the ED and the regional funding allocation that must be distributed. The ED must choose between efficiency (distributing funding to two towns where the damage is expected to be greatest) and fairness (distributing funds to all towns). Our experience with the game to date indicates that players tend to opt for criteria based on fairness and on population numbers.

Another significant dilemma can be found in the conflict between short-term and long-term interests. A mayor focused on short-term concerns is likely to worry first about being re-elected at the next elections, and may therefore implement those policies are most likely to achieve that purpose. Exactly what policies these are depends on the make-up of the electorate and on the percentages of green, average and undecided voters in the relevant town. However, a mayor focused on long-term concerns is less concerned about and feels less limited by the short-term consequences of his/her actions and is likely to opt for more far-reaching adaptation policies in accordance with environmental goals.

On an electoral level, an important conclusion that can be drawn is that the higher the proportion of citizens concerned about the environment is, the more effort will be demanded of local representatives in environmental matters. Such measures are therefore easier to undertake, because the electoral barrier is weaker. This result is in line with the predictions of theories such as the Median Voter Theorem (Congleton, 2002), bringing to light the importance of education and public awareness of environmental issues.

7. Experience gained in implementing the game and future development

AdapteCC was implemented at the 2015 Summer School organised by the Basque Centre for Climate Change (BC3) and the University of the Basque Country (UPV/EHU), as part of the summer courses run by the latter. In total twenty-two students on the summer course played the game. These students came from different academic backgrounds and different knowledge areas (economics, management and business studies, engineering, biology, etc.). The game was played in English, and the playing time was two hours. Table 3 shows how participants rated the game on completing it⁵.

Table 3. Rating of the game by players at the 2015 BC3-UPV/EHU Summer School

1. I think the game is difficult	2,41
2. I think the instructions are sufficiently clear	3,91
3. I think the game is useful in helping to understand adaptation to CC	3,95
4. I think that the game works properly	4,23
5. My overall rating of the game is:	7,91

In general, the game was rated as having a medium level of difficulty, which is ideal for motivating and encouraging players (i.e. it is neither too easy nor too difficult). A high score was obtained in the question concerning whether the game works properly, though players indicated that they needed more time, especially in the negotiation, discussion and results-reading stages. They also rated the level of clarity of the instructions as high, and in their remarks they stressed the importance of devoting sufficient time and effort to the initial presentation, particularly to clarify issues concerned with the electoral level and the motivations of the different types of voter. Finally, a high score was also awarded in the question concerning the usefulness of the game in helping to understand adaptation to CC, though some players gave low scores on this item, remarking that it was not so much adaptation to CC that the game facilitated but rather understanding of the process of political decision-making in matters of adaptation. Given that this is precisely what the game is intended for, it might perhaps be advisable to reword this question for future surveys. The overall score is 7.91, which for an initial score is high and satisfactory, and provides evidence of the usefulness of activities of this type for educational purposes.

⁵ The survey is scored on a scale of 1-5 for the first four items and 1-10 for the fifth.

These results are supplemented by observations made in the course of the game. Students interacted comfortably and in an orderly fashion, in a general atmosphere of enthusiasm, cordiality and active participation.

Given that the game does not require extensive prior knowledge of environmental issues, we believe that it could also be used in other forums and with players from different backgrounds, including undergraduates, postgraduates and specialists. Given that it is not too difficult, we believe that it could also be used for upper secondary and vocational training students.

Conclusions

Adaptation is an essential part of the struggle against climate change, in a context in which far-reaching mitigation measures will still not suffice to prevent the global average temperature from increasing over the course of this century.

This document presents an educational activity in which a role-play game is used to give players first-hand experience of the difficulties and opportunities that arise in making decisions concerning adaptation to CC at local and regional levels.

The design of the game enables various conclusions to be extrapolated that can be applied in real life. The experience obtained in implementing the game and the scores awarded to it by players confirm its practical usefulness and suitability for use in a variety of teaching environments.

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Annex I

Description of the Excel spreadsheets to be used in the AdapteCC game

The Excel spreadsheet designed for the AdapteCC game is simple to use, as it is already prepared so that a few items of data gathered during the game can be entered, and the rest is then automatically filled in to produce the final results.

The spreadsheet has several pages: 1 page for each town, 1 page for the ED, 1 page with the final results, 1 page showing the results in graph form and 1 page for “data”, where the data for the game are concentrated, i.e. costs, likelihoods, population numbers, etc.

There is no need to use the Excel spreadsheet until the ED has to make the final distribution of funding. When that time comes, open the Excel file. Go to the ED page as shown in Figure A1.

Figure A1. View of the ED page

DEPARTAMENTO DE MEDIO AMBIENTE	
PRESUPUESTO DISPONIBLE	1600
ALCALDE 1	300
ALCALDE 2	300
ALCALDE 3	300
ALCALDE 4	1300
ALCALDE 5	300
ALCALDE 6	300
REMANENTE	0

The amount of money allocated by the ED to each town must be entered in the boxes for the relevant mayors on this page. The remainder at the end must be 0, indicating that all the funds have been distributed.

This information is shown to the rest of the players who are acting as town representatives so that they know how much funding is allocated to each of them. After a few

minutes to enable the latter to reach their decisions, the adaptation measures selected by each town are then entered on the spreadsheet.

To do this, go to the Excel page for each town and locate the "Adaptation Measures" section in the central area. There, put an X in the "Implemented" column beside each measures selected, leaving the boxes for measures not selected blank. See Figure A2.

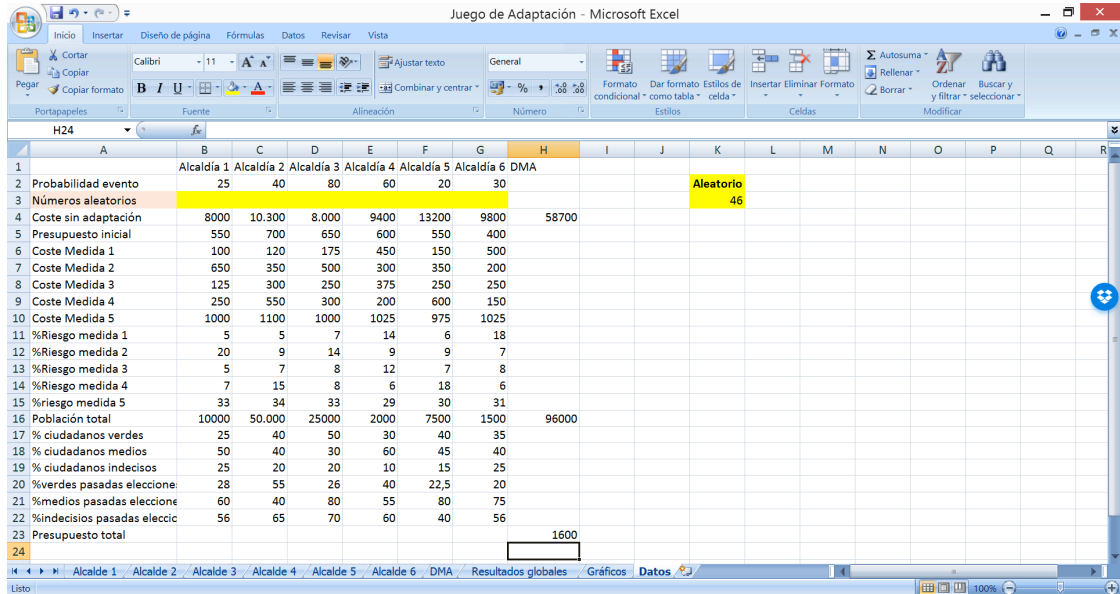
Figure A2. View of the Excel page for a town

TIPO	EJECUTADA	COSTE	DAÑO EVITADO
1. Dotación de medios de extinción	X	500	18 %
2. Sistema de Gestión Forestal	X	200	7 %
3. Campaña de información		0	0 %
4. Instalación de letreros	X	150	6 %
5. Construcción de cortafuegos		0	0 %
TOTAL		850	31 %

Once this has been done for each town and it has been checked that the data are correct, go to the "Data" page. All the data used in the game are shown here. Observe that the data for the game can be changed easily by marking them on this page.

The last stage as regards the Excel spreadsheet is to calculate the likelihood of extreme events, to determine whether they are considered to have occurred or not after 50 years. To randomise this calculation, the Excel function that enables a random number between two given numbers to be selected is used (in this case between 0 and 100). Thus, if the likelihood of an event is shown as 25 and the random number between 0 and 100 that comes up is 25 or lower the event is considered to have taken place. If it is higher than 25 it is considered not to have taken place. To get Excel to do this just copy cell K3, located below the cell marked "Random", which contains the formula explained above, select row B3-G3 (in yellow) and paste to obtain the random number for each town (see Figure A3). Excel will then fill in the data automatically. Once this has been done no further modifications can be made anywhere in the documents, because double clicking on any cell of the spreadsheet will cause the random numbers (and therefore all the final results of the game) to change.

Figure A3. View of the "Data" page



Finally, all results for the game are shown on the "Overall Results" and "Graphs" pages. The "Overall Results" page (Figure A4) shows election results, adaptation costs, whether events take place, impacts after adaptation and numerous other useful ratios concerning the effectiveness of the money invested in adaptation. The "Graphs" page (Figure A5) shows the same final results in graph form.

Figure A4. View of the "Overall Results" page

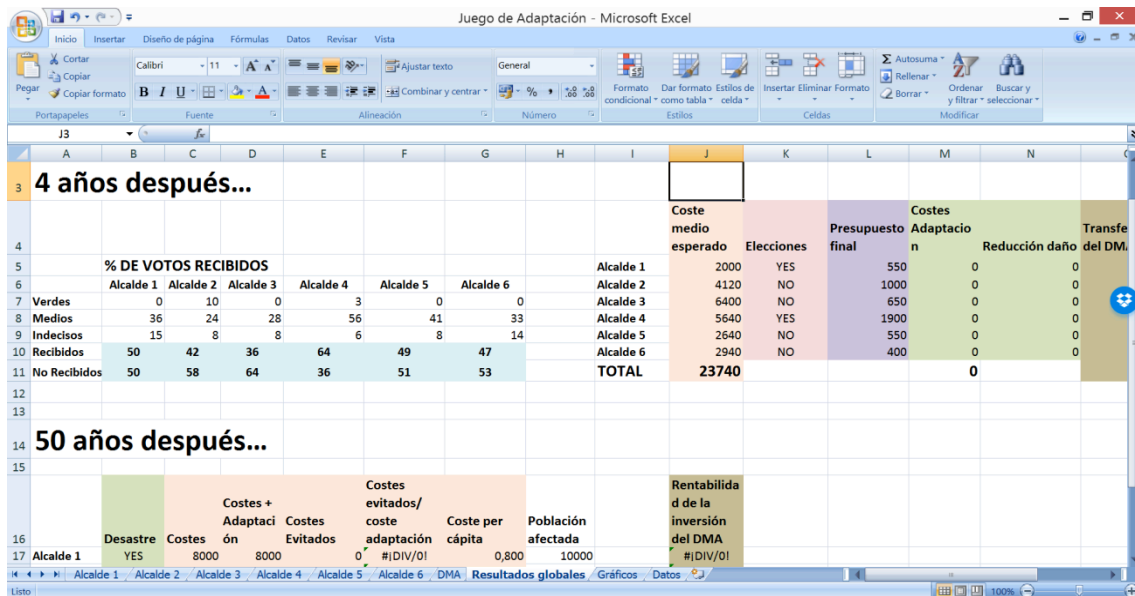
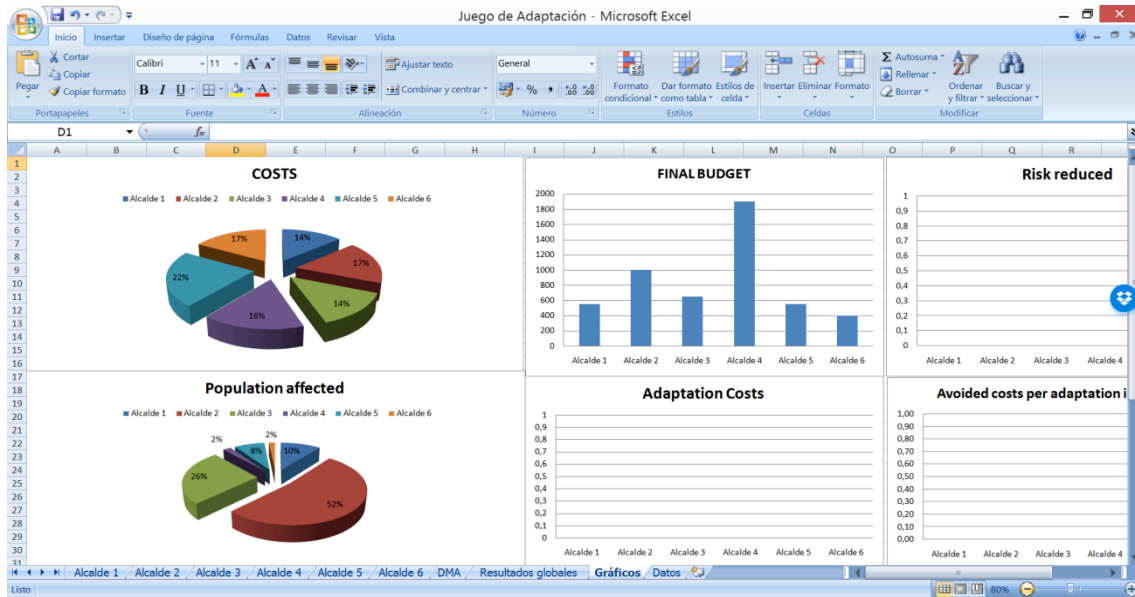
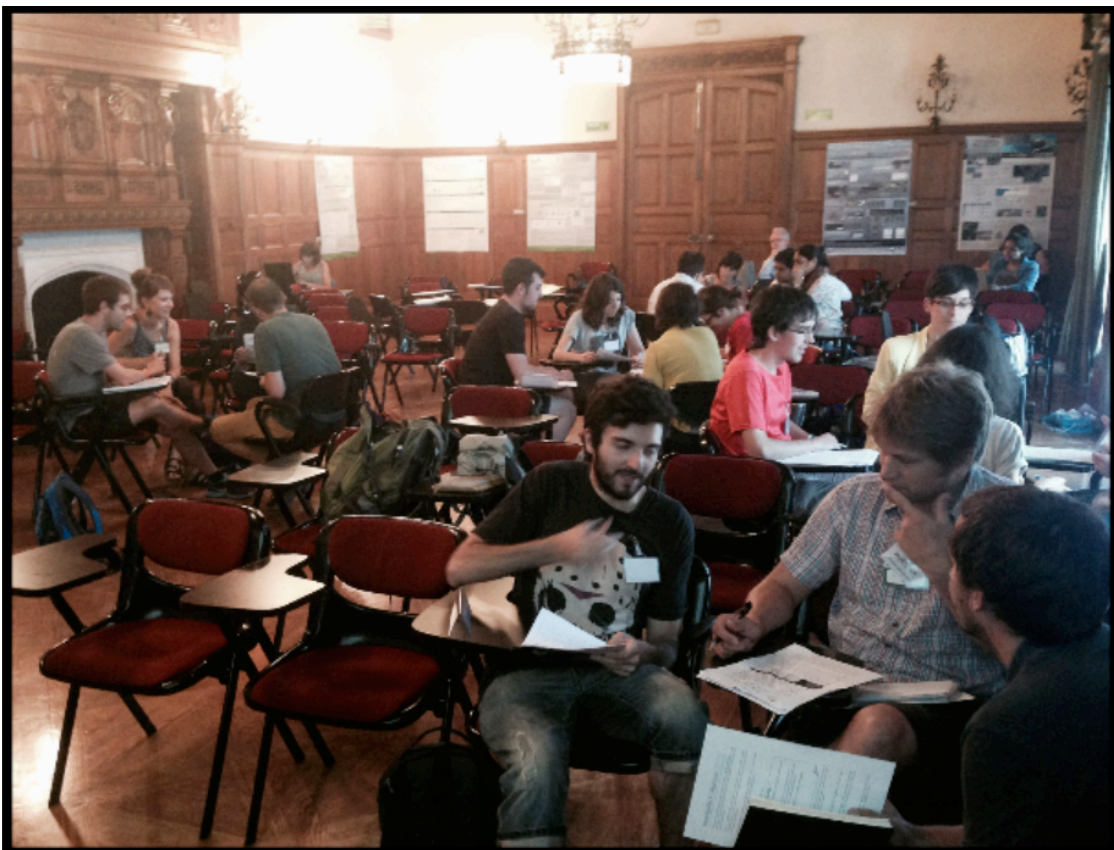


Figure A5. View of the "Graphs" page



ANNEX II. Photos taken during the gaming session at the 2015 Summer School





STAGES OF THE GAME

- The Game will have the following stages:
- 1. Reading of information and study of strategies (Apron. 11 min)
 - 2. Meetings with the ED (Apron. 15 min)
 - 3. Sharing out of ED funding (Apron. 10 min)
 - 4. Choice of measures by regions (Apron. 5 min)
 - 5. Calculation of probabilities and implementation of measures (Apron. 5 min)
 - 6. Reading of results and discussion (Apron. 20 min)