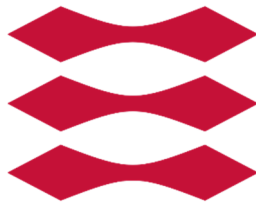


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# **Selecting the Host City of the 2024 Olympic Games using Systemic Planning**

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# Abstract

Past selections of Olympic host cities have been criticised for bribery, corruption, lack of transparency and favouring gigantism. Also, in the past, host cities have in numerous cases had financial difficulties after hosting the Olympic Games. In addition, cities applying to become an Olympic host city have declined in the last decade.

The International Olympic Committee (IOC) has recognised that there are problems with the selection and hosting of the Olympic Games and has set out a package of reforms in its 'Agenda 2020' to shape their bidding process and put further importance on sustainability of the Olympic Games.

The objective of this study was to use Systemic Planning (SP), which has the purpose of assisting decision-makers in dealing with complex planning problems and compare five candidate cities suitability to host the Olympic Games in 2024 taking into account cities sustainable development.

With SP there were five Operational Research (OR) methods used:

- Brainstorming
- Analytic Hierarchy Process
- Scenario Analysis
- Stakeholder Analysis
- Sensitivity Analysis

Combining these five OR methods with the five SP perspectives the aim was to make a comprehensive decision support for the IOC to select the host city of the 2024 Olympic Games.

Various criteria were selected which could assist with comparing the cities in terms of their suitability to host the Olympic Games in 2024.

The cities were compared to these criteria and assessed from different viewpoints, such as different stakeholders' perception and different scenarios, to see if different visions would alter in the final outcome.

The results of the study showed that Paris is recommended as the host city of the 2024 Olympic Games with Los Angeles also to be considered.

Furthermore, the study showed that SP can be used as a decision support for the IOC for future selections of Olympic host cities as well as in other complex planning problems.

# Table of Contents

<b>List of Figures .....</b>	<b>v</b>
<b>List of Tables.....</b>	<b>vii</b>
<b>Abbreviations.....</b>	<b>ix</b>
<b>Acknowledgements .....</b>	<b>xi</b>
<b>1 Introduction.....</b>	<b>1</b>
1.1 Olympic bids and Olympic Games .....	2
1.2 Candidate cities for the 2024 Olympic Games.....	5
1.3 Problem formulation, structure and learning objectives .....	8
<b>2 Theory and Methodology .....</b>	<b>10</b>
2.1 Systemic Planning .....	10
2.2 Brainstorming.....	12
2.3 Analytic Hierarchy Process (AHP) .....	13
2.3.1 The eigenvector method procedure.....	15
2.3.2 Consistency .....	17
2.3.3 Strengths and weaknesses of AHP.....	18
2.3.4 The Expert Choice software.....	19
2.4 Scenario analysis (The BAU and SD visions).....	19
2.5 Stakeholder analysis (STA).....	20
2.6 Sensitivity analysis .....	21
<b>3 Determination of Criteria .....</b>	<b>22</b>
3.1 BAU criteria list .....	22
3.2 Agenda 2020 criteria list (mixed BAU and SD) .....	23
3.3 SD criteria list.....	24
<b>4 Screening Assessment .....</b>	<b>25</b>
4.1 Selection of screening criteria .....	25
4.2 Results of screening assessment.....	26
4.2.1 Screening assessment by ranking cities from 1-5 .....	27
4.2.2 Screening assessment by gathering data and scaling 0-10.....	28
<b>5 The AHP model.....</b>	<b>29</b>
5.1 Determination of the AHP goal hierarchy.....	29
5.2 Sub-criteria for BAU assessment .....	31
5.3 Sub-criteria for SD assessment.....	33

<b>6 Full Assessment.....</b>	<b>37</b>
6.1 BAU assessment results .....	37
6.1.1 Olympic Games .....	38
6.1.2 Olympic City .....	39
6.1.3 Total score for BAU assessment .....	41
6.2 SD assessment results .....	42
6.2.1 Economy .....	42
6.2.2 Environment .....	44
6.2.3 Social .....	46
6.2.4 Total score for SD assessment.....	48
6.3 Full assessment results .....	49
<b>7 Discussion of results .....</b>	<b>51</b>
7.1 AHP runs.....	51
7.1.1 Basic run (Level I) .....	51
7.1.2 Focus on Olympic Games (Level III).....	52
7.1.3 Focus on Olympic City (Level III) .....	53
7.1.4 Focus on BAU (Level II).....	54
7.1.5 Focus on SD (Level II) .....	55
7.1.6 Focus on Strong SD (Level II and III).....	56
7.1.7 Conclusion of the six runs .....	58
7.2 Five SP perspectives .....	59
7.2.1 Core Performance .....	59
7.2.2 Wider Performance.....	60
7.2.3 Fairness .....	61
7.2.4 Diversity .....	61
7.2.5 Robustness .....	66
<b>8 Conclusion and recommendation.....</b>	<b>67</b>
<b>References .....</b>	<b>69</b>
<b>Appendix A - Criteria description .....</b>	<b>81</b>
<b>Appendix B - Logbook.....</b>	<b>87</b>
<b>Appendix C - Revised Pairwise Comparisons .....</b>	<b>111</b>

# List of Figures

Figure 1-1: Overview of the bidding process for 2024 Olympic Games .....	4
Figure 1-2: Los Angeles 2024 Olympic Bid Logo.....	5
Figure 1-3: Paris 2024 Olympic Bid Logo.....	5
Figure 1-4: Budapest 2024 Olympic Bid Logo.....	6
Figure 1-5: Rome 2024 Olympic Bid Logo .....	6
Figure 1-6: Hamburg 2024 Olympic Bid Logo.....	6
Figure 2-1: Example of AHP hierarchy .....	13
Figure 2-2: Process of scenario development.....	19
Figure 2-3: Comprehensive sustainable development.....	20
Figure 2-4: Power-Interest grid of stakeholders.....	21
Figure 5-1: The determination of the AHP hierarchy .....	30
Figure 5-2: Overview of the AHP hierarchy with all sub-criteria.....	36
Figure 6-1: Total score for each city for Olympic Games criterion.....	38
Figure 6-2: Olympic Games sub-criteria weights .....	39
Figure 6-3: Total score for each city for Olympic City criterion .....	39
Figure 6-4: Olympic City sub-criteria weights.....	40
Figure 6-5: Total score for each city for the BAU assessment.....	41
Figure 6-6: Total score for each city for the Economic pillar .....	42
Figure 6-7: Economy sub-criteria weights .....	43
Figure 6-8: Total score for each city for the Environmental pillar.....	44
Figure 6-9: Environmental sub-criteria weights.....	45
Figure 6-10: Total score for each city for the Social pillar .....	46
Figure 6-11: Social sub-criteria weights .....	47
Figure 6-12: Total score for each city for the SD assessment.....	48
Figure 6-13: Total values for cities for the full assessment - basic results.....	49
Figure 6-14: Distribution of scores for cities .....	49

Figure 6-15: Weights of sub-criteria for the full assessment – basic results .....	50
Figure 7-1: Total values for cities in the basic run.....	52
Figure 7-2: Total values for cities when the focus is on Olympic Games.....	53
Figure 7-3: Total values for cities when the focus is on Olympic City.....	54
Figure 7-4: Total values for cities when the focus is on BAU .....	55
Figure 7-5: Total values for cities when the focus is on SD.....	56
Figure 7-6: Strong sustainability .....	56
Figure 7-7: Total values for cities when the focus is on strong SD.....	57
Figure 7-8: Total values for cities when focus is on Olympic Games and BAU .....	65
Figure 7-9: Gradient sensitivity analysis.....	65



# List of Tables

Table 1-1: Litmus Test of complexity .....	2
Table 1-2: Overview of candidate cities.....	7
Table 2-1: Seven hard and seven soft system techniques and methods .....	11
Table 2-2: Methods selected .....	12
Table 2-3: Gradation scale for quantitative comparison of alternatives.....	14
Table 2-4: Random Consistency Index (RI).....	17
Table 3-1: BAU criteria.....	23
Table 3-2: Agenda 2020 criteria.....	23
Table 3-3: SD criteria.....	24
Table 4-1: BAU criteria selected for the Screening assessment.....	25
Table 4-2: Data from cities for screening criteria .....	26
Table 4-3: Screening assessment by ranking 1-5 .....	27
Table 4-4: Screening assessment by grading and scaling 0-10 .....	28
Table 5-1: Olympic Games sub-criteria.....	31
Table 5-2: Olympic City sub-criteria .....	32
Table 5-3: Economic pillar sub-criteria.....	33
Table 5-4: Environmental pillar sub-criteria.....	34
Table 5-5: Social pillar sub-criteria.....	35
Table 6-1: Scores for the cities for each sub-criterion under the Olympic Games .....	38
Table 6-2: Scores for the cities for each sub-criterion under the Olympic City.....	40
Table 6-3: Scores for the cities for each sub-criterion under the Economic pillar .....	42
Table 6-4: Scores for cities for each sub-criterion under Environmental pillar .....	44
Table 6-5: Scores for cities for each sub-criterion under Social pillar.....	46
Table 7-1: Weights for sub-goals and criteria for basic results.....	51
Table 7-2: Weights for sub-goals and criteria with focus on Olympic Games .....	52
Table 7-3: Weights for sub-goals and criteria with focus on Olympic City .....	53

Table 7-4: Weights for sub-goals and criteria with focus on BAU .....	54
Table 7-5: Weights for sub-goals and criteria with focus on SD .....	55
Table 7-6: Pairwise comparisons between the three pillars of sustainability .....	57
Table 7-7: Weights for sub-goals and criteria with focus on strong SD .....	57
Table 7-8: Overview of the results from the AHP runs. Total values for cities .....	58
Table 7-9: Revised results from the six AHP runs. Total values for cities .....	62
Table 7-10: Revised results with Average temperature. Total values for cities.....	63
Table 7-11: Revised results from the six AHP runs with criteria weight revised. Total values for cities .....	64
Table 7-12: Weights for sub-goals and criteria with focus on Olympic Games and BAU .....	64

# Abbreviations

Abbreviation	Full name
AHP	Analytic Hierarchy Process
BAU	Business as usual
CBA	Cost Benefit analysis
CBA	Cost Benefit Analysis
CI	Consistency Index
COSIMA	Composite MCA model
CP	Core Performance
CR	Consistency Rating
DI	Diversity
EPOMM	European Platform on Mobility Management
FA	Fairness
GDP	Gross Domestic Product
IOC	International Olympic Committee
MCDA	Multi Criteria Decision Analysis
MM	Mind Mapping
NOC	National Olympic Committee
OR	Operation Research
OSAC	Overseas Security Advisory Council
PA	Preference Analysis
RA	Monte Carlo-Simulation
RI	Random consistency Index
RO	Robustness
ROD	Rank Order Distribution
SA	Scenario analysis
SD	Sustainable development
SIMDEC	Simulation and Multi-Criteria Decision Analysis
SMART	Simple Multi-Attribute Rating Technique
SP	Systemic Planning
STA	Stakeholder analysis
SWOT	Strengths Weaknesses Opportunities and Threats
TOP	The Olympic Partner programme
U.S.	United States
WP	Wide Performance



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# 1 Introduction

In February 2017, Budapest withdrew its Olympic bid to host the Olympic Games in 2024, leaving Los Angeles and Paris the only candidate cities left in the attempt to become the host city. Budapest was, however, not the first city to withdraw its bid. Previously, Rome and Hamburg had made similar moves (Dunai, 2017).

Further, a similar situation occurred for the 2022 Winter Olympic Games when four cities withdrew their bids, again leaving two cities left to bid (Kemp, 2015).

The reason for these withdrawals was that politicians and/or the public criticised the cost of hosting the Olympic Games (Dunai, 2017; Giorgio, 2016; Huggler, 2015; Kemp, 2015).

A selection of host cities have also been criticised for corruption, bribery and lack of transparency (Ingle, 2016; Kemp, 2015; Mallon, 2000).

Many have also criticised the International Olympic Committee (IOC) for encouraging gigantism. Cities are required to have over 30 competition venues, ninety training facilities and an Olympic Village that will need to accommodate over 15,000 people. Cities are also required to have broadcasting facilities, accommodation for journalists and over 40,000 hotel rooms for IOC members and spectators among other infrastructure such as good transportation systems (Kemp, 2015). For that reason, many host cities have had financial problems after hosting the Olympic Games (Todd, 2016; Smith, 2012).

As a result of this criticism, the future of the Olympic Games may now be at stake.

In the past, the Olympic Games were a chance for cities to market themselves, welcome the world and speed up urban development. Today however, it is considered a high-risk event, harmful for the environment and overly costly (Kemp, 2015).

The IOC has recognised these criticisms, and has set out a package of reforms in its 'Agenda 2020' (The International Olympic Committee, 2014). The Agenda has recommendations to reduce the cost and the size of the Olympic Games and shape the bidding process. It also recommends that host cities show good governance and tailor their Olympic bids to fit long-term sporting, economic, social and environmental needs.

This shows that the selection of the host city is a difficult task. However, to determine whether the problem can be dealt with by 'traditional' planning (systematic planning) or if it is a complex planning problem that requires complex approaches and procedures (systemic planning), a Litmus Test can be used (Leleur, 2008, as cited in Jeppesen, 2009).

In a Litmus Test, seven 'Yes' or 'No' questions need to be answered. If the questions are answered either 'Yes' or 'Maybe' it can indicate a possible complex problem task. The Litmus Test is shown in Table 1-1.

**Table 1-1: Litmus Test of complexity.**

<b>‘Will a traditional planning approach cause problems with regard to ...’</b>
<b>Formulation of goals and objectives?</b>
<b>YES.</b> It is difficult to formulate specifically what makes a city the best city to host the Olympic Games since there are many concerns that need to be taken into account.
<b>Identification and design of major alternatives before reaching the goals identified within the given decision-making situation?</b>
<b>YES.</b> The selected alternative may change the original plan on how the city will host the Olympic Games due to economic, environmental or, social constraints that may arise during the process. Therefore, even if an alternative is selected that is ideal at the time of the selection it may not necessarily be suitable in the end.
<b>Prediction of major sets of consequences that would be expected to follow upon adoption of each alternative?</b>
<b>YES.</b> Each alternative involves uncertainties that are hard to predict precisely for the future. E.g. the cost of hosting the Olympic Games, transportation demand, world politics (boycott of nations), revenue of ticket sale, future use of sporting venues, economic crisis and natural hazards.
<b>Evaluation of consequences in relation to desired objectives and other important values?</b>
<b>YES.</b> Some of the consequences are not easily measurable and can only be represented by numbers attained in an illogical way.
<b>Decision based on information provided in the preceding steps?</b>
<b>YES.</b> Since there are complications in all of the above consequences, it is difficult to make a specific decision based on solid facts.
<b>Implementation of this decision?</b>
<b>YES.</b> There are two main stakeholders (the IOC, host city) with interests and power in the decision and there can be different perceptions.
<b>Feedback of actual program results and their assessment in the light of the new decision-situation?</b>
<b>YES.</b> It is difficult to make actual decisions based on consequences that are not easily measurable.

Since all seven questions in the Litmus Test are answered ‘YES’, the selection of an Olympic host City can be described as a complex problem.

To deal with complex problem such as this, Systemic Planning (SP) can be used. SP has the purpose of assisting decision-makers dealing with complex planning problems and help decision-makers to reach a more inclusive decision (Leleur, 2012).

Nevertheless, to understand the bidding process and the selection of the host city, the following section discusses how the modern Olympic Games came to be and how the bidding process works.

## **1.1 Olympic bids and Olympic Games**

The first modern Olympic Games were held in 1896 in Athens, Greece. However, the Olympic Games are much older than this, originally held from 776 BC through to 393 AD in Olympia in Greece (Penn Museum, n.d.).

The man responsible for reviving the ancient Olympic Games was Pierre de Coubertin. Inspired by these ancient Olympic Games, Coubertin decided to create the modern Olympic Games and in 1894 he founded the IOC. This new committee set itself the objective of organising the first Olympic Games of modern times (The International Olympic Committee, 2007).



Coubertin's first plan was to have the first modern Olympic Games in 1900 in his hometown Paris, but the committee was so excited that they convinced Coubertin to move the Olympic Games forward to 1896 and have Athens as the first host city (Penn Museum, n.d.).

Since 1896 the Olympic Games have been held every four years, except in 1916, 1940 and 1944 because of World Wars I and II (The International Olympic Committee, 2007).

In 1924 a winter version of the Olympic Games (the Winter Olympic Games) took place for the first time, and was held every four years in the same year as the Summer Games until 1992 when the IOC decided to host the Winter Olympic Games every four years and the Summer Olympic Games every four years with each Winter Games occurring two years after each Summer Games and vice versa (Ibid.).

The Olympic Games are held in a different city every four years and to host the Olympic Games cities have to go through the IOC bidding process (The International Olympic Committee, 2017a).

Ten years prior to the Olympic Games, the IOC invites National Olympic Committees (NOCs) to declare an interest in bidding on behalf of a city in their respective country.

Then the IOC provides workshops to the potential cities. In these workshops, cities will have the opportunity to learn more about how to plan Olympic Games that will continue to meet community needs after the Olympic Games are over. These workshops also help cities to evaluate if they should continue with the bid.

Cities which take the decision to bid for the Olympic Games will enter the official Candidature Process, made up of three stages. Cities must submit a report with certain elements after every stage, each of which addresses different elements of the cities' proposals in the context of the inherent nature of each country, region and city. After each submission, the IOC executive board confirms the transition of the cities to the next stage.

After stage three, an evaluation commission will evaluate each city and make a report summarising each city's advantages and risks. Then approximately two months before the election, the evaluation commission will publish the report.

Following the report, candidature cities have a right to respond to the report and have a briefing with the IOC and international federations that have sports in the Olympic Games.

Then, approximately seven years prior to the Olympic Games, an election, will take place to determine the host city. In the election, a city will need a minimum of fifty percent of the vote to be selected as the host city.

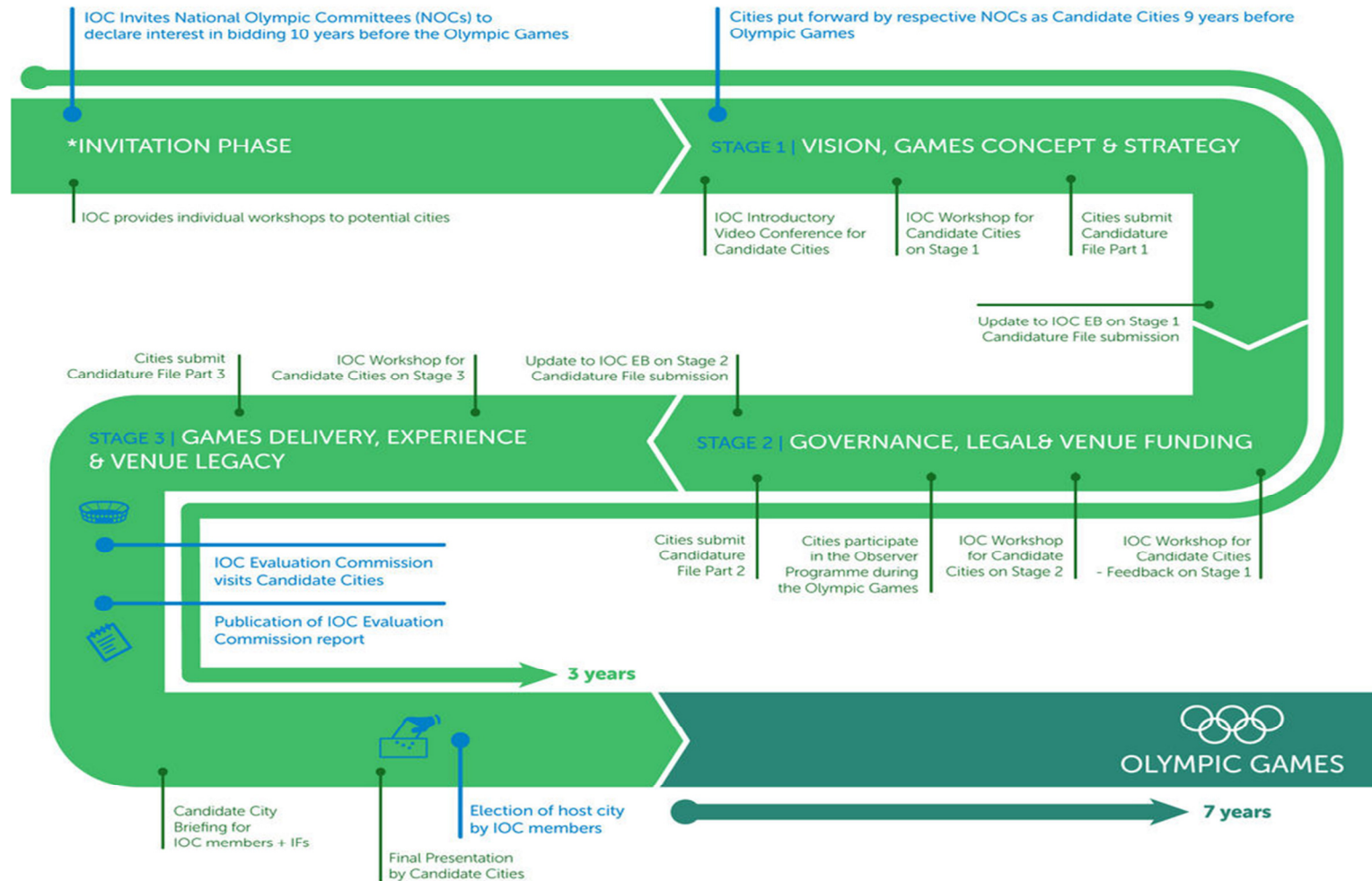
If no city gets majority of votes, the city with the smallest number of votes is eliminated and another round of voting takes place until one city has the majority.

An overview of the bidding process is shown in Figure 1-1.

The aim of this new process is to ensure excellent Olympic Games without compromising the field of play for the athletes, as well as meeting the needs of the city and region to ensure the Olympic Games will leave positive, long-term, sustainable development (The International Olympic Committee, 2014).

Sustainable development can be defined as: *'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'* (World Commission on Environment and Development, 1987).

The process of selecting the host city of the 2024 Olympic Games is ongoing and the election will take place on 13th of September 2017 in Lima, Peru where one of the two remaining candidate cities will be selected as the host city of the 2024 Olympic Games.



**Figure 1-1: Overview of the bidding process for 2024 Olympic Games.**  
**Source: The International Olympic Committee, 2017a.**

## 1.2 Candidate cities for the 2024 Olympic Games

Two cities remain as candidate cities for the 2024 Olympic Games. Three other cities were candidate cities but withdrew their bids due to financial obligation and/or lack of public support (Huggler, 2015; Giorgio, 2016; Dunai, 2017).

In this study, all five cities will be evaluated as a candidate city since in the beginning of the study one other city was still in the run to become the host city. Furthermore, it is interesting to evaluate all the cities and assess whether one of the withdrawn cities should have been recommended as the host city. This can also demonstrate the possibility to make a comprehensive decision support even when several alternatives need to be compared on a number of elements.

The two candidate cities still in the running to become the host city of the 2024 Olympic Games are in alphabetical order:

### Los Angeles:

Los Angeles is the second most populated city in the United States (U.S.) with a population of 4 million (Los Angeles 2024 Exploratory Committee, 2016) and 12.3 million in the metropolitan area (United Nations, 2016). Los Angeles is located on the south-western coast of the U.S., approximately 190 kilometres north of the Mexican border and covers around 1,215 km<sup>2</sup> (Pitt, 2017).

Los Angeles has a Mediterranean climate with a yearly average temperature of 19.5 °C with the hottest month being August with an average of 23.9 °C (Norwegian Meteorological Institute, 2017a).



Figure 1-2: Los Angeles 2024 Olympic Bid Logo.  
Source: gamesbids.com.

### Paris:

Paris is the capital of France with a population of around 2.2 million (*Paris Candidature File Stage*, 2016) and 10.9 million within its metropolitan area, making it the most populated metropolitan area in the European Union (United Nations, 2016). Paris is located just north of central France and is built on both sides of the river Seine. The city covers 105 km<sup>2</sup> with the metropolitan area covering around 12,000 km<sup>2</sup> ("Metropolitan areas", 2015).

Paris has an oceanic climate with an annual average temperature of 12.0 °C, with August being the warmest month with an average of 20.0 °C (Norwegian Meteorological, 2017b).



Figure 1-3: Paris 2024 Olympic Bid Logo.  
Source: gamesbids.com.

The three cities that withdrew their bids are: (listed in order of withdrawal, from most recent to least recent)

### **Budapest:**

Budapest was a candidate city until February 2017, when the government decided to withdraw the Budapest bid due to lack of public support (Dunai, 2017).

Budapest is the capital of Hungary and has a population of 1.7 million people (United Nations, 2016) and is the eighth largest city in the European Union (Berg et al., 2014). The city covers 525 km<sup>2</sup> and the metropolitan area covers 2,538 km<sup>2</sup> with a population of 2.4 million (Budapest, 2017). Budapest is located in the middle of Europe and intersects three Pan-European transport corridors (European Commission, 2017). Furthermore, Budapest lies on the banks of the river Danube which is one of the main waterways in Europe (INE, 2017).

Budapest has a humid continental climate with an average temperature of 11.3 °C with July being the warmest month with an average temperature of 21.5 °C (Budapest, 2017).



Figure 1-4:  
Budapest 2024  
Olympic Bid Logo.  
Source:  
gamesbids.com.

### **Rome:**

Rome was a candidate city until September 2016, when the majority of the city council decided to withdraw the bid due to the financial obligations of the Olympic Games and risk of overrun cost (Giorgio, 2016).

Rome is the capital of Italy with 4.3 million inhabitants in the metropolitan area (Comitato organizzatore Roma 2024, 2016). Rome covers an area of 1,283 km<sup>2</sup> with its metropolitan area covering 5,686 km<sup>2</sup> ("City of Rome, Lazio", 2010). Rome is located in the western part of central Italy and sits on the bank of the river Tiber (Ibid.).

Rome lies in a Mediterranean climate zone with an annual average temperature of 15.3 °C with August being the warmest month with an average temperature of 24.5 °C (*Roma/Urbe 24 m. s.l.m.*, n.d.).



Figure 1-5: Rome  
2024 Olympic Bid  
Logo.  
Source:  
gamesbids.com.

### **Hamburg:**

Hamburg was a candidate city until November 2015 when the citizens of Hamburg voted in a referendum to withdraw the bid (Huggler, 2015).

Hamburg is the second biggest city in Germany with a population of 2 million and covers an area of around 750 km<sup>2</sup> (Hamburg, 2017). Hamburg lies in the northern part of Germany and sit on the banks of the river Elbe. Hamburg is also one of the biggest transport hubs in the world (Ibid.).

Hamburg lies in an oceanic climate zone with annual average temperature of 9 °C with July being the warmest month with an average of 17.4 °C (Norwegian Meteorological Institute, 2017c).



Figure 1-6:  
Hamburg 2024  
Olympic Bid Logo.  
Source:  
insidethegames.biz.

Out of these five cities, three of them have already hosted the Olympic Games before: Paris, Los Angeles and Rome ('Past Olympic Host City Election Results', 2017).

Paris hosted in 1900 and 1924 with France hosting the Olympic Games five times in total, three winter games and two summer games (Ibid.).

Los Angeles hosted in 1932 and 1984 with the U.S. hosting eight times in total, four winter games and four summer games (Ibid.).

Rome hosted in 1960 with Italy hosting three times, two winter games and one summer games (Ibid.).

Hamburg and Budapest have never hosted the Olympic Games. However, Germany has hosted the Olympic Games three times, two Winter Games and one Summer Games while Hungary has never hosted the Olympic Games (Ibid.).

Paris has bid for the Olympic Games six times since 1924 but has been unsuccessful in all bids (Mallon, 2017). Also, Paris has never defeated a city in an Olympic bidding election. In 1900 Paris was awarded the games without a bidding process and in 1924 Paris was selected since Coubertin, the father of the modern Olympic Games was to retire from the IOC after the 1924 Olympic Games and as he was Parisian it was decided to award Paris the Olympic Games (Ibid.).

Similarly, Los Angeles has bid for the Olympic Games ten times, but in all cases, has been unsuccessful. Los Angeles, like Paris, has never defeated a city in an election, since in both 1932 and 1984 the Olympic Games were awarded to Los Angeles because there were no other candidate cities (Ibid.).

Budapest has bid five times for the Olympic Games but has been unsuccessful in all cases. Rome has bid six times and been selected two times, in 1908 and 1960. However, in 1908, Rome had to cancel the hosting of the Olympic Games for financial reasons due to the eruption of Vesuvius Mountain. Instead the Olympics was hosted in London ('Past Olympic Host City Election Results', 2017).

Hamburg on the other hand, has never bid for the Olympic Games although they wanted to bid for the 2012 Olympic Games but the German NOC decided to select Leipzig as their candidate city (Starcevic, 2003).

An overview of the candidature cities is shown in Table 1-2.

**Table 1-2: Overview of candidate cities.**

City	Los Angeles	Paris	Budapest	Rome	Hamburg
Continent	North America	Europe	Europe	Europe	Europe
Population	4 million	2.2 million	1.7 million	4.3 million*	2 million
Size	1,215 km <sup>2</sup>	105 km <sup>2</sup>	525 km <sup>2</sup>	1,283 km <sup>2</sup>	750 km <sup>2</sup>
Avg. Temperature	23.9 °C	12 °C	11.3 °C	15.3 °C	9 °C
Olympic host city	2x	2x	Never	1x	Never
Bids for Olympic Games	10x	6x	5x	6x	Never

\*: Metropolitan area

## **1.3 Problem formulation, structure and learning objectives**

The selections of host cities have been criticised in the past, for corruption, bribery and lack of transparency in the voting (Ingle, 2016; Mallon, 2000; Kemp, 2015).

The IOC has recognised that there is a problem with the selection, and has set out a package of reforms in its 'Agenda 2020', which has recommendations to reduce the cost and the size of the Olympic Games. Furthermore, the 'Agenda 2020' has recommendations for shaping of the Olympic Games bidding process as well as recommendations for host cities to show good governance and tailor their Olympic bids to fit long-term sporting, economic, social and environmental needs.

The candidate cities for the 2024 Olympic Games are the first candidate cities to use these recommendations during the bidding process. The purpose of this is to ensure excellent Olympic Games without compromising the field of play for the athletes, while meeting the needs of the city and region to ensure that the Olympic Games will leave a legacy of positive, sustainable development (The International Olympic Committee, 2017a).

The aim of this study is to compare the suitability of five candidate cities' to host excellent Olympic Games in 2024 without jeopardising the field of play for the athletes and to meet the needs of the city and region and uphold long-term sustainable development.

The objective is to use Systemic Planning (SP), which has the purpose of assisting decision-makers in dealing with complex planning problems, and apply and combine hard and soft Operations Research (OR) methods from SP to assess the cities suitability and make recommendations for which city should be selected. In this study the use of the following five methods are found relevant:

- Brainstorming (Soft)
- Analytic Hierarchy Process (AHP) (Hard)
- Scenario Analysis (SA) (Hard)
- Stakeholder Analysis (STA) (Soft)
- Sensitivity Analysis (Hard)

As indicated these five methods are divided into hard and soft methods. Three hard methods and two soft methods will be used in this study.

### **Disposition of the report**

Following the introduction and the problem formulation in Chapter 1, Chapter 2 starts by describing the SP and the five different SP perspectives, each of which is applicable to this study. The chapter ends with a description of the five OR methods listed above.

Chapter 3 presents all criteria that may be relevant in this study without considering the number of criteria. These criteria are divided into three long lists: Business As Usual (BAU), Agenda 2020 and Sustainable Development (SD).

In Chapter 4, six key criteria are selected from the long lists in Chapter 3. Then data is collected for these six criteria and two versions of a screening assessment are conducted to rank the cities. Later these screening assessments are viewed to see if they harmonise with the results from the full assessment. Moreover, the screening assessments will be used in respect to one of the five SP perspectives in Chapter 7.

Chapter 5 begins by explaining the structure of the full AHP model used in the study. Then all sub-criteria selected for the full model are listed and explained. At the end of the chapter, a full model is shown.

Chapter 6 presents the results from the AHP and explains the results.

Following the results from Chapter 6, Chapter 7 presents results from different weight sets of sub-goals and criteria. The chapter ends by examining the model and the results in respect to the five SP perspectives discussed in Chapter 2.

Finally, in Chapter 8 a conclusion is given and recommendations are made followed by a view on where this study can be applied in other complex planning problems.

In respect to this, the learning objective for this study is as follows:

**Learning objectives – As best as possible:**

1. Structure a decision support model for a complex decision problem
2. Select and combine relevant OR methods to be applied in the modelling work
3. Find and apply relevant data for the problem
4. Interpret modelling results and carry out modelling reformulation if suitable
5. Use the modelling as a basis for making decision recommendation(s)
6. Communicate the results and their foundation
7. Consider how this study could be applied in the future and indicate reliable changes that could be relevant to implement in this respect

## 2 Theory and Methodology

### 2.1 Systemic Planning

Complicated problems can be described as problems that are possible to explore, determine and solve using known procedures. Complex problems on the other hand tend to be problems that do not have a fully known procedure and need to be handled differently to complicated problems, with complementary methods. Usually a complex planning problem requires 'out of the box thinking' (Leleur, 2012).

Systemic Planning (SP) has the purpose of assisting decision-makers in dealing with complex planning problems. Therefore, SP can take over when systematic procedures are not sufficient. Thus, with complex situations or decisions, SP can better guide decision-makers in obtaining more comprehensive decision support (Ibid.).

When using SP to deal with complex problems, SP uses five different perspectives which are (Leleur, 2017):

1. Core Performance (CP)
2. Wider Performance (WP)
3. Fairness (FA)
4. Diversity (DI)
5. Robustness (RO)

The use of these five perspectives has the purpose of making a more comprehensive assessment than would be made if only one of the perspectives were used. This aims to lead to better decision support for decision-makers.

The methods used for the five SP perspectives in this study are shown in bold in Table 2-1. The methods have been selected from a list of 2×7 methods with the purpose of exploring and examining the five perspectives with suitable methods and thereby assist decision-makers in dealing with complex problems (Leleur, 2012).

The methods in Table 2-1 are divided into two groups, hard methods and soft methods. Hard methods can be described as methods used when the problem is well defined and there is a possibility of using data to evaluate the outcome. The methods are mostly logical/mathematical and the outcomes will in general produce solutions to the problem.

Soft methods on the other hand tend to be used when problems are poorly defined, when stakeholders involved may see the problem differently, and the outcomes are usually based on learning and better understanding of the problem rather than a calculated solution (Leleur, 2012; Cairns, 2006).



For complex problems, the objective is to combine the use of these hard and soft methods to explore the five perspectives in order to obtain a comprehensive approach. A more detailed description of the methods in Table 2-1 can be seen at [www.systemicplanning.dk](http://www.systemicplanning.dk).

**Table 2-1: Seven hard and seven soft system techniques and methods.**  
Source: Leleur, 2012.

<b>Hard methods</b>	<b>Soft methods</b>
Cost Benefit Analysis (CBA)	<b>Brainstorming</b>
<b>Analytic Hierarchy Process (AHP)</b>	Mind Mapping (MM)
Simple Multi-Attribute Rating Technique (Smart/Smarter)	Strengths, Weaknesses, Opportunities and Threats (SWOT)
Composite MCDA models (COSIMA, SIMDEC)	Critical Systems Heuristics (CSH)
<b>Scenario Analysis (SA)</b>	Soft Systems Methodology (SSM)
Preference analysis (PA)	<b>Stakeholder analysis (STA)</b>
<b>Sensitivity analysis</b> Monte Carlo simulation (RA), SIMRISK	Future workshop (FW)

As regards the five perspectives in Leleur (2017), the first perspective, CP puts focus on one or several key factors. CP uses conventional methods which are generally applied to indicate the performance of alternatives when elements are easy to understand and calculate. The method generally used in the CP is CBA, which calculates costs and benefits of a project in terms of monetary values to provide the net present value, internal rate of return and benefit cost ratio.

In this study, CBA is, however, not used due to insufficient monetary values from the cities. In addition, all past host cities have underestimated the cost in the past (Flyvbjerg et al., 2016). Thus, there would be high uncertainties with the cost.

The second perspective, the WP, examines effects that are harder to compare in terms of monetary values but effects that are still important for the project. Multi Criteria Decision Analysis (MCDA) methods such as AHP or SMART apply here and can be used together with methods such as COSIMA or SIMDEC that combines the MCDA methods with the CBA method.

In this study, the AHP is selected as most of the elements evaluated are non-monetary values. Moreover, AHP can break down complex problems such as this into sub-problems for easier comprehension.

In the third perspective, the FA, the focus is on the stakeholders involved in the project and different scenarios can be applied depending on stakeholders' preferences. Thus, FA examines how a project might turn out if certain stakeholder perspectives are seen as more important or less important than perceived generally. Methods used in FA can be SA, STA or PA which can establish different future scenarios and recognise different stakeholders and their power and interest for the project at hand.

Also important for the FA perspective are methods such as brainstorming, MM, or SWOT. These methods can help with identifying different scenarios or stakeholders that might be relevant to project.

In this study STA and SA are used together with brainstorming to identify the main stakeholders involved as well as scenarios that may arise.

The fourth perspective DI considers whether some elements or approaches to the problem have been missed or forgotten or have been recognised late in the process. In case of important elements or approaches being forgotten, a reassessment should be made in the steps before (CP, WP and FA). For the DI perspective, soft methods are generally applicable.

In this study, brainstorming is used in order to work out which elements or approaches may have been forgotten late in the process.

The final perspective, the RO, is important because uncertainty can influence the outcome. Methods generally applied here are Sensitivity analysis or RA to examine and simulate different values of elements and calculate their influence on the total outcome of the project. In this study Sensitivity analysis is used to alter some elements and see if they deviate from the initial outcome.

The selected methods for this study are shown in Table 2-2 and why they are selected. These methods are also described further in the following sections.

**Table 2-2: Methods selected.**

Method	Why Selected
<b>Brainstorming</b>	Selected to assist with constructing of the AHP model and to come up with idea of criteria and scenarios that might be relevant to the study. As well to assist with recognising stakeholders that might be involved and idea of elements or scenarios that might have been forgotten in the study.
<b>AHP</b>	Selected since many of the elements that are evaluated are non-monetary. AHP also constructs the problem into sub-problems which are easier to comprehend. Moreover, it estimates scores for each alternative which are easy to understand.
<b>SA</b>	Selected to identify scenarios that might arise and affect the outcome. For example, the IOC is trying to move in the direction of sustainability. Thus, one scenario might be a scenario where the IOC would base their selection mostly on sustainability.
<b>STA</b>	Selected as it is important to identify the main stakeholders involved in the selection and see how their influence and interest might affect the outcome.
<b>Sensitivity analysis</b>	Selected to see how the outcome change if elements are modified. Also, to identify if the outcome is robust or if there are great differences in the outcomes when elements are modified.

## 2.2 Brainstorming

Brainstorming can help people to produce new ideas for solving problems. Brainstorming is intended to help people to think about problems in a new way. It motivates people to come up with ideas spontaneously and without thinking rationally (Arivanianthan, 2015). However, it is unrealistic to expect brainstorming to solve complex problems. Still, brainstorming can produce ideas or elements that can be valuable for other methods (Bass/Pfeiffer, 1998).

Brainstorming is generally conducted by groups during special sessions. A typical brainstorming session starts by formulating the problem that needs to be solved. Then the people involved in the session come up with as many ideas as possible to solve the problem. The ideas should be generated spontaneously and without rational thinking and one of the main principles of brainstorming is that criticism and censorship are forbidden. The focus should be on quantity of ideas rather than quality of the ideas.

The purpose behind brainstorming is that by producing lots of ideas, there might be a possibility of developing new and innovative ideas that can be valuable for solving the problem (Arivanianthan, 2015).

In this study, no formal brainstorming sessions have taken place since there is only one person involved.

Nevertheless, there is a possibility of individual brainstorming. One of the procedures that can be used is writing down thoughts and ideas that come up in relation to a specific problem that needs to be solved. Afterwards, these written thoughts and ideas can be examined in order to evaluate if they can help solve the problem.

The objective in this study is to use brainstorming to help develop the AHP hierarchy by coming up with ideas of different scenarios and elements. Brainstorming helps also with the selections of criteria as well as working out which elements or approaches may have been forgotten late in the process.

## 2.3 Analytic Hierarchy Process (AHP)

AHP is a MCDA method that was developed in the 1970s by T.L. Saaty (Forman, 1993). It was developed to find an easy and straightforward methodology to assist in obtaining a better understanding of complex problems.

AHP is a method that is simple to use and can help structure and organise a complex problem in such a way that it is relatively easy to analyse and understand (Bhushan & Rai, 2004).

Furthermore, evidence from psychological studies indicated that people can compare  $7 \pm 2$  things at a time (Miller, 1956). Therefore, to deal with large and complex decision-making problems, it is essential to break them down which is part of the AHP method.

The AHP is used when a set of alternatives has been defined among which the best alternative has yet to be determined. The AHP helps decision-makers to structure a problem and divide the problem into a hierarchy of sub-problems, which can be better comprehended and evaluated (Bhushan & Rai, 2004).

The first step in the process is to define the problem or the goal, such as in this study, 'Selecting the host city of the 2024 Olympic Games'. Following the goal, criteria that contribute to the decision making are set down, such as, environmental, social and economic factors when describing sustainable development (described in Section 2.4).

For each of the criteria selected, levels of sub-criteria can be laid down to expand particular criteria further and for more detailed analysis. Finally, at the bottom of the hierarchy, the alternatives which are to be compared are laid down. Figure 2-1 shows an example of a simple AHP hierarchy.

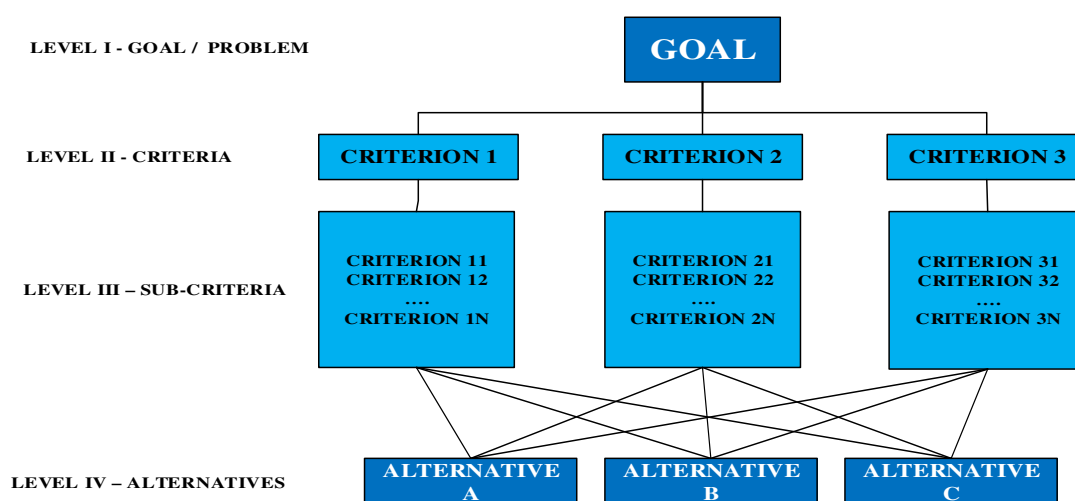


Figure 2-1: Example of AHP hierarchy.

When the structure of the hierarchy has been organised, the alternatives are compared two by two for each criterion in the level above the alternatives. As well as comparing alternatives to the criteria, the criteria connected in each level need to be compared.

The pairwise comparisons are constructed by using numerical values from a gradation scale, see Table 2-3. The scale is a nine-point intensity scale that Saaty created to express the strength or the weakness of an alternative compared to another alternative for a certain criterion, or when comparing two criteria (Saaty, 2008).

**Table 2-3: Gradation scale for quantitative comparison of alternatives.**  
Source: Saaty, 2008.

<i>Option</i>	<i>Numerical value(s)</i>
<b>Equal</b>	<b>1</b>
<i>Weak / Slightly important</i>	2
<b>Moderate importance</b>	<b>3</b>
<i>Moderate plus importance</i>	4
<b>Strong importance</b>	<b>5</b>
<i>Strong plus importance</i>	6
<b>Very strong</b>	<b>7</b>
<i>Very very strong</i>	8
<b>Extremely strong</b>	<b>9</b>
<i>If the alternatives are very close but not completely equal</i>	1.1 – 1.9
Reflecting dominance of second alternatives compared with the first	Reciprocals
<i>Numbers 2,4,6,8 used with fuzzy inputs, such as if alternative is better than moderate but not strong</i>	

Hence, if alternative *A* is very strong under a certain criterion when compared to alternative *B*, alternative *A* will be given value 7.

The number of comparisons that need to be made can be calculated using Equation (2.1) (Teknomo, 2006):

$$C = \frac{n(n-1)}{2} \quad (2.1)$$

where *n* is the number of alternatives and *C* is the number of comparisons.

Thus, with five alternatives there will be ten comparisons for each criterion.

When comparing alternatives under a certain criterion, the pairwise comparisons are set up in a matrix such as the matrix below, which is a comparison between three alternatives:

$$\begin{array}{c|ccc} & A1 & A2 & A3 \\ A1 & a_{11} & a_{12} & a_{13} \\ A2 & a_{21} & a_{22} & a_{23} \\ A3 & a_{31} & a_{32} & a_{33} \end{array}$$

where *A1* to *A3* are the alternatives and *a<sub>ij</sub>* is the pairwise grade value between alternatives.

Once the construction of all comparison matrices is done, the next step is to get the relative score of each alternative for each criterion and also the relative weight of each criterion. Several methods can be used to calculate the weights, such as the geometric mean method and the eigenvector method (Barfod & Leleur, 2014).

The method used in this study is the eigenvector method which is the original method from Saaty, since the software used, Expert Choice, uses the eigenvector method procedure (<http://expertchoice.com>).

### 2.3.1 The eigenvector method procedure

The eigenvector method calculates the weight of each alternative for a certain criterion by reducing the pairwise matrix to a comparison vector.

The method begins with the comparison matrix introduced before and give (2.2) below (Barfod & Leleur, 2014):

$$A = \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \dots & a_{nn} \end{bmatrix} = \begin{bmatrix} w_1/w_1 & \dots & w_1/w_n \\ \vdots & \ddots & \vdots \\ w_n/w_1 & \dots & w_n/w_n \end{bmatrix} \quad (2.2)$$

where  $a_{ij} = w_i/w_j$ .

As,  $w_i/w_j = 1$  for  $i = j$  the diagonal elements of the matrix are always one. Furthermore, the entries in the matrix  $w_{ij}/w_{ji}$  and  $w_{ij}/w_{ji}$  follow the constraint:

$$\frac{w_i}{w_j} \times \frac{w_j}{w_i} = 1 \quad (2.3)$$

which gives that the lower triangular matrix is filled with the reciprocal values:

$$\frac{w_j}{w_i} = \frac{1}{w_i/w_j} \quad (2.4)$$

Multiplying  $A$  by  $\underline{w} = (w_1 \dots w_n)^T$ , where  $\underline{w}$  is a set of criteria which is normalised to 1 thus:

$$\sum_{j=1}^n w_j = 1 \quad (2.5)$$

leads to:

$$A \cdot \underline{w} = \begin{bmatrix} w_1/w_1 & \dots & w_1/w_n \\ \vdots & \ddots & \vdots \\ w_n/w_1 & \dots & w_n/w_n \end{bmatrix} \cdot \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = n \cdot \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = n \cdot \underline{w} \quad (2.6)$$

And:

$$(A - nI) \cdot \underline{w} = 0 \quad (2.7)$$

where  $n$  is the number of alternatives and  $I$  is the identity matrix.

Due to the consistency of Eq. (2.6), the system of homogenous linear equations, Eq. (2.7), has only trivial solutions.

As described in Barfod & Leleur (2014), the exact values of  $w_i/w_j$  are in general unknown and must be estimated as human judgments are never so accurate that Equation (2.6) will be satisfied completely. In any comparison matrix, small uncertainties in the coefficients indicate small uncertainties in the eigenvalues. Therefore, if matrix  $A'$  defines the decision-makers' estimate of  $A$  and  $\underline{w}'$  corresponds to  $A'$ , then:

$$A' \underline{w}' = \lambda_{max} \underline{w}' \quad (2.8)$$

where  $\lambda_{max}$  is the largest eigenvalue of  $A'$ .  $\underline{w}'$  can then be obtained by solving the system of linear equations. See (2.8).

To illustrate the method consider comparing three alternatives to one criterion (Barfod & Leleur, 2014):

$$A = \begin{bmatrix} 1 & 3 & 5 \\ 1/3 & 1 & 3 \\ 1/5 & 1/3 & 1 \end{bmatrix}$$

Then the determinant of  $(A - \lambda \cdot I)$  is set to zero:

$$\det(A - \lambda \cdot I) = \begin{vmatrix} 1 - \lambda & 3 & 5 \\ 1/3 & 1 - \lambda & 3 \\ 1/5 & 1/3 & 1 - \lambda \end{vmatrix} = 0$$

This gives the characteristic polynomial:

$$p(\lambda) = -\lambda^3 + 3\lambda^2 + \frac{16}{45} = 0$$

Solving for  $\lambda$  gives the eigenvalues:

$$\begin{aligned} \lambda_1 &= 3.039 \\ \lambda_2 &= -0.019 + 0.342i \\ \lambda_3 &= -0.019 - 0.342i \end{aligned}$$

Which gives  $\lambda_{max} = 3.039$ .

Putting  $\lambda_{max}$  into Equation (2.8) leads to:

$$\begin{bmatrix} -2.039 & 3 & 5 \\ 1/3 & -2.039 & 3 \\ 1/5 & 1/3 & -2.039 \end{bmatrix} \cdot \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix} = 0$$

Then by using Equation (2.5), the system of linear equations will be:

$$\begin{aligned} -2.039w_1 + 3w_2 + 5w_3 &= 1 \\ 1/3 w_1 - 2.039w_2 + 3w_3 &= 1 \\ 1/5 w_1 + 1/3 w_2 + -2.039w_3 &= 1 \end{aligned}$$

Solving the system will give:

$$\underline{w}^T = \begin{bmatrix} 0.637 \\ 0.258 \\ 0.105 \end{bmatrix}$$

which gives the score of each alternative for that particular criterion.

### 2.3.2 Consistency

Perfect consistency is very difficult to accomplish in a pairwise comparison, and lack of consistency is expected to exist in almost any set of pairwise comparisons (Mocenni, 2015).

The AHP method allows for this inconsistency in the comparison to a certain level. The AHP provides a measure of consistency in each comparison set, called Consistency Index (CI).

Saaty proved that for a constant reciprocal matrix, the largest eigenvalue is equal to the size of the comparison matrix,  $\lambda_{max} = n$ . Then he defined the following measure of consistency index as a deviation or degree of consistency (Teknomo, 2006):

$$CI = \frac{(\lambda_{max} - n)}{(n - 1)} \quad (2.9)$$

Knowing the CI, it is possible to determine the Consistency Ratio (CR), by dividing the CI by a Random consistency Index (RI):

$$CR = \frac{CI}{RI} \quad (2.10)$$

Values for the random consistency index can be seen in Table 2-4, where n is the number of alternatives:

**Table 2-4: Random Consistency Index (RI).**  
Source: Barfod & Leleur, 2014.

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.9	1.12	1.24	1.35	1.40	1.49

For the CR, Saaty suggests that the ratio should be less than 0.1, otherwise the comparison should be revised.

Observing the example in Sub-section 2.3.1, where  $\lambda_{max} = 3.039$ , the CR is 0.034, since:

$$CI = \frac{3.039 - 3}{2} = 0.0195$$

And from Table 2-4,  $RI = 0.58$  for  $n = 3$ , thus:

$$CR = \frac{0.0195}{0.58} = 0.034$$

As 0.034 is less than 0.1 the pairwise comparisons in the example can be perceived as sufficiently consistent.

### **2.3.3 Strengths and weaknesses of AHP**

The AHP method is a useful tool to help decision-makers with complex problems. It structures problems into sets of sub-sets which are easier to handle and by using the pairwise comparison the decision-makers can focus on one small part of the problem at a time.

The method also has redundancy in that it asks decision-makers to evaluate all possible comparisons. Thus, if A is two times stronger than B and B is two times stronger than C, it could be assumed that A is four times stronger than C. However, by asking decision-makers to evaluate A against C it is possible to check for the consistency in the pairwise comparisons (Barfod & Leleur, 2014).

AHP can also be used to examine different scenarios and evaluate how the alternatives would perform in different scenarios (Ibid.).

AHP can be used with a wide range of elements since it allows for judgements of elements that are easy to understand and calculate, as well as elements that are less easy to evaluate in terms of monetary values or reliable data.

Nevertheless, the AHP has been criticised. In Barfod & Leleur, 2014, some weaknesses are specified.

First, the scale from Table 2-3 is bound to force inconsistency in the pairwise comparisons. For example, if A is considered to be five times more important than B and B is three times more important than C, then A should be fifteen times more important than C, but that is not possible with the scale.

Along with that, the scale in Table 2-2 has weaknesses with the transformation from the verbal scale to the numerical scale. Users of the verbal scale will have their judgements converted to the numerical scale, such as if decision-makers say that A is slightly more important than B then the numerical scale will assume A to be two times more important than B, when that may not be the case.

AHP has also been criticised for rank reversal of existing alternatives if a new alternative is introduced to the system or if one alternative is excluded from the system.

The meaning of response to questions has been criticised. With many of the pairwise comparisons there are no scales with which to compare the elements to each other. And there could be some fuzziness or questions understood differently by different users which could lead to errors.

The AHP has also been criticised for not being built on a testable foundation of rational behaviour. As mentioned above, there is no rational scale or data available that makes users base their answers on rational decision making.

Lastly, AHP can also reduce its attractiveness to users when there are large numbers of alternatives to compare or when there are large numbers of elements that alternatives need to be compared to, since with many alternatives or elements, there could be many pairwise comparisons that need to be made.



Despite these criticisms, AHP is popular because it is relatively easy to use and understand. Also, its widespread acceptance has resulted in various companies using AHP when solving complex problems (Bhushan & Rai, 2004).

### 2.3.4 The Expert Choice software

The software used to develop the AHP in this study and to compare and calculate the scores of the alternatives is Expert Choice (<http://expertchoice.com/>).

Expert Choice helps users to define goals, sub-goals, criteria and alternatives and organise them into a structured hierarchical tree in an easy way (Barfod, 2014).

The software also helps users to compare alternatives by giving feedback if inconsistency is high and furthermore, has three unique ways of comparing alternatives: numerical scale, verbal scale and graphical scale.

After the users have made the comparisons, the software calculates the score for each alternative and the weights of each criterion using the eigenvector method.

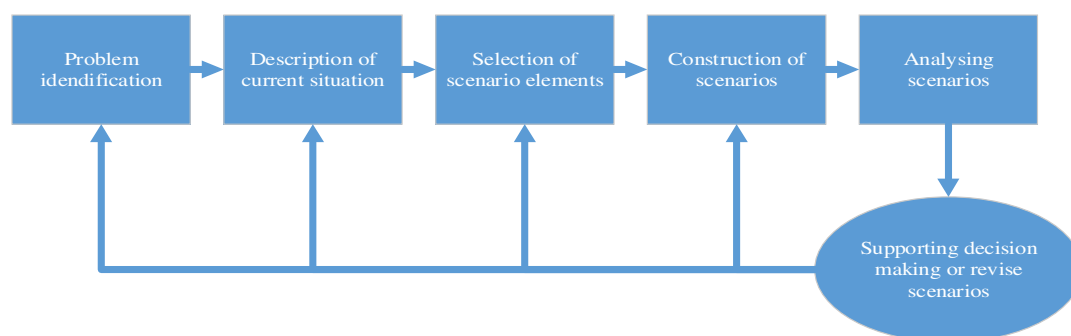
In addition, the software has a sensitivity analysis, which can help to determine how a certain change would affect the results. Thus, if the result of the model differs from the decision-makers' expectations, it is possible to adjust the model and/or decisions until the model is aligned with the expectations of the decision-makers.

Then the model result will either change to confirm decision-makers' expectations, or the perception of the decision-makers will change based on the modelling. In the first case, not only the expectations will be verified, but a detailed justification will be available if one is required. In the second case, the decision-makers will have learned something and may have avoided a costly mistake (Ibid.).

## 2.4 Scenario analysis (The BAU and SD visions)

Scenario analysis (SA) is used to construct different possible future scenarios. Thus, SA generates what could happen in the future and could therefore serve as a compass for lines of action that could be taken today (Kosow & Gaßner, 2008).

SA can be constructed in many ways and there is no standardising procedure (Bood & Postma, 1998). However, most of them have similar structures. Figure 2-2 displays a 'typical' process.



**Figure 2-2: Process of scenario development.**  
Source: 'Stakeholder Analysis', 2017.

In the first step, the problem has to be identified. In this study the problem is ‘Selecting the Host City of the 2024 Olympic Games’.

After identifying the problem, the second step looks into the current situation.

In the third step, selections of scenario elements are made. In step four, the scenarios are constructed, followed by analysing the scenarios in step five.

The last step concludes if the scenarios can help decision-makers make a better decision or if the scenarios have to be revised.

Therefore, SA can occasionally result in an iterative process where people move back and forth between the interrelated phases since it is almost always possible to find other scenarios (Ibid.).

In this study, two scenarios are constructed: Business As Usual (BAU) and Sustainable Development (SD).

The BAU scenario is based on the assumption that members of the IOC will select the host city based on elements that have had significant influence on which city is selected as the host city in past selections.

The SD scenario is based on sustainable development in the city, since one of the key criteria in the ‘Agenda 2020’ is sustainability.

To achieve sustainable development, three core elements have to be harmonised: economic growth, social inclusion and environmental protection. These are better known as the three pillars of sustainability (United Nations, 2017a).

For that reason, if any of the pillars are weak, the system as a whole is unsustainable (Gudmundsson, Hall, Marsden & Zietsman, 2015). Figure 2-3 illustrates the three pillars of sustainable development.



Figure 2-3: Comprehensive sustainable development.  
Source: Rochester Institute of Technology.

## 2.5 Stakeholder analysis (STA)

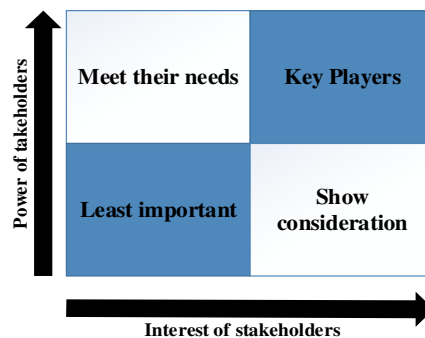
Stakeholder analysis (STA) assesses the power and interest of stakeholders. A stakeholder can be described as any group or a person that has something at stake or has an interest in the project in question. Many stakeholders can be involved in each project, such as governments, inhabitants of a city or country, environmentalists, or consumers of a project (World Bank, 2001).

For STA it is important to identify stakeholders that are involved in a project and analyse them in terms of interest and power (Ibid.).

Therefore, if stakeholders have high power and high interest they are what is called ‘key players’ in the project. On the other hand low power and low interest stakeholders are called ‘least important’ for the project (‘Stakeholder Analysis’, 2017).

STA starts by identifying the stakeholders involved in a project. Then each stakeholder is analysed in terms of interest and power.

Furthermore, stakeholders are also analysed for similarity and whether they can be identified as the ‘same group’. Once stakeholders have been analysed in terms of interest and power, the stakeholders can be placed on a power-interest grid, see Figure 2-4 (Ibid.).



**Figure 2-4: Power-Interest grid of stakeholders.**  
Source: ‘Stakeholder Analysis’, 2017.

In this study, there are several stakeholders that can be recognised directly: the IOC, the NOC, city council/government, Olympic athletes, sponsors of the Olympic Games, and the inhabitants of the city.

Looking closely at these stakeholders, it is possible to divide them into two stakeholder groups: Olympic Games and Olympic City.

In the Olympic Games, stakeholders are: the IOC, the NOC, Olympic athletes and sponsors. These stakeholders have a primary interest in hosting great Olympic Games with great facilities for athletes and sports with less concern about the city’s needs.

In the Olympic City, stakeholders are: the city council/government of the city and the residents of the city. The primary interest here concerns how the Olympic Games can benefit the host city.

## 2.6 Sensitivity analysis

Sensitivity analysis can help to see how robust the outcome of a project is. The purpose is to evaluate if the outcome will change by adjusting initial data or elements. Thus, by changing initial data or elements and observing the outcome, it is possible to observe how sensitive the outcome is.

If the sensitivity analysis gives a completely different outcome it could be observed that the outcome is not robust. On the other hand, if the sensitivity analysis yields only minor changes, it is possible to make assumptions based on the initial outcome (Chinneke, 2006).

There are several ways to approach sensitivity analysis. The easiest way is to change an initial data or element and run the model again and observe changes in the outcome. Nevertheless, this method should only be used to solve small models since it is time consuming and complicated if used for large models. For large models, computer based methods such as RA can be used (Ibid.).

In this study the sensitivity analysis will be conducted by changing the weights of elements involved in the model and observing whether they will change the final outcome or if the initial outcome is robust.

### **3 Determination of Criteria**

In order to evaluate and compare alternatives, a number of criteria are needed. First, three lists are created, under the headings BAU, Agenda 2020 and SD. The purpose of the long lists is to include all criteria that may be relevant without considering their number. Later the long lists are scrutinised to produce short lists with an operational number of criteria and with best possible avoidance of double counting. These long lists are considered the outcome of brainstorming.

The first list is a list of BAU criteria, which are criteria that have been important when selecting the host city in the past.

The second list is a list of criteria that the IOC has in its 'Agenda 2020' (The International Olympic Committee, 2014). The goal of the IOC is to move towards sustainability and take into consideration the sustainable development of the city after the games, while also hosting well-organised Olympic Games which will provide a great experience for athletes and spectators (Ibid.).

The third list is a list of SD criteria, which is a set of fully-fledged criteria for a sustainable urban environment since the IOC wants to move towards sustainability and the sustainable development of the host city.

Some of the criteria listed in the BAU list are also listed in the Agenda 2020 list or the SD list. There is nothing wrong with having criteria listed in two lists or all lists. It indicates that criteria important in past selections are still important for the IOC today, and are also considered important for sustainable development.

#### **3.1 BAU criteria list**

BAU criteria are criteria that have been key factors in past bids when selecting the host city. According to Feddersen, Meanning and Zimmermann (2008), Poast (2007) and Swart & Bob (2004) some criteria have been more significant when it comes to the selection of the host city. These criteria are listed in Table 3-1 in alphabetical order and a further description of each criterion can be seen in Appendix A.

In addition, Feddersen et al. (2008) showed that for a successful bid, cities have to score relatively 'high' on three key criteria from Table 3-1.

- Number of available hotel rooms within 50 km
- Distance from Olympic Village to venues
- Average Temperature

Thus, if the IOC selects the host city according to the past selections, candidate cities should focus on these three criteria as key factors and then make an effort to also score highly in the other criteria listed in Table 3-1.

**Table 3-1: BAU criteria.**  
**Source: Feddersen et al. (2008), Poast (2007) and Swart & Bob (2004).**

BAU Criteria		
Accountability	Distribution of Games	Population size
American Corporation Dependence	European Identity	Presidential Preference
Average Temperature	Existing Venues	Reconstruction of venues
Bid team composition	Gross Domestic Product (GDP)	Relationship marketing
Communication and exposure / Image	Infrastructure	Unemployment rate
Corruption	Number of available hotel rooms within 50 km	Venues only built on approval of bid
Distance from Olympic Village to Venues	Political support /public support	

## 3.2 Agenda 2020 criteria list (mixed BAU and SD)

The Agenda 2020 criteria list is a list that focuses on future bids where the IOC wants to emphasise sustainable development and cost constraints while still hosting well organised Olympic Games (The International Olympic Committee, 2014).

Criteria are selected from ‘Agenda 2020’ and from a report from the recent bid for the 2022 Winter Olympic Games (The 2022 Evaluation Commission, 2015). There, the IOC implemented some of the recommendations from ‘Agenda 2020’. These criteria are listed in Table 3-2 in alphabetical order and described further in Appendix A.

**Table 3-2: Agenda 2020 criteria.**  
**Source: The International Olympic Committee, 2015; The Evaluation Commission, 2015.**

Agenda 2020 criteria		
Accommodation	Marketing	Safety
Athletes experience	Media operations	Security
Discrimination	Medical service	Sport Operations
Energy	Olympic Village	Sustainability
Feasibility	Peace & humanity	Transparency
Finance	Plans for sport venues	Transport
Gender equality	Political and public support	

One criterion in Table 3-2 is sustainability. However, sustainability is a broad concept and could be related to many topics.

In this study, a long list with criteria for sustainable development is made in order to evaluate the cities in terms of sustainability.

### 3.3 SD criteria list

Criteria for sustainable development are taken from two documents: United Nations Indicators of Sustainable Development (United Nations, 2007) and European Commission Indicators for Sustainable Cities (Science for Environment Policy, 2015).

From these documents, criteria are selected that are assumed to be important for urban sustainability. The SD criteria list is shown in Table 3-3 in alphabetical order and is described further in Appendix A. The list is divided into the three pillars of sustainability: Economy, Environment and Social, which are described in Section 2.4.

**Table 3-3: SD criteria.**  
Source: United Nations, 2007, Science for Environment, 2015.

SD criteria		
Economy	Environment	Social
GDP	Air quality	Corruption
Inflation	Biodiversity	Crime
Sustainable public finance	Ecosystem	Education
Tourism	Renewable Energy	Gender Equality
Transportation	Green Spaces	Health
Unemployment rate	Greenhouse Gas Emission	Population change
	Land use and status	Poverty
	Solid waste treatment	Quality public space
	Vulnerability to natural hazards	Sanitation
	Water Quality	

Part of the criteria in Table 3-3 is also listed in Table 3-1 and Table 3-2. This indicates that the IOC has considered the sustainability of cities in the past selections. However, the IOC wants to put additional emphasis on sustainability or what is called ‘legacy’ in ‘Agenda 2020’ (The International Olympic Committee, 2014).

## 4 Screening Assessment

Screening assessment is generally made to reduce the number of alternatives before a more detailed assessment is made. However, in this study only five alternatives are involved. Therefore, the screening assessment is made to get a simple ranking of the alternatives. Later this ranking will be compared to the full assessment. Moreover, the screening assessments will be used in respect to one of the five SP perspectives.

### 4.1 Selection of screening criteria

When selecting the criteria to use in the assessments, it is important to select the appropriate number of criteria, not too few or too many.

For the screening assessment, the three criteria for a successful bid in the past, discussed by Feddersen et al. (2008) are selected from the BAU criteria list. In addition, three criteria are selected from the Agenda 2020 list and the SD list to include criteria concerning sustainable development. The selected criteria are shown in Table 4-1 in alphabetical order. The table shows which criteria are selected, why they are selected and how they are measured and with what data.

**Table 4-1: BAU criteria selected for the Screening assessment.**

Criteria	Why selected	How measured and what data
<b>Average temperature</b>	Feddersen et al. (2008) showed that average temperature was a significant factor in a successful bid in past selections.	Data taken from the bid books (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016). The highest average temperature over the days of the proposed competition time is used. For temperature in Hamburg, the average temperature of July (proposed competition month) is used with an additional 5°C since the average temperature for the other cities are the highest average temperature over the days of the proposed competition and are usually 3°C to 7°C higher than the average temperature for that month.
<b>Corruption</b>	Feddersen et al. (2008) showed that lower corruption aided successful bids in the past selections. Low corruption is also an important factor for sustainable cities since good governance is essential for sustainable development (United Nations, 2007). High corruption can contribute to income and wealth inequality (OECD, 2016).	Data for corruption is taken from Transparency International which ranks countries using a corruption perception index (Transparency International, 2017).
<b>Distance from Olympic Village to Venues</b>	Time spent for travel between Olympic Village and venues can be bad for athletes. Furthermore, Feddersen et al. (2008) showed that cities with shorter distances were more likely to have a successful bid.	Data is taken from the bid books (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016) For Hamburg data is taken from the vision report and distances are estimated using Google Maps (Hamburg, 2015).

Table 4-1: Continue.

Criteria	Why selected	How measured and what data
<b>GDP</b>	According to Poast (2007), the IOC has a bias to select cities from countries that have sustained high rates of real GDP per capita. GDP is also a powerful indicator of economic development, although it does not account for social or environmental cost of production and consumption.	Data for GDP per capita is taken from European Commission for all cities in Europe (Eurostat, 2016a). For Los Angeles, data is taken from the Open Data Network ('GDP per capita for Los Angeles', 2013). The data that is used is from 2014. However, the data from Eurostat is in Euros and has to be converted into U.S. dollars for 2014 using a rate of 1.33 ('Euro to US dollars', 2016).
<b>Number of available hotel rooms within 50 km</b>	It is important to consider whether cities are capable of accommodating the media, the IOC members, national governing bodies, Olympic sponsors, international federations and spectators, among the usual tourists.	Data is taken from the Olympic bid books (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016). For Hamburg, no bid book is available. Data is taken from a Deloitte report from 2014 to estimate the number of hotel rooms that exist and the number of future hotel rooms (Brabant & Schwender, 2014).
<b>Renewable Energy</b>	Energy from renewable energy resources can indicate future energy security. It can also reduce environmental impact since use of non-renewable energy sources pollutes more and therefore contributes to climate change (United Nations, 2007). Renewable energy is important to the IOC as one of the requirements for candidate cities is to minimise carbon emission from the Olympic Games (The International Olympic Committee, 2016c).	The percentage of renewable energy of total energy consumption is used. The data is taken from the European Commission (Eurostat, 2016b) and California Energy Commission (California Energy Commission, 2016). The data for European cities is taken for each country since there is no data to use for the cities. However, for Los Angeles, data for the state of California is used, since it is possible to use that data and furthermore, the population of California is comparable to the four European countries.

## 4.2 Results of screening assessment

The statistics from the criteria selected are gathered together and are listed in Table 4-2.

Table 4-2: Data from cities for screening criteria.

Source: Various reports and websites.

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
<b>Average Temperature</b>	27.6°C	23.5°C	26.8°C	33.0°C	22.4°C (G)
<b>Corruption /Transparency in 2016</b>	18/176 nations 74 points	23/176 nations 69 points	57/176 nations 48 points	60/176 nations 47 points	10/176 nations 81 points
<b>Distance from Olympic Village to venues</b>	26.37 km	15.08 km	8.37 km	22.60 km	10.15 km (G)
<b>GDP per capita 2014</b>	59,708 US\$ (E)	71,687 US\$	22,211 US\$	42,028 US\$	78,470 US\$
<b>Number of available hotels rooms (50 km)</b>	102,409	141,773	28,734	64,621	26,139 (G)
<b>Renewable energy use in percentage of total use</b>	27% in California in 2016	14.3% in France in 2014	14.6% in Hungary in 2014	17.1% in Italy in 2014	13.8% in Germany in 2014

(G): Guesstimate. The data for Hamburg is a guess from various reports and websites. (E): Estimation: The GDP for Los Angeles is an estimation from the Open Data Network website ('GDP per capita for Los Angeles', 2013)



With this data, two screening assessments are made to rank the cities. In the first, cities are ranked from 1-5 for each criterion while the second screening assessment grades the cities from 0-10 for each criterion. The following sub-sections show the results for these screening assessments.

#### 4.2.1 Screening assessment by ranking cities from 1-5

With the data gathered in Table 4-2 a ranking from one to five is created. For each criterion the city with the best data receives five points. The city with the worst data receives one point. The best data is as follows:

- Closest average temperature to 25 °C
- The lowest corruption
- Shortest distance from Olympic Village to Olympic Venues
- Highest GDP per capita
- Most hotel rooms within 50 km
- Highest renewable energy use from total consumption of energy

The temperature of 25 °C is selected since in Feddersen et al. (2008), the median of average temperature for successful bids in the past was 24.93 °C. Moreover, for athletes, ideal temperature is below 25 °C (LePage, 2011). As a result, the highest average temperature of the days in the proposed competition period is selected since during most of the day cities will have lower temperatures which is ideal for athletes.

The sum of all the criteria ranking gives total points for each city. The ranking is shown in Table 4-3.

**Table 4-3: Screening assessment by ranking 1-5.**

<b>Criterion / City</b>	<b>Los Angeles</b>	<b>Paris</b>	<b>Budapest</b>	<b>Rome</b>	<b>Hamburg</b>
<b>Average Temperature *</b>	3	5	4	1	2
<b>Corruption</b>	4	3	2	1	5
<b>Distance from Olympic Village to venues</b>	1	3	5	2	4
<b>GDP</b>	3	4	1	2	5
<b>Number of available hotel rooms (50 km)</b>	4	5	1	3	2
<b>Renewable Energy</b>	5	2	3	4	1
<b>Total Score</b>	<b>20</b>	<b>22</b>	<b>16</b>	<b>13</b>	<b>19</b>

The outcome of the screening assessment by ranking cities from one to five ranks Paris as the best city followed by Los Angeles and Hamburg, then Budapest and Rome.

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\* Los Angeles and Hamburg have the same difference from 25 °C. Los Angeles is given a higher ranking since the data is from the bid books but for Hamburg the temperature was a 'guesstimate'

In addition to this screening assessment, another screening assessment is created to evaluate whether this will result in different outcome.

#### 4.2.2 Screening assessment by gathering data and scaling 0-10

This screening assessment uses a grade scale from 0-10 where cities with the best data in each criterion from Table 4-2 receive a ten and the cities with the worst data zero. The cities between receive grades based on Equation (4.1):

$$Grade = 10 - \left( \frac{H - C}{H - L} \times 10 \right) \quad (4.1)$$

where  $H$  is the best data from the five cities,  $C$  is the data from the city that needs a grade and  $L$  is the worst data from the five cities.

The outcome of this screening assessment can be seen in Table 4-4.

**Table 4-4: Screening assessment by grading and scaling 0-10.**

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
Average Temperature*	6.8	8.1	7.8	0	6.8
Corruption**	7.9	6.5	0.3	0	10
Distance from Olympic Village to venues	0	6.3	10	2.1	9.0
GDP	6.7	8.8	0	3.5	10
Number of available hotel rooms (50 km)	6.5	10	0.2	3.3	0
Renewable Energy	10	0.4	0.6	2.5	0
<b>Total Score</b>	<b>37.9</b>	<b>40.1</b>	<b>18.9</b>	<b>11.4</b>	<b>35.8</b>

Despite different screening methods the ranking is the same, Paris is again number one followed by Los Angeles and Hamburg, then Budapest and Rome.

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\* For 'Average Temperature', the best data is assumed to be 25 °C. For that reason, no city has a 10 in grade for 'Average Temperature'. The worst data is from Rome (furthest from 25 °C). Therefore, the grades for Paris and Hamburg have to be multiplied by -1 to get a grade from 0-10 since it is possible to go in both directions from 25 °C.

\*\* Calculated using the points from Transparency International.

# 5 The AHP model

## 5.1 Determination of the AHP goal hierarchy

To evaluate and compare the cities to one another using the AHP model, a hierarchy needs to be constructed. The first task in building the AHP hierarchy is to select a goal or objective.

The objective of this study is to select the host city of the 2024 Olympic Games and therefore placed at the top of the hierarchy.

Below, two sub-goals are created based on the scenarios discussed in Section 2.4, which are BAU and SD.

Underneath these two sub-goals, criteria are established.

Criteria for BAU are based on the stakeholders selected in Section 2.5, thus Olympic Games and Olympic City.

For the Olympic Games, cities are compared on how successfully they can host Olympic Games with emphasis on athletes and sports, with less concern for the cities finance and support.

Olympic City on the other hand compares the cities in terms of their capability regarding finance, infrastructure and support.

Criteria for SD are based on the three pillars of sustainability: Economic, Environmental and Social described in Section 2.4.

In the next level of the hierarchy, sub-criteria are selected.

The selections of these sub-criteria are discussed further in Sections 5.2 and 5.3.

Figure 5-1 illustrates the structure of the AHP hierarchy without the sub-criteria.

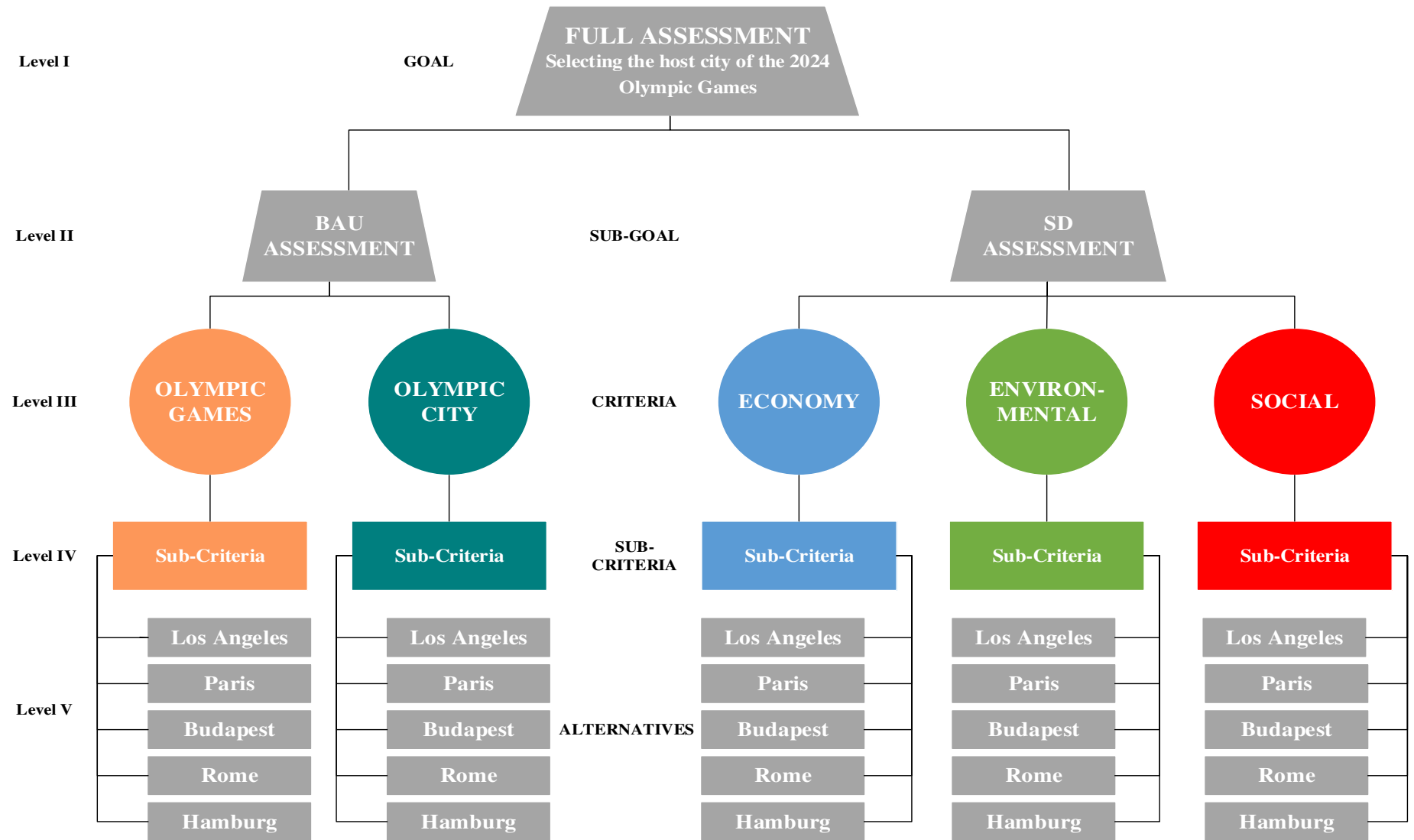


Figure 5-1: The determination of the AHP hierarchy.

## 5.2 Sub-criteria for BAU assessment

Eight sub-criteria from the long list of BAU criteria in Section 3.1 are selected and divided under the two criteria selected in Section 5.1, Olympic Games and Olympic City.

However, it has to be observed that if a sub-criterion is selected under the BAU assessment, it is not selected under the SD assessment. This is done in order to prevent double counting, which would likely give more weight to the double counted sub-criterion in the final outcome than it deserves (*Multi-criteria analysis: a manual*, 2009).

For the BAU assessment, four sub-criteria are selected for the Olympic Games and four for the Olympic City. The sub-criteria selected are listed in Table 5-1 for Olympic Games and Table 5-2 for Olympic City in alphabetical order. Both tables show which criteria are selected, why they are selected and how they are measured or compared between the cities.

**Table 5-1: Olympic Games sub-criteria.**

Olympic Games		
Criteria	Why selected	How measured and what data
<b>Accountability</b>	It is important that cities are capable of hosting and delivering successful major events. Cities can show this by having a reputation for hosting successful sporting events and showing a range of great facilities.	Information on how many big sporting events and other big events the city has hosted in the past. Various websites are used to gather this information.
<b>Distance from Olympic Village to Venues</b>	Time spent for travel between Olympic Village and sport venues can be bad for Olympic athletes. Furthermore, Feddersen et al. (2008) showed that cities with shorter distances were more likely to have a successful bid.	The average distance from Olympic Village to competition venues. Data is taken from bid books and the vision report for Hamburg (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2015).
<b>Distribution of Olympic Games</b>	It could be assumed that the IOC prefers to maintain geographic diversity when awarding the Olympic Games, since the Olympic Games has a global appeal. Hence, the IOC should rotate the Olympic Games among the continents.	Past Olympic cities are examined for the distribution of the summer Olympic Games. Information are taken from the website GamesBids.com which displays all former Olympic host cities ('Past Olympic Host City Election Results', 2017).
<b>Existing Venues</b>	It is important for the IOC to know if cities have the sporting facilities needed to host the Olympic Games or if cities will need to construct these venues. Cities that still need to construct venues could be in more financial risk (Taylor, 2017).	How many venues exist before the bid and how many venues will need to be constructed before the Olympic Games? Data is taken from bid books and the vision report for Hamburg (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2015).

**Table 5-2: Olympic City sub-criteria.**

Criteria	Olympic City	
	Why selected	How measured and what data
<b>Corruption</b>	Feddersen et al. (2008) showed that lower corruption aided for successful bids in past selections. Low corruption is also an important factor for sustainable cities since good governance is essential for sustainable development (United Nations, 2007). Also, high corruption can contribute to income and wealth inequality (OECD, 2016).	Report from Transparency International which uses corruption perception index to compare and rank countries for corruption (Transparency International, 2017).
<b>GDP</b>	According to Poast (2007), the IOC prefers to select cities that have sustained high rates of real GDP per capita. GDP is also a powerful indicator of economic development, although it does not account for social or environmental cost of production and consumption.	Data for GDP per capita is taken from the European Commission for all cities in Europe (Eurostat, 2016a). For Los Angeles, data is from the Open Data Network ('GDP per capita for Los Angeles,' 2013). The data used is from 2014. However, the data from Eurostat is in Euros and has to be converted to U.S. dollars for 2014 using a rate of 1.33 ('Euro to US dollars,' 2016).
<b>Infrastructure</b>	The IOC needs to be convinced that the city has the necessary infrastructure to host a successful Olympic Games, including the ability to provide services and accommodation for spectators, sponsors and IOC members.	How many hotels rooms are within 50 km. of the city? How many passengers went through the city's airports in 2015? Data for the hotel rooms is taken from the bid books (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016). For Hamburg, no bid book is available. Data is taken from a Deloitte report from 2014 to estimate the number of hotel rooms currently existing and the number that will exist in the future (Brabant & Schwender, 2014). For airport capacity statistics from the various airport websites are used.
<b>Political and public support</b>	It is important that the government and the public support the Olympic Games since the Olympic Games depend on volunteer work and sometimes require financial help and planning permits from the government.	How great a percentage of public and political support do the cities have to host the Olympic Games? Data is taken from the bid books (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016). Various websites is also used to get more information, such as for Hamburg since no bid book is available for Hamburg.

## 5.3 Sub-criteria for SD assessment

For SD assessment, nine sub-criteria are selected from the Agenda 2020 list in Section 3.2 and the SD criteria list in Section 3.3.

These nine sub-criteria are divided under the three pillars of sustainability, with three sub-criteria for each pillar.

The sub-criteria selected are listed in alphabetical order in Table 5-3 for the Economic pillar, Table 5-4 for the Environmental pillar and Table 5-5 for the Social pillar.

**Table 5-3: Economic pillar sub-criteria.**

Economic pillar		
Criteria	Why selected	How measured and what data
<b>Tourism</b>	<p>Helps by contributing to the economy of the city/nation.</p> <p>Can also help to provide an important influence on the economic well-being of the population.</p> <p>Tourists can also contribute to the economic objectives of a government and display its possible role as a relevant player in moving towards a more innovative economy (United Nations, 2007).</p> <p>Tourism can also be related to the criteria 'Communication and Exposure / Image' in BAU since a good image of a city will attract people. In addition, it can illustrate how well cities market themselves.</p>	<p>Report from Euromonitor is used (Euromonitor International, 2016). This report contains the number of tourists in 2015 in 100 cities around the world. Furthermore, a general 'gut feeling' is used to 'guesstimate' the image of the cities.</p>
<b>Transportation</b>	<p>Good transport systems can result in positive effects such as accessibility to new markets or workers (Rodrigue, &amp; Notteboom, 2017). However, if a transportation system is bad in terms of capacity or reliability it can be costly to the society and reduce the quality of life (Ibid.).</p> <p>Also, the use of cars for passenger transportation is generally less energy efficient and has greater environmental and social impacts than public transportation (United Nations, 2007).</p> <p>In addition, the IOC needs to verify if the transportation is reliable in order for athletes and spectators to travel to venues quickly, safely and easily.</p>	<p>Two elements are examined. The modal split in the cities and the congestion.</p> <p>For modal split, data is taken from European Platform on Mobility Management (EPOMM, 2017) and from city of Los Angeles (City of Los Angeles, 2015).</p> <p>For congestion, a report from INRIX is used (Cookson &amp; Pishue, 2017).</p>
<b>Unemployment rate</b>	<p>Could indicate the ability of the city/nation to create employment. Can also indicate the status of the economy in the city/nation (United Nation, 2007).</p>	<p>Statistics from Eurostat and city of Los Angeles is used (Eurostat, 2016c; City of Los Angeles, 2016) .</p>

**Table 5-4: Environmental pillar sub-criteria.**

Environmental pillar		
Criteria	Why selected	How measured and what data
<b>Greenhouse Gas Emission</b>	<p>An increase of greenhouse gasses in the atmosphere contributes to global warming. Greenhouse gas emission is believed to cause an increase in the global mean temperature, which is expected to have a very negative impact on the environment and furthermore on the economy and the society in most countries in the world (United Nations, 2007).</p> <p>For the IOC, it is important since, one of the requirements for candidate cities is to minimize carbon emission from the Olympic Games (The International Olympic Committee, 2016c).</p>	<p>The greenhouse gas emissions are estimations. Data is from 2005 for European cities and 2010 for Los Angeles.</p> <p>However, it is possible to get emission data for countries both in 2005 and 2013. Thus, the difference in 2005 between cities and countries are estimated to be the same in 2013. Thus, it is possible to estimate the greenhouse gas emissions in 2013 for the cities. Greenhouse gas emissions for cities in 2013 are calculated using data from the World Bank and UCLA (World Bank, 2011, 2016; UCLA, 2015).</p>
<b>Renewable Energy</b>	<p>Energy from renewable energy resources can indicate future energy security. It can also reduce environmental impact since use of non-renewable energy sources pollutes more and therefore contributes to climate change (United Nations, 2007).</p> <p>Renewable energy is important to the IOC as one of the requirements for candidate cities is to minimise carbon emission from the Olympic Games (The International Olympic Committee, 2016c).</p>	<p>The percentage of renewable energy use from the total consumption is examined along with what other energy sources the countries are using. Data from Eurostat (Eurostat, 2016c), California Energy Commission (California Energy Commission, 2016) and the World Nuclear Association website is used to compare the cities (World Nuclear Association, 2017).</p>
<b>Vulnerability to natural hazards</b>	<p>Disaster caused by vulnerability to natural hazards has a negative impact on the development of a city/country (United Nations, 2007).</p> <p>Furthermore, the IOC needs to verify if there is a high risk of natural hazard to the cities since cities that have a high risk of natural hazard could be at risk of cancelling the Olympic Games due to natural hazards occurring before or during the Olympic Games.</p>	<p>To examine 'Vulnerability to natural hazards' information from the World Factbook from CIA is used (CIA, 2017), along with various websites.</p>



**Table 5-5: Social pillar sub-criteria.**

Social pillar		
Criteria	Why selected	How measured and what data
<b>Crime</b>	<p>Crime has a very significant negative impact on sustainable development. Crime creates fear and lowers the quality of life in a city (United Nations, 2007).</p> <p>Crime can include robbery, homicides, how safe citizens feel around the city as well as the risk of terrorist attacks.</p> <p>For the IOC, it important to know if the cities have a high crime rate or if there is a risk of terrorist attacks as security cost is sometimes high for the Olympic Games (The 2022 Evaluation Commission, 2015; CBC News, 2017).</p>	<p>Information from Overseas Security Advisory Council (OSAC) is used (OSAC, 2017). Also, a crime index from a website called Numbeo is used ('Crime', 2017). The website gathers information from users of the website and develops a crime index. This is not scientifically correct data but can give some hints as to how safe the cities are. Statistics from countries can also be inaccurate. In some countries people are likely to not report crimes and data can also be altered by government institutions ('Crime', 2017).</p>
<b>Discrimination</b>	<p>Discrimination is one of the core principle in the Olympic charter, which states: <i>'The host city shall prohibit any form of discrimination with regard to country or person on grounds of race, colour, sex, sexual orientation, language, religion political or other opinion, national or social origin, property or other status'</i> (International Olympic Committee, 2015). Promoting gender equality and the empowerment of women can also help defeat poverty and promote sustainable development (United Nations, 2007).</p>	<p>Reports from Freedom House (Freedom House, 2017) and Amnesty International are used (Amnesty International, 2017). Also a Global Gender Gap report from the World Economic Forum (World Economic Forum, 2017).</p>
<b>Health</b>	<p>Indicates how many have access to primary health care. Accessibility to health care is of fundamental significance as it reflects on health system progress, equity and sustainable development (United Nations, 2007). Also, for the IOC, bid cities will have to show the availability of hospitals in the city and the number of hospital beds.</p>	<p>Two elements are reviewed.</p> <p>The numbers of hospital beds per 1000 people which are taken from the bid books as well as from a report from Hamburg (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i>, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2014). Healthcare Access Index for the countries from Lancet Magazine is also used (Barber et al., 2017).</p>

With these sub-criteria, the AHP hierarchy is completed and is illustrated in Figure 5-2.

The next step is to make pairwise comparisons. Using Equation (2.1) each sub-criterion that alternatives are compared to requires ten comparisons and therefore, the total pairwise comparisons that are required to complete the full assessment is 191\*. That is 92\* for BAU and 99\* for SD.

If no sub-goals or criteria is constructed, and all sub-criteria are connected to each other, 306\* comparisons would be required.

Therefore, by having sub-goals and criteria, the pairwise comparisons are reduced by 115.

As well as reducing the number of pairwise comparisons, the sub-goals and criteria in Level II and III enable more detailed assessment.

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\*  $BAU = \left(4 \times 10 + \frac{4 \times 3}{2}\right) \times 2 = 92$ ,  $SD = \left(3 \times 10 + \frac{3 \times 2}{2}\right) \times 3 = 99$ ,  $\Rightarrow BAU + SD = 92 + 99 = 191$   
**No criteria dimension** =  $\left(17 \times 10 + \frac{17 \times 16}{2}\right) = 306$

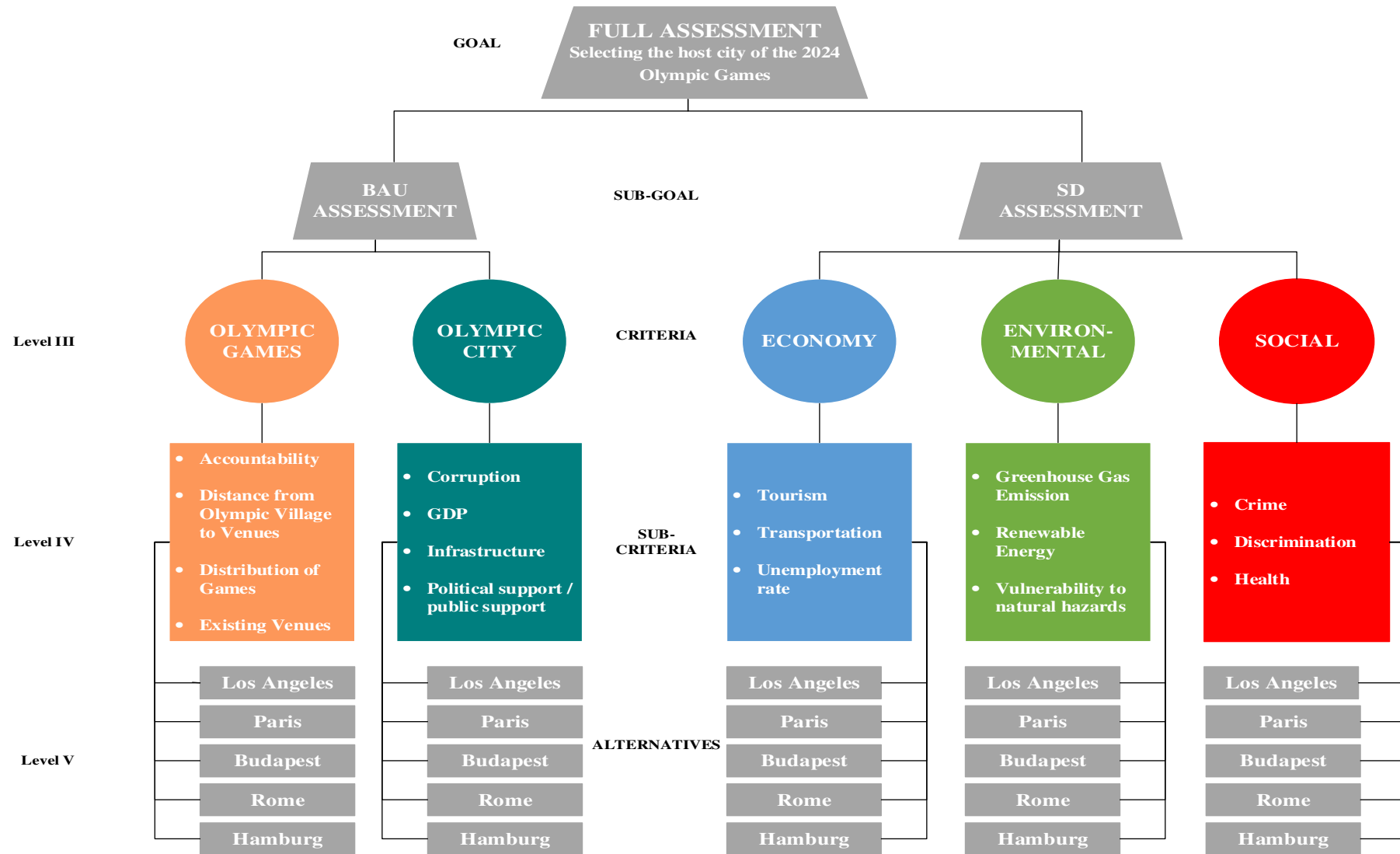


Figure 5-2: Overview of the AHP hierarchy with all sub-criteria.

## 6 Full Assessment

The results for the full assessment are developed using the AHP method described in Section 2.3. To develop the results, pairwise comparisons between the cities are made for each sub-criterion selected in Sub-section 5.2 and 5.3 as well as between sub-criteria linked together, see Figure 5-2. The pairwise comparisons can be seen in a logbook in Appendix B.

In the logbook, alternatives are given values in comparison to one another with values from Table 2-3. For each comparison, various references and sometimes “gut feeling” are used to estimate the given values.

The sub-goals in Level II and the criteria in Level III are not compared but are weighted equally. This is done in order to get what is referred to as the basic results. These sub-goals and criteria are later weighted differently to give a more comprehensive set of results (model runs) and include methods used in the five perspectives of SP. These results are shown and discussed in Sections 7.1 and 7.2.

After making the pairwise comparisons, the Expert Choice software, described in Sub-section 2.3.4, computes the scores for each alternative in relation to each criterion using the eigenvector method described in Sub-section 2.3.1.

The software also calculates the weight of each sub-criterion, the total score for each alternative in relation to the BAU assessment and the SD assessment as well as the total value for each alternative for the full assessment.

Inconsistency does exist in the comparisons. However, that was expected as perfect consistency is almost impossible to reach in comparison methods as described in Sub-section 2.3.2.

The average inconsistency is 0.024 with the highest inconsistency being 0.051. This is beneath 0.1 which Saaty recommends the ratio should not exceed. The inconsistency for each comparison can be seen with each comparison in the logbook in Appendix B.

The results from the basic run are presented in the following sections. The first two sections show the results for the BAU and the SD assessment. The last section shows the results for the full assessment. In the basic run the sub-goals in Level II has equal weight, 50% each. Also, criteria in Level III have equal weights, in BAU 50% each and in SD 33.3% each.

### 6.1 BAU assessment results

The results for the BAU assessment are divided into three sub-sections. The first two sub-sections will present the scores for the two criteria beneath the BAU assessment, the Olympic Games and the Olympic City. The last sub-section will present the results for the BAU assessment.

### 6.1.1 Olympic Games

Figure 6-1 presents the score for each city for the Olympic Games criterion. Los Angeles has the highest score followed by Paris and Budapest.

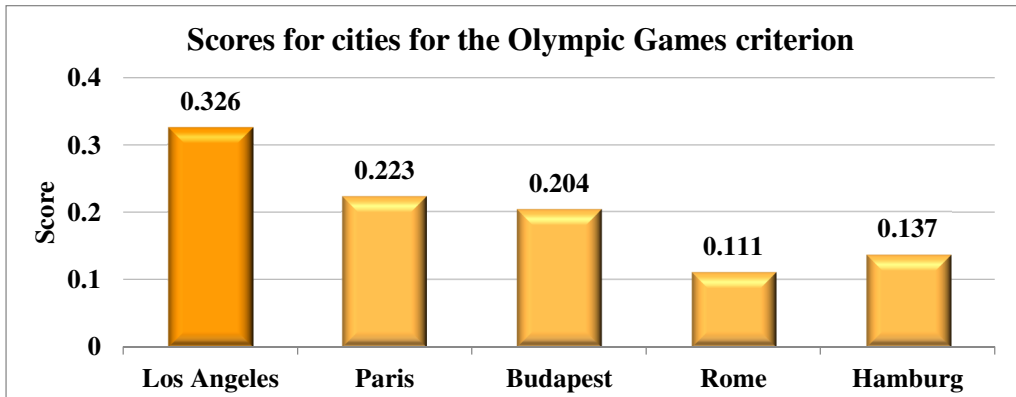


Figure 6-1: Total score for each city for Olympic Games criterion.

Observing the scores for the sub-criteria under the Olympic Games shows that Los Angeles has the highest score in two sub-criteria, 'Existing Venues' and 'Accountability', see Table 6-1.

Table 6-1: Scores for the cities for each sub-criterion under the Olympic Games.

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
Accountability	0.325	0.325	0.121	0.192	0.036
Distance from Olympic Village to Venues	0.040	0.163	0.431	0.059	0.307
Distribution of Games	0.117	0.048	0.501	0.077	0.257
Existing Venues	0.514	0.258	0.053	0.122	0.053

In 'Existing Venues', Los Angeles has the highest score since it has the most venues already existing for the Olympic Games in 2024. Los Angeles has also built the proposed Olympic Village by now (Los Angeles 2024 Exploratory Committee, 2016).

Having most of the venues already in existence can reduce the financial risk since there is no need to allocate money to constructing new expensive sporting venues (Taylor, 2017).

In 'Accountability', Los Angeles has the highest score since Los Angeles demonstrates the ability to host big events. Los Angeles has hosted the Olympic Games twice previously ('Past Olympic Host City Election Results', 2017). Los Angeles has also hosted the Men's and Women's FIFA World Cup final (FIFA, 2013). It also hosts annually big non-sporting TV events that are watched by millions of people worldwide ('The Oscars', 2017; 'The Grammys', 2017).

However, Los Angeles has a low score in 'Distance from Olympic Village to Venues'.

As mentioned above, Los Angeles will mostly use existing venues and these venues are spread across Los Angeles. Therefore, the distances between sites will be greater in Los Angeles than in other cities (Los Angeles 2024 Exploratory Committee, 2016).

Table 6-1 also reveals that Budapest has the highest score in two sub-criteria, 'Distance from Olympic Village to Venues' and 'Distribution of Olympic Games'.

Budapest has the shortest average distance planned from the Olympic Village to Olympic Venues. Budapest intends to build an Olympic Park with numerous new venues and an Olympic Village alongside the Olympic Park (Budapest 2024 Committee, 2016).

Budapest and Hungary have never hosted the Olympic Games before and only once have the summer Olympic Games been held in Eastern Europe. Therefore, for ‘Distribution of Olympic Games’, Budapest has the highest score (‘Past Olympic Host City Election Results’, 2017).

Even though Budapest has the highest score in these two sub-criteria, it has a lower total score for the Olympic Games than both Los Angeles and Paris. The reason is that Budapest has the lowest score in ‘Existing Venues’ which has the highest weight among the sub-criteria under Olympic Games, see Figure 6-2.

Budapest has the lowest score in this criterion because many of the venues would need to be constructed in time for the Olympic Games.

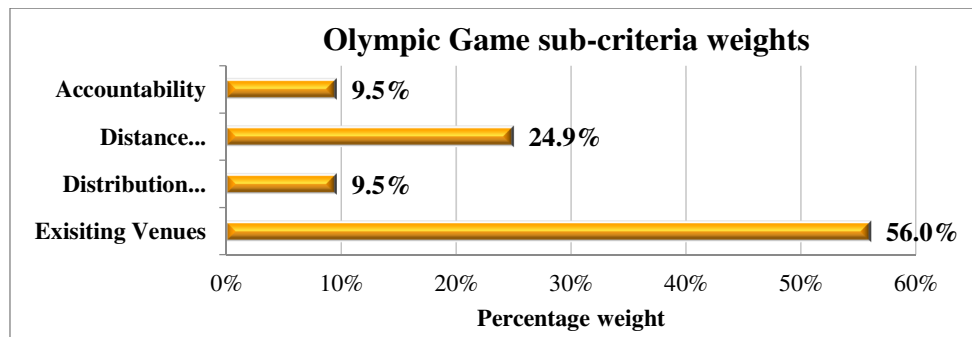


Figure 6-2: Olympic Games sub-criteria weights.

The reason for the high weight of ‘Existing Venues’ is because the IOC has weighted existing sport venues highly in past screening assessments (IOC Candidature Acceptance Working Group, 2000, 2004, 2008, 2012).

Additionally, ‘Existing Venues’ can also reveal whether the cities could be at financial risk when hosting the Olympic Games (Taylor, 2017).

### 6.1.2 Olympic City

Figure 6-3 presents the score for each of the cities for the Olympic City criterion. The figure shows that Paris has the highest score followed by Los Angeles.

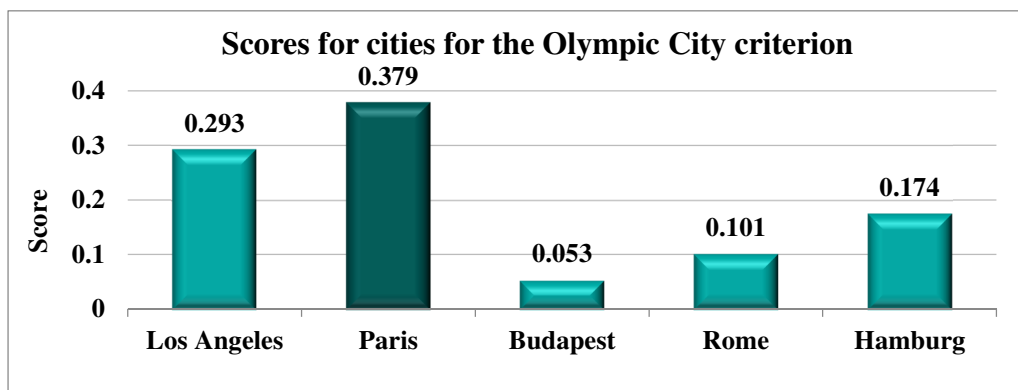


Figure 6-3: Total score for each city for Olympic City criterion.

The scores for sub-criteria under the Olympic City in Table 6-2 illustrate that Paris has the highest score in one sub-criterion as well as high scores in two other sub-criteria.

**Table 6-2: Scores for the cities for each sub-criterion under the Olympic City.**

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
Corruption	0.250	0.168	0.046	0.046	0.491
GDP	0.157	0.315	0.038	0.075	0.415
Infrastructure	0.314	0.466	0.047	0.125	0.047
Political and public support	0.457	0.306	0.096	0.096	0.044

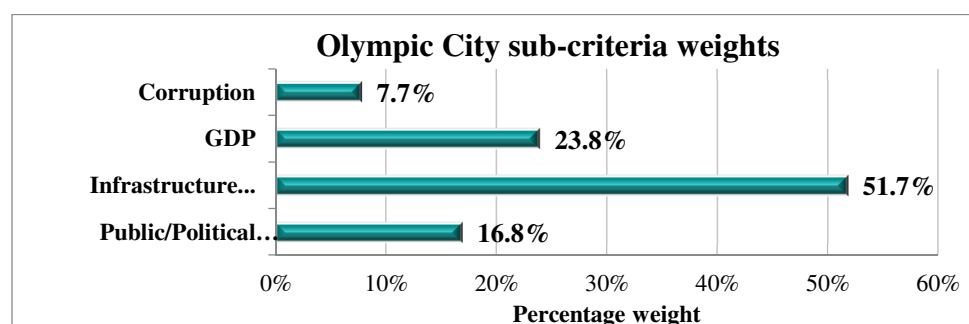
Paris has the highest score in ‘Infrastructure’. Paris has an estimation of 142,000 hotel rooms planned within 50 km before 2024 (*Paris Candidature File Stage 1*, 2016). Furthermore, Paris had the most airport passengers in 2015 among the five cities (Paris-Aéroport, 2016). Therefore, it can be expected that Paris is capable of serving and accommodating a high number of people.

Table 6-2 also reveals that out of the four sub-criteria under Olympic City, Hamburg has the highest score in two of them, ‘GDP’ and ‘Corruption’. In ‘GDP’ Hamburg was estimated to have the highest GDP per capita of all the cities in 2014 (Eurostat, 2016a). For ‘Corruption’, Germany was the least corrupted country out of the five nations in 2016 according to Transparency International (Transparency International, 2017).

However, despite the highest score in these two sub-criteria, Hamburg is behind both Paris and Los Angeles for total score for Olympic City.

Figure 6-4 shows that ‘Infrastructure’ has the highest weight among the four sub-criteria and Hamburg, with Budapest has the lowest score in that sub-criterion. As a result, Hamburg has a low score for Olympic City.

Hamburg is estimated to have the lowest number of hotel rooms among the five cities, an estimated 26,000 hotel rooms within 50 km from the city (Brabant & Schwendner, 2014). Hamburg also had a low number of airport passengers in 2015, with only Budapest having fewer airport passengers (Hungarian Statistical Office, 2017; Hamburg Airport, 2016).



**Figure 6-4: Olympic City sub-criteria weights.**

‘Infrastructure’ has the highest weight since in past screening assessments from the IOC, accommodation and infrastructure have been weighted highly (IOC Candidature Acceptance Working Group, 2000, 2004; 2008, 2012). Infrastructure is also important to give an idea of whether the cities will be able to serve and accommodate all spectators for the Olympic Games.

### 6.1.3 Total score for BAU assessment

Figure 6-5 presents the score for each city for the basic BAU assessment where Olympic Games and Olympic City each have 50% weight.

The figure shows that Los Angeles has the highest total score for BAU followed by Paris.

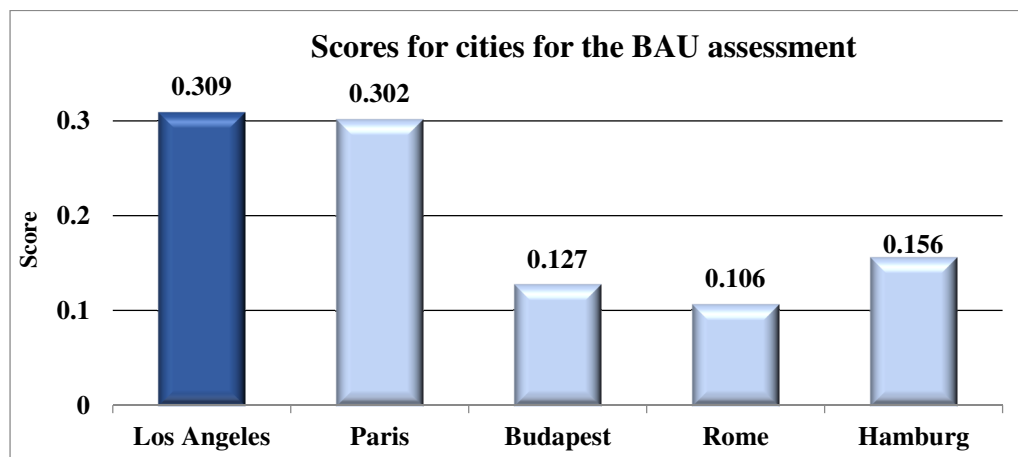


Figure 6-5: Total score for each city for the BAU assessment.

Los Angeles and Paris are ranked as number one and two in both Olympic Games and Olympic City. Therefore they have the highest total score for BAU.

As pointed out in Sub-section 6.1.1, Los Angeles has shown its capability for hosting major events.

In addition, Los Angeles, like Paris, is capable of accommodating and serving a high number of people. Los Angeles is planning to have around 102,000 hotel rooms within 50km before 2024 (Los Angeles 2024 Exploratory Committee, 2016). Los Angeles airports also served nearly 90 million passengers in 2015 (Los Angeles World Airports, 2016, 2017; John Wayne Airport, 2017).

Los Angeles also has the support from the majority of its citizens and politicians in the city (Mackay, 2016).

Paris, too, has support from the majority of its citizens and politicians in the city (Rowbottom, 2016). Moreover 50 mayors around the world have signed a letter in support of Paris 2024 ('Over 50 Mayors from World Capital', 2017).

However, Paris has a lower score than Los Angeles in 'Existing Venues'. Paris will need to construct venues, including the Olympic Village and the Aquatic complex, for the Olympic Games and that could be a financial risk (*Paris Candidature File Stage 1*, 2016; Taylor, 2017).

Moreover, Paris has the lowest score for 'Distribution of Games'. The Olympic Games were held in London in 2012 which is near Paris and could influence the selection of the host city, since the IOC wants to allocate the Olympic Games between the continents (Poast, 2007).

## 6.2 SD assessment results

The results for the SD assessment are divided into four parts. The first three parts present the scores for the cities for the three pillars of sustainability under the SD assessment, Economy, Environment and Social. The final part presents the results for the SD assessment where the three pillars have equal weight, each being 33.3%.

### 6.2.1 Economy

Figure 6-6 presents the score for each city for the Economic pillar. The figure shows that Budapest has the highest score followed by Paris and Hamburg.

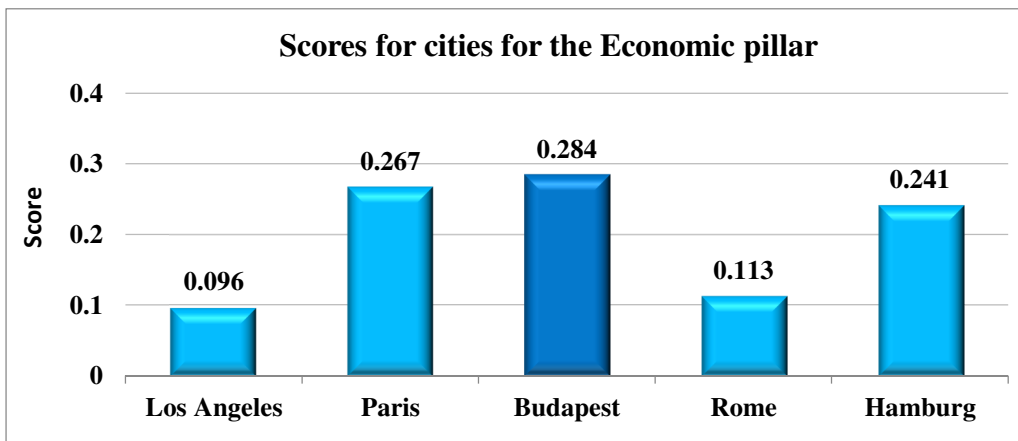


Figure 6-6: Total score for each city for the Economic pillar.

For the sub-criteria under the Economic pillar, Budapest has the highest score in one sub-criterion, 'Transportation'. Budapest also has a relatively high score in 'Unemployment rate', see Table 6-3.

Table 6-3: Scores for the cities for each sub-criterion under the Economic pillar.

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
Tourism	0.198	0.397	0.075	0.294	0.035
Transportation	0.050	0.320	0.320	0.113	0.196
Unemployment rate	0.173	0.077	0.271	0.041	0.438

Budapest has with a strong public transport system Data from the European Platform on Mobility Management (EPOMM) reveals that in Budapest, 45% of people commuted using public transport systems and only 35% by car in 2014 (EPOMM, 2017). Furthermore, according to a report from INRIX, there was low congestion in Budapest compared to the other four cities in 2016 (Cookson & Pishue, 2017).

For 'Unemployment rate', Budapest has a high score since in Budapest the unemployment rate was 5.3% in 2014 and only Hamburg had a lower unemployment rate among the five cities with 4.5% (Eurostat, 2016c).

However, Budapest did not have as many tourists as Paris, Los Angeles or Rome in 2015 (Euromonitor International, 2016).



It can also be argued that the image of Budapest is not as good as Rome or Paris. Yet that can be controversial since each individual has their own perception of image.

Table 6-3 also shows that Paris has the highest score in two sub-criteria, ‘Transportation’ and ‘Tourism’.

Paris has the highest score in ‘Transportation’ together with Budapest. According to EPOMM for modal split, only 17% of people travelled by private motorised vehicle in 2008 (driving, motorcycle or taxi). 47% walked and 33% used public transport (EPOMM, 2017).

However, despite few people using cars, there is a heavy congestion in Paris in 2016 according to INRIX (Cookson & Pishue, 2017).

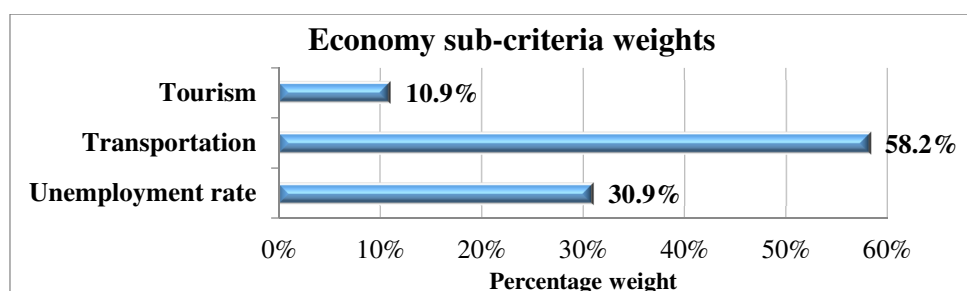
The congestion could be the reason why people walk or use public transportation. In addition, the city is very compact and was not designed for big motorised vehicles (Small, 2016).

Paris also has the highest score for ‘Tourism’ since Paris had the most tourists among the five cities in 2015 (Euromonitor International, 2016). However there was a drop in tourists traveling to Paris in 2016 due to the terrorist attacks and the current image of Paris could be argued to have suffered as a results (Hosie, 2017). Despite this drop, Paris is still among the most popular tourist destinations in the world (Ibid.).

However, the unemployment rate was high in Paris in 2015 (Eurostat, 2016c). The reason for a high unemployment rate in France could be related to the low economic growth in France. The economic growth has been slow and was only 1.2% over the whole year in 2015 (Ellyatt, 2016). As a result, Paris has a low score for ‘Unemployment’.

Despite Budapest having a low score in ‘Tourism’ and Paris having a low score in ‘Unemployment rate’, the cities have the highest score for the Economic pillar.

That is because ‘Transportation’ has the highest weight of all the sub-criteria, seen in Figure 6-7.



**Figure 6-7: Economy sub-criteria weights.**

‘Transportation’ has the highest weight since good transportation system can result in better accessibility to new markets and workers. As a result, it could reduce the unemployment rate and increase economic growth (Rodrigue, & Notteboom, 2017).

Furthermore, the IOC wants to ensure that athletes and spectators can go between venues and accommodations quickly, safely and easily (Richter, 2012).

## 6.2.2 Environment

Figure 6-8 presents the score for each city for the Environmental pillar. Paris has the highest score followed by Budapest.

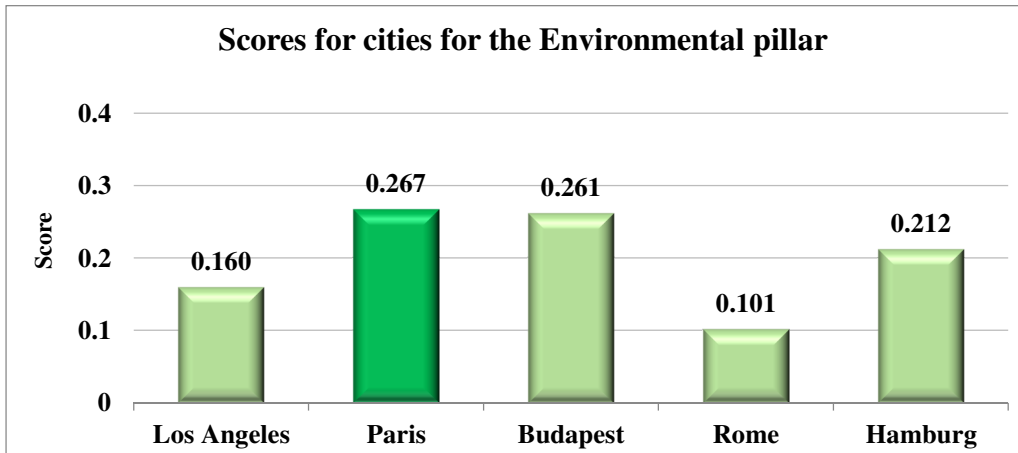


Figure 6-8: Total score for each city for the Environmental pillar.

The scores for the sub-criteria show that Paris has a relatively high score in all the sub-criteria and has the highest score in one sub-criterion, see Table 6-4.

Table 6-4: Scores for cities for each sub-criterion under Environmental pillar.

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
Greenhouse Gas Emission	0.049	0.240	0.398	0.240	0.073
Renewable Energy	0.476	0.209	0.105	0.140	0.070
Vulnerability to natural hazards	0.059	0.294	0.294	0.059	0.294

Paris has the highest score in 'Vulnerability to natural hazard' with Budapest and Hamburg despite a risk of floods in all three cities (CIA, 2017). The reason for high score despite the risk of flood is that Rome and Los Angeles have higher risk of natural hazards. Los Angeles is at risk of landslides, earthquakes and tsunamis and Rome sits close to an active volcano and is vulnerable to earthquakes (County of Los Angeles, 2017; 'A County Hazards', 2017; 'Tsunami Facts and Information', 2017; CIA, 2017).

Budapest has the highest score in 'Greenhouse Gas Emission' (World Bank, 2011, 2016). The reason for Budapest having low emission could be linked to the transportation since it had less congestion than the other four cities in 2016 (Cookson & Pishue, 2017). Furthermore a high percentage of people use alternative transport modes to cars.

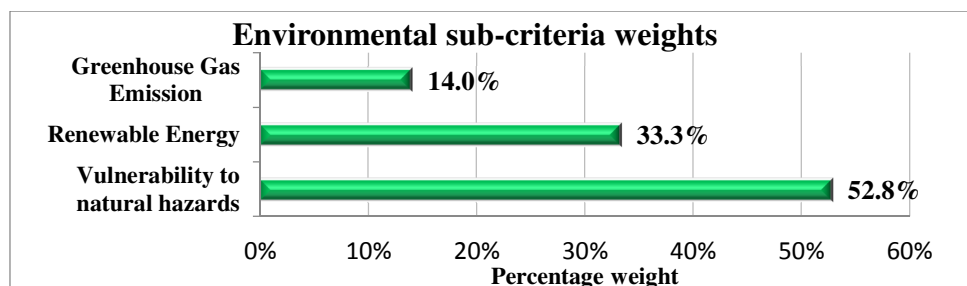
In 'Renewable Energy', Los Angeles has the highest score. The reason is that in Los Angeles, an estimated 27% of the energy use came from renewable energy in 2016 (California Energy Commission, 2016) compared to 13.8% to 17.1% in the other four cities in 2015 (Eurostat, 2016b).

Despite the highest score in 'Renewable Energy', Los Angeles ranks fourth out of the five cities for the Environmental pillar.

The reason for that is due to the weights of the sub-criteria which show that ‘Vulnerability to natural hazards’ has the highest weight, see Figure 6-9.

This is why Los Angeles and Rome have the lowest overall score for the Environmental pillar.

Moreover, in Los Angeles greenhouse gas emissions were estimated to be much higher than in the other four cities in 2013 (UCLA, 2015). The cause for that could be linked partly to the transportation, since the private car is popular in Los Angeles and Los Angeles had the highest congestion among all cities in the world in 2016 according to INRIX (Cookson & Pishue, 2017).



**Figure 6-9: Environmental sub-criteria weights.**

The reason for a high weight of ‘Vulnerability to natural hazards’ is because for the IOC, it is important that cities show capability of dealing with natural hazards and that the risk of natural hazards is low during or before the Olympic Games.

In addition, if a city has a strong risk reduction program or is not exposed to natural hazards, the city has more potential to focus on modifying their energy use and therefore lower greenhouse gas emissions.

What is more, the Olympic Games were previously relocated due to natural hazards. In 1908 the IOC switched the host city from Rome to London due to financial problems in Rome as a result of the Mount Vesuvius eruption (‘Past Olympic Host City Election Results’, 2017).

### 6.2.3 Social

Figure 6-10 presents the score for each city for the Social pillar. Hamburg has the highest score followed by Paris.

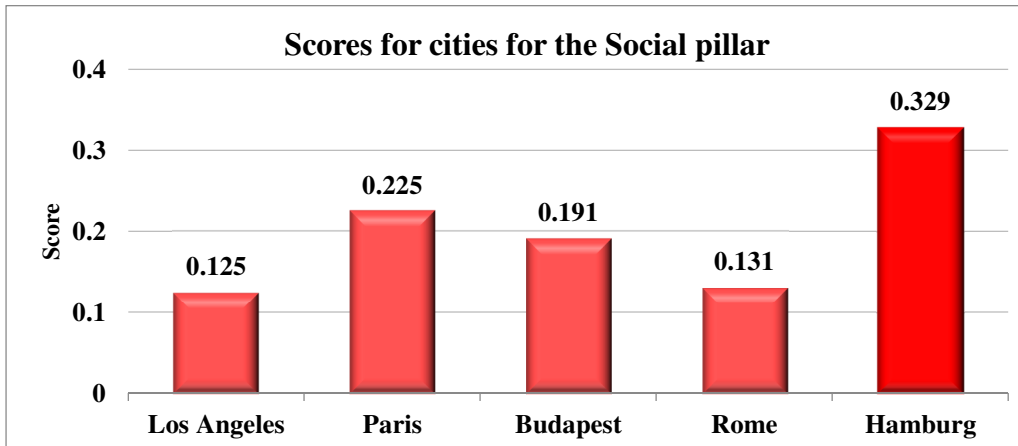


Figure 6-10: Total score for each city for the Social pillar.

The score for the sub-criteria shows that Hamburg has high scores in two sub-criteria, 'Discrimination' and 'Crime'.

Hamburg has the highest score in 'Discrimination' since discrimination was lowest in Germany among the five countries in 2016 according to Amnesty International and Freedom House report (Amnesty International, 2017; Freedom House, 2017).

Moreover, Germany had the highest gender equality among the five nations in 2016 by the Global Gender Gap Report (World Economic Forum, 2017).

Hamburg also has a high score in 'Crime'. According to the website Numbeo, Hamburg has a low crime index ('Crime', 2017). Nevertheless, the risk of terrorist attacks are high according to OSAC (OSAC, 2017) and with last year's terrorist attack in Berlin, there is a high alert in Germany.

Table 6-5: Scores for cities for each sub-criterion under Social pillar.

Criterion / City	Los Angeles	Paris	Budapest	Rome	Hamburg
Crime	0.124	0.124	0.395	0.124	0.234
Discrimination	0.146	0.225	0.040	0.146	0.442
Health	0.059	0.416	0.271	0.096	0.158

Table 6-5 also shows that Paris has the highest weight in 'Health'. The reason for this is that access to healthcare in France is the highest among the five nations according to a Healthcare Access Index published in Lancet Magazine (Barber et al., 2017). Furthermore Paris along with Budapest has the highest number of available hospital beds among the five cities (*Paris Candidature File Stage 1*, 2016; Budapest 2024 Committee, 2016).

The table also shows Budapest with the highest score in 'Crime'. Budapest has the lowest crime index among the cities according to Numbeo ('Crime', 2017). Also, according to OSAC the chance of terrorist attacks is the lowest in Hungary among the five nations (OSAC, 2017).

However, discrimination was the worst in Hungary among the five nations according to Amnesty International and Freedom House report in 2016 (Amnesty International, 2017; Freedom House, 2017). Furthermore, Budapest had the lowest equality among the five countries in 2016 (World Economic Forum, 2017).

The results for the Social pillar also show that Los Angeles has the lowest total score for the pillar.

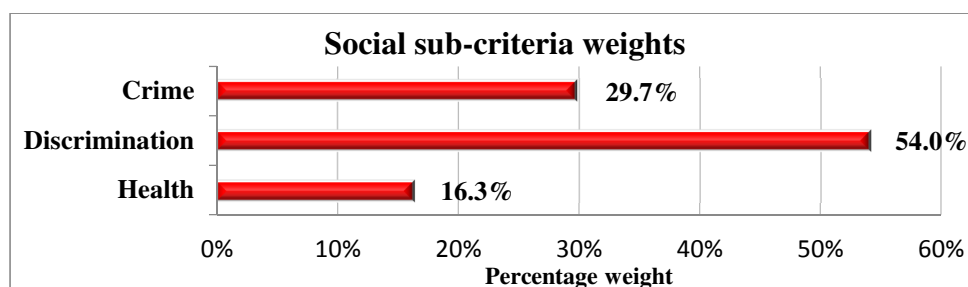
Los Angeles has the lowest score in ‘Health’. This is due to the fact that Los Angeles has the lowest number of hospital beds per 1000 people or only 1.8 (Los Angeles 2024 Exploratory Committee, 2016). Also, access to healthcare is lower than in France, Italy and Germany according to the Healthcare Access Index published in Lancet Magazine (Barber et al., 2017).

Los Angeles also has low scores for ‘Discrimination’ and ‘Crime’.

For ‘Discrimination’, Los Angeles has a lower score than Hamburg and Paris since the U.S. had a lower score in the Freedom House report along with lower gender equality than Germany and France in 2016 (Freedom House, 2017; World Economic Forum, 2017). It can also be argued that the election of Donald Trump could affect the IOC since Trump wants to close U.S borders to specific people (Conway, 2016).

For ‘Crime’, Los Angeles has the lowest score with Paris and Rome. In all the countries the risk of terrorist attacks remains high, although it is higher in Europe (OSAC, 2017; ‘Terrorism – USA travel advice’, 2017). However, France hosted the UEFA final tournament last year and there were no attacks during the four weeks of the tournament (UEFA, 2017). Moreover, last time a terrorist attack was made at the Olympic Games happened on U.S. soil in Atlanta in 1996 (History.com Staff, 2010).

Nevertheless, Hamburg has the highest score for the Social pillar since the two sub-criteria Hamburg scores highly in, ‘Discrimination’, and ‘Crime’ have the highest weights among the sub-criteria under the Social pillar, see Figure 6-11.



**Figure 6-11: Social sub-criteria weights.**

‘Discrimination’ has the highest weight since non-discrimination is one of the fundamental principles of Olympism in the Olympic Charter (The International Olympic Committee 2015). Furthermore, discrimination can result in inequality among people (United Nations, 2017b).

For ‘Crime’, the IOC needs to be assured that the cities are safe and according to Section 17.2 in the Host City Contract Principle for the 2024 Olympic Games, it is required that cities can guarantee a safe and peaceful celebration of the Olympic Games (International Olympic Committee, 2016b). Moreover, it can be said that crime compromises human dignity, creates a climate of fear and erodes quality of life (United Nations, 2007).

## 6.2.4 Total score for SD assessment

Figure 6-12 presents the results for each city for the basic SD assessment where all three pillars of sustainability, Economy, Environmental and Social have an equal weight, thus each has a weight of 33.3%. The figure shows that Hamburg has the highest total score followed by Paris and Budapest.

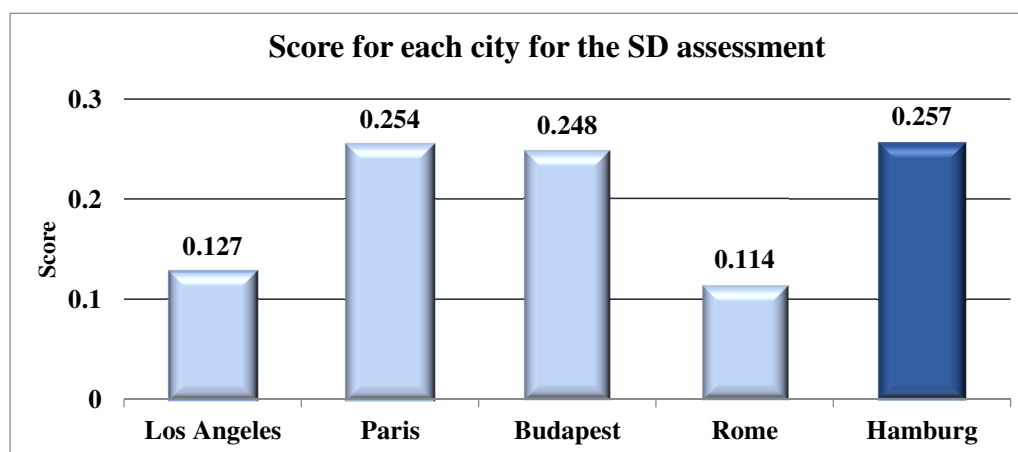


Figure 6-12: Total score for each city for the SD assessment.

The results from the three pillars, Economy, Environmental and Social, show that Hamburg has relatively high scores in all three pillars. Hamburg has the lowest unemployment rate among the five cities. Furthermore, Germany has the lowest discrimination among the five nations involved and Hamburg is also the least vulnerable to natural hazards together with Budapest and Paris.

Moreover, the three sub-criteria in which Hamburg has high scores are also given high weights for the SD assessment.

Hamburg, however, does have high greenhouse gas emission and Germany had low percentage use of renewable energy in 2015 (World Bank, 2011, 2016; Eurostat, 2016b). However, the use of renewable energy is high in Germany and Germany produces the most renewable energy of all European Union countries (Eurostat, 2016d). However, the demand for energy is also higher in Germany and therefore, the percentage of renewable energy out of total consumption is lower than in the other countries (Eurostat, 2016e). Hamburg also had fewer tourists compared to the other four cities in 2015 (Euromonitor International, 2016).

Paris, as well, has a high total score for the basic SD assessment. Paris has the highest score for 'Transportation', 'Tourism', 'Vulnerability to natural hazards' and 'Health'.

On the other hand, Paris has a low score for 'Crime' since there is a high risk of terrorist attacks in France (OSAC, 2017). Moreover, according to the website Numbeo, Paris has a high crime index ('Crime', 2017).

Paris also has a low score for 'Unemployment rate' since Paris had the second highest unemployment rate among the five cities in 2015 (Eurostat, 2016c).

## 6.3 Full assessment results

For the full assessment basic results, the score for the BAU and SD assessments from Sub-sections 6.1.3 and 6.2.4 are combined and have equal weight with each counting 50%.

Figure 6-13 presents the total value for each city for the full assessment. The figure shows that Paris has the highest total value followed by Hamburg and Los Angeles.

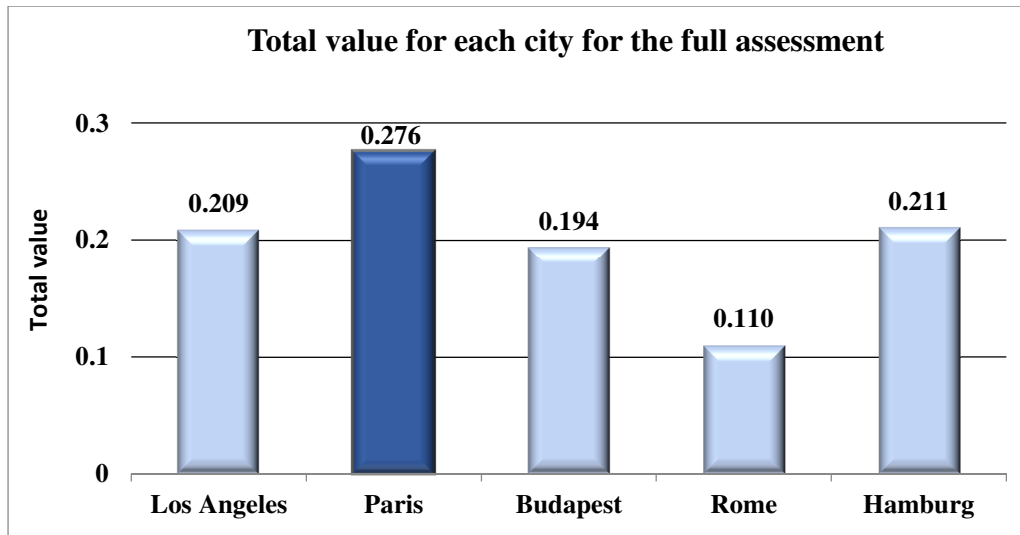


Figure 6-13: Total values for cities for the full assessment - basic results.

These results are similar to the results from the screening assessments made earlier in Section 4.2. There, Paris had the highest scores followed by Los Angeles and Hamburg, then Budapest and Rome. The only difference is that Los Angeles and Hamburg switch places.

Paris does not, however, have the highest score in either BAU or SD. Los Angeles has the highest score for BAU while Hamburg has the highest score for SD.

Nevertheless, in both assessments Paris has a high score and was close to the highest score in both BAU and SD.

Moreover, by observing the distribution of the total value between the criteria in level III, Figure 6-14 shows that Paris has relatively even score distribution between the five criteria. The figure also shows that most of Los Angeles' total value comes from the two BAU criteria while for Hamburg it comes from the three pillars of sustainability under SD.

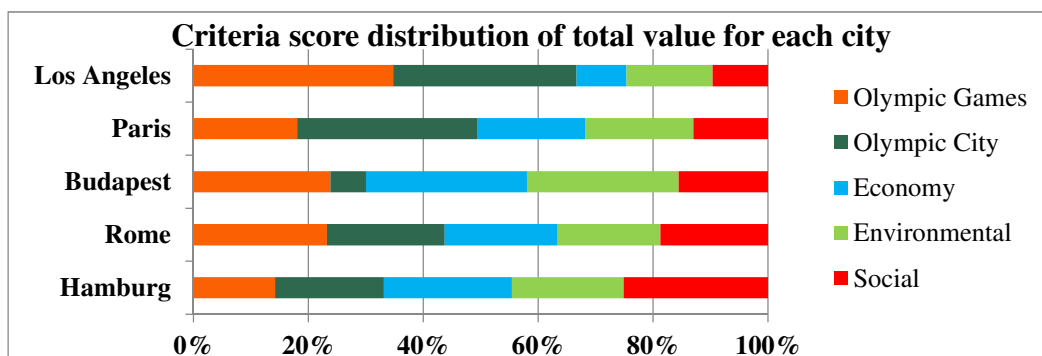
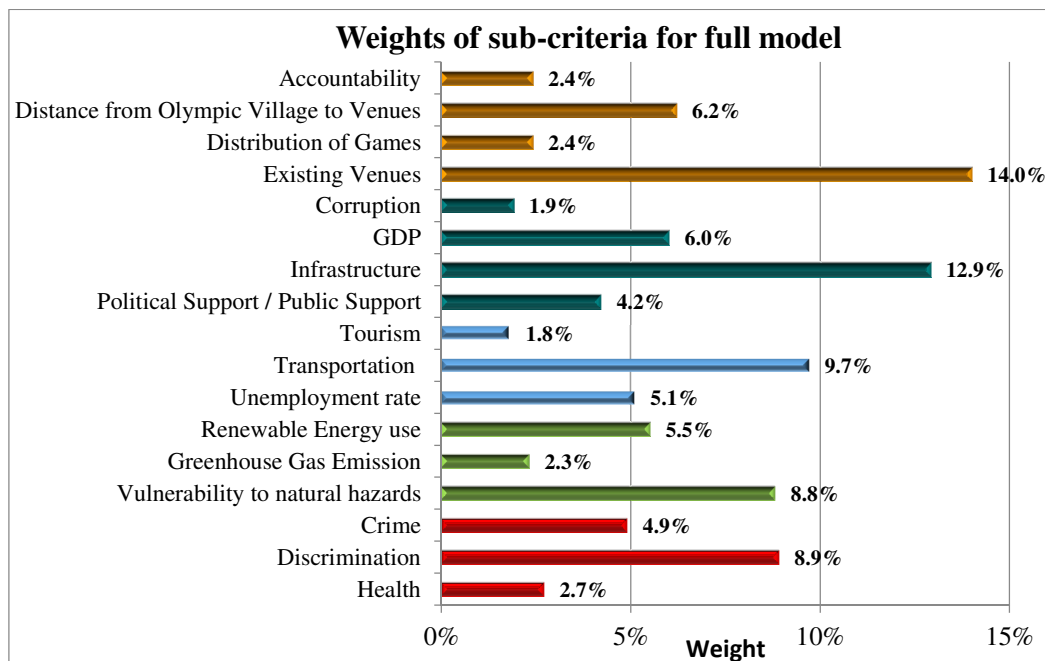


Figure 6-14: Distribution of scores for cities.

In addition, Paris has high scores in the three sub-criteria that have the highest weight: ‘Existing Venues’, ‘Infrastructure’ and ‘Transportation’, see Figure 6-15.



**Figure 6-15: Weights of sub-criteria for the full assessment – basic results.**

These results and the results from the screening assessments show that Paris is number one. However, different future scenarios and perspectives could change the ranking order.

In the following chapter, different runs will be made with different weights between the sub-goals in Level II and between the criteria in Level III in Figure 5-2 in order to see whether different weight sets will alter the ranking of the cities.

In addition, the results will be examined on the basis of the five SP perspectives to see how the ranking is influenced under the different perspectives.



# 7 Discussion of results

## 7.1 AHP runs

The result from the full assessment and the screening assessment makes a strong case for selecting Paris as the host city of the 2024 Olympic Games. However, it must here be observed that the weights for the sub-goals in Level II and the weights for the criteria in Level III in Figure 5-2 were weighted equally.

For that reason, different runs are conducted for the AHP model to estimate different scenarios.

Altogether, six different AHP runs are designed for making a more comprehensive assessment:

- Basic
- Focus on Olympic Games
- Focus on Olympic City
- Focus on BAU
- Focus on SD
- Focus on strong SD

The outcomes from these runs are shown in Sub-sections 7.1.1 to 7.1.6.

### 7.1.1 Basic run (Level I)

The first run is a basic run which is the result from the full assessment made in Chapter 6.

For the basic run the following weights are given between sub-goals and criteria in Levels II and III from Figure 5-2. Bold indicates the areas in the hierarchy active in the calculation.

**Table 7-1: Weights for sub-goals and criteria for basic results.**

Basic run					
Level II	BAU: 50%		SD: 50%		
Level III	Olympic Games 50%	Olympic City: 50%	Economic: 33%	Environ - mental: 33%	Social: 33%

This basic run represents the Wider Performance (WP) in the five SP perspectives described in Section 2.1. Many of the criteria are hard to compare in terms of monetary values or solid data.

Figure 7-1 shows the results from the basic results. Paris has the highest total value followed by Hamburg and Los Angeles as discussed in Section 6.3.

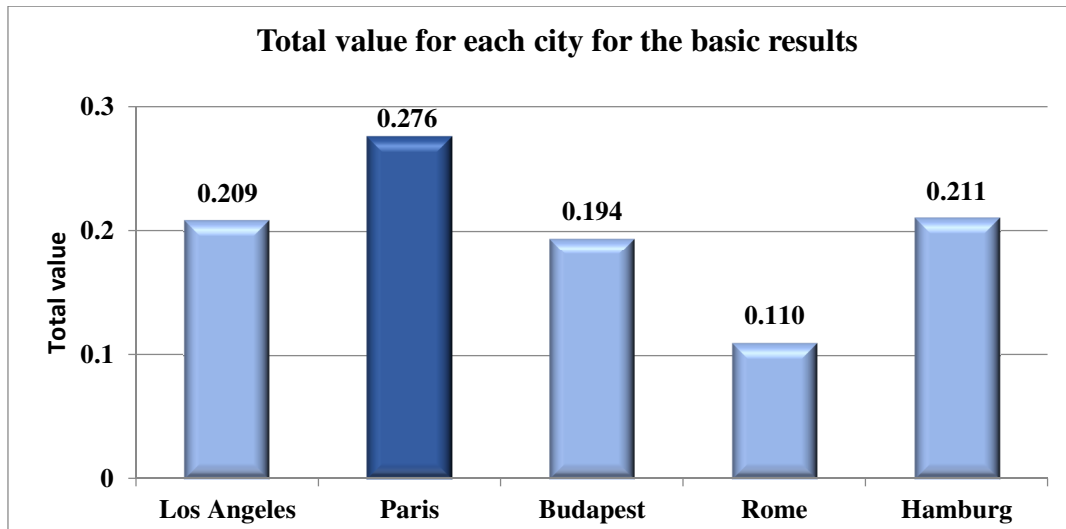


Figure 7-1: Total values for cities in the basic run.

### 7.1.2 Focus on Olympic Games (Level III)

Focus on Olympic Games represents the Fairness (FA) in the five SP perspectives. The run examines what the outcome would be if the Olympic Games stakeholders' preferences weighed more than Olympic City stakeholders' preferences. Thus, the focus is on the stakeholder group which has the prime interest in hosting great Olympic Games with great facilities for athletes and sports with less concern for the city or its infrastructure.

In this run the following weights are given between sub-goals and criteria in Levels II and III in Figure 5-2 to represent the Olympic Games stakeholders' preferences. Bold indicates the areas in the hierarchy active in the calculation.

Table 7-2: Weights for sub-goals and criteria with focus on Olympic Games.

Focus on Olympic Games					
Level II	BAU: 50%		SD: 50%		
Level III	<b>Olympic Games 75%</b>	<b>Olympic City: 25%</b>	Economic: 33%	Environ - mental: 33%	Social: 33%

With a focus on the Olympic Games stakeholders' preferences, Paris has the highest total value followed by Los Angeles, Budapest and Hamburg with Rome being last. The results are shown in Figure 7-2 with the basic results behind to see the difference in total value between the two runs.

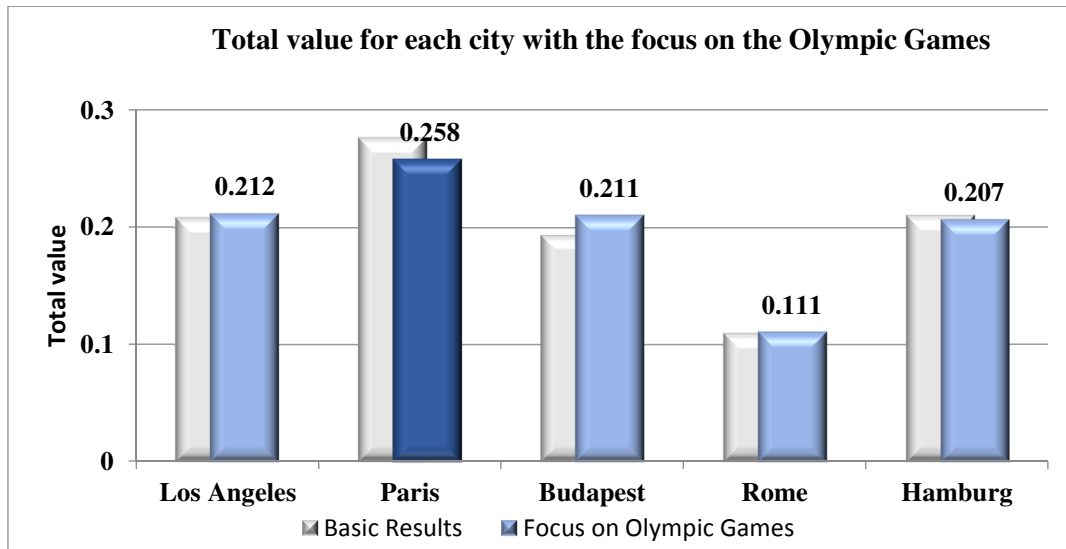


Figure 7-2: Total values for cities when the focus is on Olympic Games.

Budapest has the most increase from the basic results. Moreover, Paris decreases its total value. The other three cities have minor differences from the basic results.

The results from Figure 6-1 and Figure 6-3 show that Budapest has the worst score for Olympic City and a high score for Olympic Games. Therefore, Budapest has an increase in total value when the focus is on the Olympic Games.

On the other hand, Paris has a higher score for Olympic City than Olympic Games and thus has a decrease when the focus is on Olympic Games.

### 7.1.3 Focus on Olympic City (Level III)

Focus on Olympic City represents the FA perspective. The run focuses on the Olympic City stakeholders' preferences. Thus the focus is on the stakeholders interested in hosting the Olympic Games but with higher concern to the host city.

The following weights are given between sub-goals and criteria in Levels II and III in Figure 5-2 to represent the Olympic City stakeholders' preferences. Bold indicates the areas in the hierarchy active in the calculation.

Table 7-3: Weights for sub-goals and criteria with focus on Olympic City.

Focus on Olympic City					
Level II	BAU: 50%		SD: 50%		
Level III	Olympic Games 25%	Olympic City: 75%	Economic: 33%	Environ - mental: 33%	Social: 33%

The results can be seen in Figure 7-3. As in the previous two runs, Paris has the highest total value.

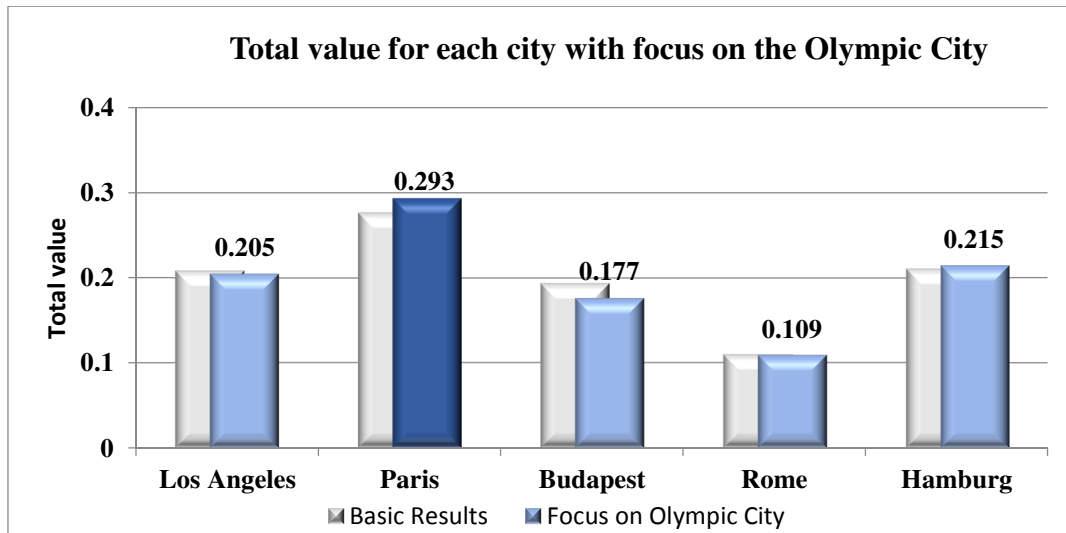


Figure 7-3: Total values for cities when the focus is on Olympic City.

Paris has an increase from the basic results and Budapest has a decrease from the basic results.

As discussed in the previous sub-section, Budapest has the worst score for Olympic City and Paris the highest score. As a result, Paris has an increase while Budapest has a decrease.

#### 7.1.4 Focus on BAU (Level II)

Focus on BAU represents the Robustness (RO) in the five SP perspectives. The focus in this run is on criteria that have been important in the past selection with less emphasis on sustainable development of the city.

The following weights are given between sub-goals and criteria in Levels II and III in Figure 5-2 to represent the focus on BAU. Bold indicates the areas in the hierarchy active in the calculation.

Table 7-4: Weights for sub-goals and criteria with focus on BAU.

Focus on BAU					
Level II	BAU: 75%		SD: 25%		
Level III	Olympic Games 50%	Olympic City: 50%	Economic: 33%	Environ - mental: 33%	Social: 33%

The results from this run can be seen in Figure 7-4. As in previous runs, Paris has the highest total value.

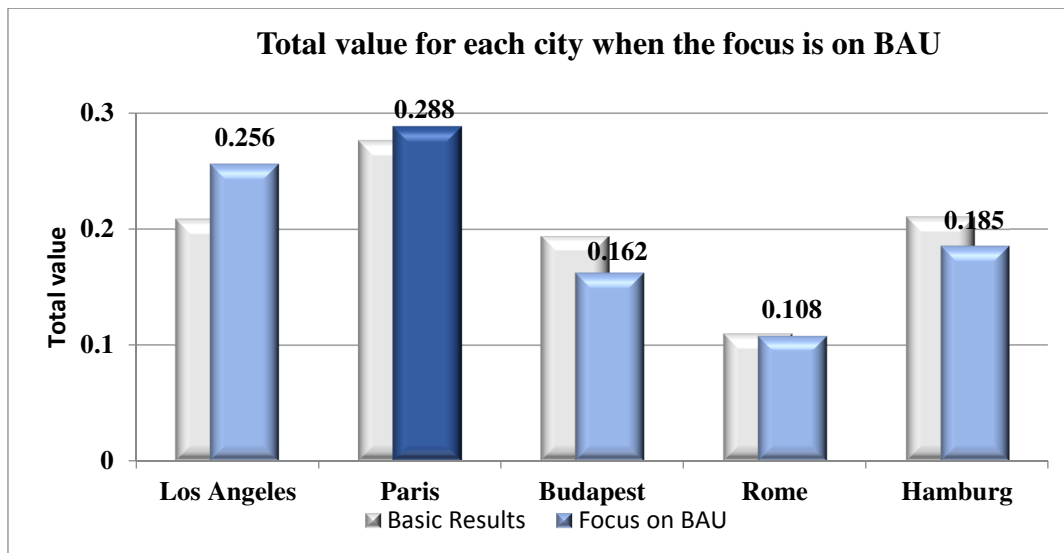


Figure 7-4: Total values for cities when the focus is on BAU.

The figure also shows that Los Angeles increases its total value significantly compared to the other cities.

The reason for the increase of Los Angeles can be seen in Figure 6-14. The figure shows that Los Angeles has most of its value coming from BAU while Budapest and Hamburg have most of their value coming from SD.

Therefore, Los Angeles has an increase in total value when the focus is on BAU while Budapest and Hamburg have a decrease.

Paris also has slightly more of its total value coming from the BAU assessment. Therefore, Paris increased its value. Rome has similar scores for BAU and SD and as a result, similar scores in this run to those in the basic results.

### 7.1.5 Focus on SD (Level II)

Focus on SD represents the RO in the five SP perspectives. The run assesses if the IOC will select the host city with more emphasis on sustainability.

The following weights are given between sub-goals and criteria in Levels II and III in Figure 5-2 to represent the focus on the SD assessment. Bold indicates the areas in the hierarchy active in the calculation.

Table 7-5: Weights for sub-goals and criteria with focus on SD.

Focus on SD					
Level II	BAU: 25%		SD: 75%		
Level III	Olympic Games 50%	Olympic City: 50%	Economic: 33%	Environ - mental: 33%	Social: 33%

The results with focus on SD are shown in Figure 7-5. Once more, Paris has the highest total value.

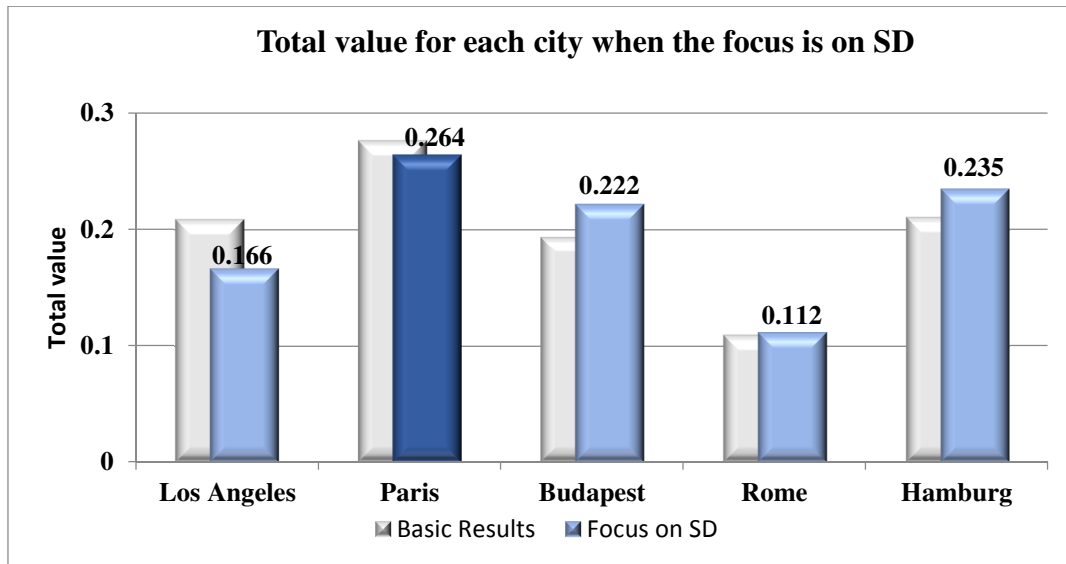


Figure 7-5: Total values for cities when the focus is on SD.

The figure shows that Los Angeles has a significant decrease in total value while Budapest and Hamburg have an increase.

As discussed in the previous sub-section, Hamburg and Budapest have most of their values from the SD assessment. Therefore, Budapest and Hamburg had an increase for total value when the focus is on SD. On the other hand, Los Angeles has a decrease since it has most of its value from the BAU assessment.

### 7.1.6 Focus on Strong SD (Level II and III)

There is a difference between strong sustainability and the sustainability referred to in the previous sub-section. In the previous sub-section, sustainability is generally perceived as weak sustainability. In weak sustainability, the belief is that it is possible to replace or duplicate the environment with products made by people. Thus, all three pillars are weighted equally (Hart, 1998).

In strong sustainability, the belief is that, natural capital cannot be replaced by products made by people (Ibid.).

As a result, the weights for the three pillars of sustainability are not equally weighted.

The Environmental pillar has the highest weight followed by the Social pillar and finally the Economic pillar. Figure 7-6 visualizes the concept of strong sustainability.

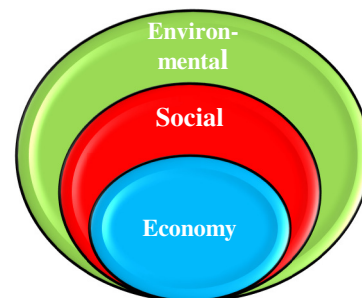


Figure 7-6: Strong sustainability.

As in the previous two runs, focus on strong SD represents the RO in the five SP perspectives. The run assesses if the IOC will select the host with emphasis on strong sustainability.

The weights for the three pillars of sustainability can be estimated by using the AHP method or the Ranking Order Distribution (ROD) method.

However, the AHP is used in this study to estimate the weights for the three pillars. The argumentation for that is that there is no principle difference in the outcome between the two methods and moreover, for reader unfamiliar with ROD it is better to use the same method throughout the study instead of presenting an additional method.

The AHP comparisons between the three pillars are shown in Table 7-6.

**Table 7-6: Pairwise comparisons between the three pillars of sustainability.**

Criteria	Economy	Environmental	Social
Economy	1	1/3	1/2
Environmental	3	1	2
Social	2	1/2	1

The comparisons in Table 7-6 give the following weights for the three pillars:

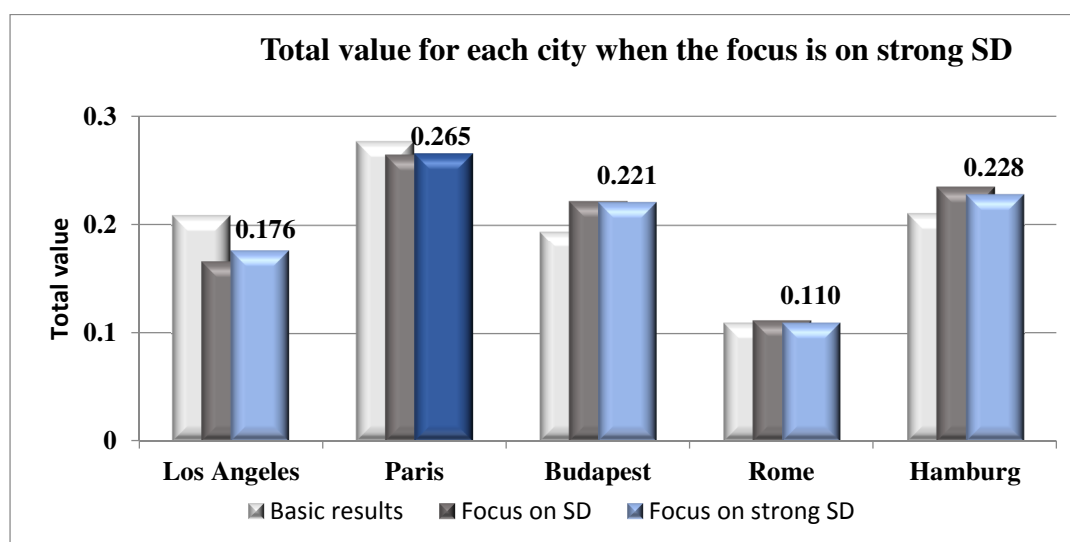
Economy: 16.3%  
Environmental: 54%  
Social: 29.7%

As a result, the following weights are given between the sub-goals and criteria in Levels II and III from Figure 5-2. Bold indicates the areas in the hierarchy active in the calculation.

**Table 7-7: Weights for sub-goals and criteria with focus on strong SD.**

Focus on strong SD					
Level II	BAU: 25%		SD: 75%		
Level III	Olympic Games 50%	Olympic City: 50%	Economic: 16.3%	Environ - mental: 54%	Social: 29.7%

The results from this run can be seen in Figure 7-7.



**Figure 7-7: Total values for cities when the focus is on strong SD.**

As in all previous runs, Paris has the highest total value.

Moreover, there is no change in ranking from the previous run when the focus was on SD. However, there is a minor difference in the total values.

Paris and Los Angeles increase their values while the other cities have a decrease. Paris and Los Angeles have their highest score in the Environmental pillar out of the three pillars of sustainability.

As a result, Los Angeles and Paris increase their total value while the other cities decrease their total value from the previous sub-section.

### 7.1.7 Conclusion of the six runs

Evaluating the outcome of all six runs shows that Paris has the highest total value in all runs followed by Los Angeles or Hamburg and then Budapest and Rome, see Table 7-8.

**Table 7-8: Overview of the results from the AHP runs. Total values for cities.**

<b>AHP run \ Run</b>	<b>Los Angeles</b>	<b>Paris</b>	<b>Budapest</b>	<b>Rome</b>	<b>Hamburg</b>
<b>Basic results</b>	0.209	<b>0.276</b>	0.194	0.110	0.211
<b>Focus on Olympic Games</b>	0.212	<b>0.258</b>	0.211	0.111	0.207
<b>Focus on Olympic City</b>	0.205	<b>0.293</b>	0.177	0.109	0.215
<b>Focus on BAU</b>	0.256	<b>0.288</b>	0.162	0.108	0.185
<b>Focus on SD</b>	0.166	<b>0.264</b>	0.222	0.112	0.235
<b>Focus on strong SD</b>	0.176	<b>0.265</b>	0.221	0.110	0.228

These results show that Paris is a stable number one in all six runs making the case strong that Paris should be the selected as the host city of the 2024 Olympic Games.

However, further examination based on the five SP perspectives could perhaps lead to a different outcome.

The following section will examine the results on the basis of the five SP perspectives and observe if Paris remains a stable number one or if there will be shift in the ranking.



## 7.2 Five SP perspectives

In the previous section the final overview shows that Paris is a stable number one as concerns the ranking of the five candidate cities. The purpose of this section is to examine whether this ranking can be maintained when further examined on the basis of the five SP perspectives listed below and described in Section 2.1:

1. Core Performance (CP)
2. Wider Performance (WP)
3. Fairness (FA)
4. Diversity (DI)
5. Robustness (RO)

In the following sub-sections, each perspective will be discussed based on the results so far.

### 7.2.1 Core Performance

The purpose of CP is to put focus on one or more key decision factors. This has been carried out in the screening assessment, see the results in Table 4-3 in Sub-section 4.2.1, leading to the following rank order of cities:

1. Paris
2. Los Angeles
3. Hamburg
4. Budapest
5. Rome

It may be relevant to consider even fewer factors than these in the screening assessment and here the three key factors from section 3.1 by Feddersen et al. (2008) are relevant:

- Number of hotel rooms within 50 km
- Distance from Olympic Village to Olympic Venues
- Average temperature

Concentrating on these factors keeps Paris as number one, with Budapest as number two, see Table 4-3 in Sub-section 4.2.1.

When choosing just one key factor, 'Existing Venues' in the BAU assessment could be used. The argumentation behind this is simply that the more venues that exist before the bid will help reducing the financial risk of hosting the Olympic Games (Taylor, 2017). Moreover, 'Existing Venues' has the highest weight of all sub-criteria in the study, see Figure 6-15.

With the results from Table 6-1 in Sub-section 6.1.1 , the following rank order is obtained:

1. Los Angeles
2. Paris
3. Rome
4. Budapest / Hamburg

With only one key factor ‘Existing Venues’, Los Angeles is number one, with Paris as number two.

Another key factor that can be selected is the ‘Accountability’ in the BAU assessment. The reason is simply that the hosting of many previous successful events can be seen as a kind of guarantee that the hosting of the Olympic Games in 2024 will also be a successful event.

With the results from Table 6-1 in Sub-section 6.1.1, the following rank order is obtained:

1. Los Angeles / Paris
3. Rome
4. Budapest
5. Hamburg

From the core performance point of view it can be concluded that Paris and Los Angeles are the top contenders.

If selecting only one of the four approaches which best represents the CP perspective, ‘Existing Venues’ might be selected. The reason is simply that ‘Existing Venues’ has the highest weight among the sub-criteria and it can also be linked to the financial risk of hosting the Olympic Games, since host cities often underestimate the construction cost of new venues (Flyvbjerg et al., 2016).

### **7.2.2 Wider Performance**

With the WP perspective, the assessment is extended to also include criteria that are important in a wider context. In this study WP has been carried out with the formulation of the criteria lists and the AHP model.

The basic run that leads to the results are shown in Figure 7-1 and the following rank order is obtained:

1. Paris
2. Hamburg
3. Los Angeles
4. Budapest
5. Rome

A number of runs have been conducted as shown in Section 7.1 which indicate that Paris remains a stable number one regardless of different sets of criteria weights.

A reason for this can be found in Figure 6-14, which shows that Paris has a relatively even score distribution over the five criteria in Level III: Olympic Games, Olympic City, Economy, Environmental and Social.

### **7.2.3 Fairness**

With the FA perspective focus is placed on which strength to give to the main stakeholders included in the study to shed a light on whether there might be a different outcome between stakeholders. In the BAU scenario in the AHP model, two stakeholders have been included as 'Olympic Games' and 'Olympic City'.

However, as shown with the runs in Sub-sections 7.1.2 and 7.1.3, there is no difference in the outcomes since Paris is number one both runs.

### **7.2.4 Diversity**

The purpose of the DI perspective is to test whether some relevant aspects have been ignored as a result of the examination so far and to see if some part of the analysis needs to be reconsidered.

#### **Reconsidering pairwise comparisons**

Here it will be of interest to see whether some reconsideration of pairwise comparisons can lead to a switch in ranking between Paris and Los Angeles.

Analysing the results so far and the outcome of the SP examinations above has led to a reconsideration of the BAU part of the AHP model.

Thus the following three criteria are reconsidered as regards pairwise comparisons: 'Accountability', 'Distance from Olympic Village to Venues' and 'GDP'.

These criteria have been shown in the logbook in Appendix B, page 89, 90 and 95.

For 'Accountability' the reconsideration put more emphasis on newer events and existing venues.

For 'Distance from Olympic Village to Venues', the reconsideration put less emphasis on the average distance but more on the possible reliability of the transportation of athletes and IOC members from the Olympic Village to venues.

For 'GDP', there is a reconsideration of the values given for GDP. In the bid books, the GDP per capita is different from the data used in this study. Thus, for the reconsideration GDP values from the bid books are used apart from for Hamburg, which does not have a bid book. Then the GDP for Hamburg will be same as before.

On the basis of the reconsiderations of 'Accountability', 'Distance from Olympic Village to Venues' and 'GDP', the pairwise comparisons for these three sub-criteria have been modified and are shown in Appendix C, pages 113 to 115.

On the basis of this, the runs in Section 7.1 have been revised and a new version of Table 7-8 has been made, see Table 7-9 where the new and old results are shown together.

**Table 7-9: Revised results from the six AHP runs. Total values for cities.**

AHP run \ Run		Los Angeles	Paris	Budapest	Rome	Hamburg
Basic results	Revised	0.228	<b>0.260</b>	0.193	0.113	0.206
	Old	0.209	0.276	0.194	0.110	0.211
Focus on Olympic Games	Revised	0.226	<b>0.246</b>	0.208	0.115	0.205
	Old	0.212	0.258	0.211	0.111	0.207
Focus on Olympic City	Revised	0.231	<b>0.275</b>	0.177	0.111	0.207
	Old	0.205	0.293	0.177	0.109	0.215
Focus on BAU	Revised	<b>0.287</b>	0.264	0.161	0.112	0.177
	Old	0.256	0.288	0.162	0.108	0.185
Focus on SD	Revised	0.175	<b>0.257</b>	0.222	0.113	0.232
	Old	0.166	0.264	0.222	0.112	0.235
Focus on strong SD	Revised	0.185	<b>0.258</b>	0.221	0.111	0.225
	Old	0.176	0.265	0.221	0.110	0.228

Regardless of modifying the comparisons for these three criteria, Paris still ranks number one in five out of six runs. However, in these revised results, Los Angeles is ranked as number one, when the focus is on BAU.

### Overlooked criteria

Along with the revised criteria, some criteria may have been left out.

Observing the criteria list, ‘Average temperature’, which Feddersen et al. (2008) explained is one of three key criteria for a successful bid and was used in the screening assessment was absent in the full assessment.

By including ‘Average temperature’ into the BAU part and replacing ‘Distribution of Games’ with it, the results are again revised in addition to the reconsidered criteria from Table 7-9.

For ‘Average temperature’ comparisons, not only the highest average temperature is considered but also the possibility of rain in the proposed competition period.

On the basis of this, the results from Table 7-9 have been revised to include ‘Average Temperature’ and are shown in Table 7-10. The comparisons between alternatives for ‘Average Temperature’ can be seen in Appendix C, page 116.

**Table 7-10: Revised results with Average temperature. Total values for cities.**

AHP run \ Run		Los Angeles	Paris	Budapest	Rome	Hamburg
Basic results	Revised with Avg. temp.	0.233	<b>0.266</b>	0.187	0.113	0.201
	Revised	0.228	0.260	0.193	0.113	0.206
Focus on Olympic Games	Revised with Avg. temp.	0.233	<b>0.254</b>	0.200	0.115	0.198
	Revised	0.226	0.246	0.208	0.115	0.205
Focus on Olympic City	Revised with Avg. temp.	0.233	<b>0.278</b>	0.174	0.111	0.204
	Revised	0.231	0.275	0.177	0.111	0.207
Focus on BAU	Revised with Avg. temp.	<b>0.293</b>	0.273	0.153	0.112	0.170
	Revised	0.287	0.264	0.161	0.112	0.177
Focus on SD	Revised with Avg. temp.	0.178	<b>0.260</b>	0.219	0.113	0.230
	Revised	0.175	0.257	0.222	0.113	0.232
Focus on strong SD	Revised with Avg. temp.	0.188	<b>0.261</b>	0.218	0.111	0.223
	Revised	0.185	0.258	0.221	0.111	0.225

By replacing ‘Distribution of Olympic Games’ for ‘Average temperature’ the ranking of the cities is unchanged from Table 7-9.

Paris is still ranked number one in five out of six runs with Los Angeles number one when the focus is on BAU.

### Reconsidering criteria weights

Here it will be of interest to see whether some change in weights of criteria can lead to a switch in ranking.

Observing the criteria weights, it might be of interest to adjust the weights of criteria under the Social pillar.

Under the Social pillar, ‘Discrimination’ has the highest weight followed by ‘Crime’ and ‘Health’.

However, ‘Crime’ which compares the crime rate in the cities and risk of terrorist attacks will be weighted as more important in these revised runs due to recent terrorist attacks.

There might be a possibility that the IOC will perhaps have greater concern for security than for discrimination because of these recent attacks.

On the basis of this, the runs in Section 7.1 have been revised again and a new version of Table 7-8 has been made, see Table 7-11.

In spite of different weights of the criteria under the Social pillar, Paris remains number one in all runs.

However, Budapest has an increase in total value in all runs. Budapest has a high score in ‘Crime’ and low in ‘Discrimination’. As a result, by switching the weights between these two sub-criteria, Budapest will have an increase in its total value.

**Table 7-11: Revised results from the six AHP runs with criteria weight revised. Total values for cities.**

AHP run \ Run		Los Angeles	Paris	Budapest	Rome	Hamburg
Basic results	Revised	0.208	<b>0.271</b>	0.208	0.110	0.204
	Old	0.209	0.276	0.194	0.110	0.211
Focus on Olympic Games	Revised	0.211	<b>0.254</b>	0.225	0.111	0.200
	Old	0.212	0.258	0.211	0.111	0.207
Focus on Olympic City	Revised	0.204	<b>0.289</b>	0.191	0.109	0.208
	Old	0.205	0.293	0.177	0.109	0.215
Focus on BAU	Revised	0.255	<b>0.286</b>	0.170	0.108	0.181
	Old	0.256	0.288	0.162	0.108	0.185
Focus on SD	Revised	0.165	<b>0.258</b>	0.242	0.111	0.224
	Old	0.166	0.264	0.222	0.112	0.235
Focus on strong SD	Revised	0.174	<b>0.260</b>	0.239	0.109	0.218
	Old	0.176	0.265	0.221	0.110	0.228

### Focus on Olympic Games and BAU

Here it will be of interest to examine a ‘conservative’ weight set with BAU having 75% weight and the Olympic Games 75% weight.

The following weights are given between sub-goals and criteria in Levels II and III in Figure 5-2 to represent the focus on Olympic Games and BAU. Bold indicates the areas in the hierarchy active in the calculation.

**Table 7-12: Weights for sub-goals and criteria with focus on Olympic Games and BAU.**

Focus on Olympic Games and BAU					
Level II	BAU: 75%		SD: 25%		
Level III	Olympic Games 75%	Olympic City: 25%	Economic: 33%	Environ - mental: 33%	Social: 33%

The results from this run can be seen in Figure 7-8.

With focus on Olympic Games and BAU the ranking is different. Los Angeles has the highest total value followed by Paris although the margin is insignificant.

Los Angeles has a big increase from the basic results since it has the highest weight for the BAU assessment as well as the Olympic Games.

On the other hand, Hamburg has a decrease. Hamburg has a low score for Olympic Games as well as low score for BAU.

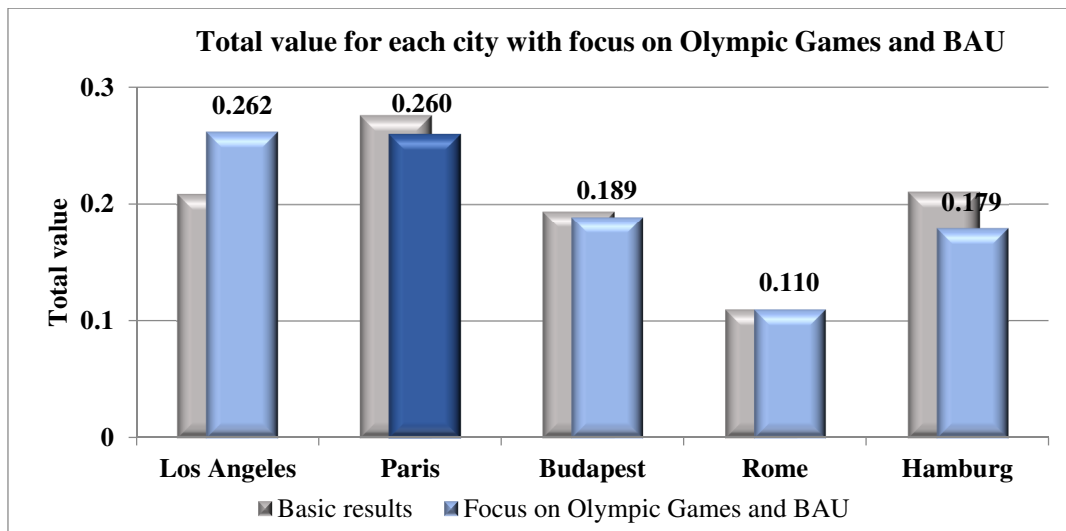


Figure 7-8: Total values for cities when focus is on Olympic Games and BAU.

### Gradient sensitivity (Wild card search) on the full assessment

Gradient sensitivity analysis can show how far modification in weight between certain elements will need to be to alter the rankings of the alternatives.

Figure 7-9 shows gradient sensitivity between the BAU and SD assessments for the full assessment from Section 6.3. The figure shows that if BAU has over 95% weight, Los Angeles would be ranked as number one followed by Paris.

Similarly, if BAU were below 2% of the weight, Hamburg would be ranked number one with Paris following.

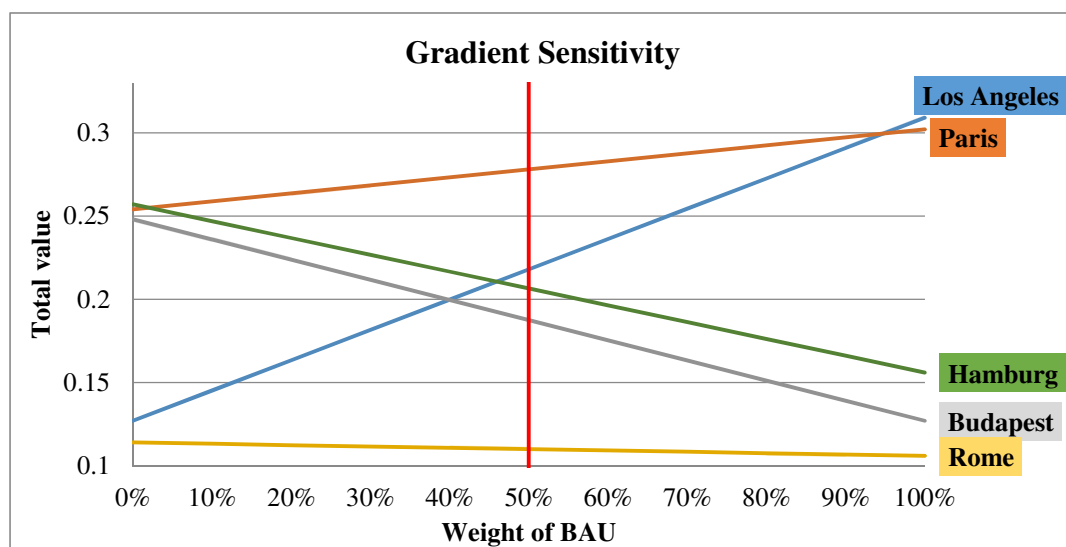


Figure 7-9: Gradient sensitivity analysis.

This shows that the focus needs to be more or less 100% on BAU or SD to alter the ranking. However, there could be a possibility that the IOC will focus exclusively on BAU as it has in previous selections, and as such Los Angeles ranks number one followed by Paris.

### **Other methods from the 2x7 table**

Looking over the 2x7 methods from Table 2-1, a method that could have been used is SWOT, which could have established new criteria to use.

However, brainstorming was used together with reports from the Science for Environment Policy (2015), the 2022 Evaluation Commission (2015), the International Olympic Committee (2014), Feddersen et al. (2008), the United Nations (2007), Poast (2007) and Swart & Bob (2004) to select criteria.

For that reason, SWOT was not used.

### **7.2.5 Robustness**

With the Robustness (RO) perspective, focus is put on the possible variability of the model formulation and the model elements. Robustness has been considered by including scenarios and different stakeholders together with a number of different weight sets.

However, as the previous sub-section shows, pairwise comparisons are also reconsidered in case new perceptions are reached as concerns the interpretation of the assessment task. Also considered are ignored elements as well as a gradient sensitivity (wild card search).

Furthermore, had the CP key factor been of an uncertain type it could have been considered to apply risk analysis such as Monte Carlo simulation.

However, 'Existing Venus' is considered a certain parameter in this study.

On this basis, the RO perspective has led to no further examinations.



## 8 Conclusion and recommendation

Applying SP and its five perspectives from Leleur (2017, 2012) shows it is possible to provide comprehensive decision support for a complex planning problem such as the one in this study.

It has been found as concerns the ranking of the five cities that Paris is a relatively stable number one. It is number one in the screening assessments as well as in the basic full assessment. Moreover, Paris is in general number one with different weight sets as well as generally with the five SP perspectives.

Only in one approach in the CP perspective as well as in a few cases in the DI perspective is Paris behind Los Angeles. In all other cases Paris is number one.

For that reason, Paris is recommended as the host city of the 2024 Olympic Games.

Paris has a relatively strong infrastructure and has also most of the venues ready for the Olympic Games. Moreover, Paris is capable of hosting the Olympic Games since it has hosted many major events in the past with success.

Paris also has a strong support from citizens and politicians in the city for the Olympic Games and moreover, many mayors around the world support the Paris 2024 bids. As well, Paris has a strong transportation system and the Olympic Village will be situated reasonably close to the venues. In addition, Paris has a strong health care access as well as low discrimination. Furthermore, it is a popular tourist destination.

Los Angeles might also be considered as it ranks number one for the BAU assessment as well as in one approach in the CP perspective and in some DI cases.

Los Angeles too, has a strong infrastructure as well as most of the venues ready including the Olympic Village. Los Angeles has also a strong support from citizens and politicians in the city and has shown the capability of hosting big events since it has hosted the Olympic Games twice previously as well as other major events.

The study also confirms that the three cities that withdrew their bids (Budapest, Rome and Hamburg) should not be recommended as the host city of the 2024 Olympic Games. In the basic results as well as in all five perspectives of SP, none of them ranks as number one.

The study show that SP has the potential to assist the IOC to defend their selection, increase the transparency and the acceptance of the selection.

Also, if a selected city is lacking in any of the key factors, the IOC can recognise these by using the findings of this study. The city which wins the bidding should be able to host excellent Olympic Games without compromising the field of play for the athletes, while at the same time should be able to meet the needs of the city and region to ensure that the Olympic Games will leave a positive long-term sustainable development.

As concerns the validity of the findings it should be observed that a sense of bias may have occurred since the study is built up and estimated by a single individual. Moreover, information was occasionally specified for countries not cities and that might perhaps not represent the true image of the cities. Also, some information was a few years old, and 'guesstimation' and 'gut feeling' were used in some comparisons.

In this study SP has been used for the complex problem of selecting the host city of the 2024 Olympic Games. In addition to the specific recommendations about the candidate cities mentioned before, it can be concluded on the experience from this study that the SP approach may be worth applying to other similar types of problems. Examples that come to authors mind are the Reykjavik City line and the Airport train in Iceland. Both consist of various elements and different alternatives. Moreover, there are many stakeholders with different views involved who need to be considered and informed.

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# Appendix A - Criteria description

These detail descriptions are taken from: Science for Environmental Policy (2015), The 2022 Evaluation Commission (2015), The International Olympic Committee (2014), Feddersen et al. (2008), Poast (2007), United Nations (2007), Swart & Bob (2004) except otherwise indicated.

## **BAU criteria**

**Accountability:** The capability of the city to deliver successful games. Cities can display this, by hosting successful sporting events and show range of great facilities.

**American Corporation Dependence Explanations:** Even though the sale of broadcasting rights and the Olympic partner programme (TOP) has allowed the IOC to avoid direct dependency on government assistances, there is a large part of American corporations as TOPs, which means that the IOC is indirectly dependent on American and Western audiences and customers.

**Average Temperature:** Feddersen et al. (2008) expressed that average temperature is a significant factor in successful bid. Furthermore, both temperatures that are too cold or too warm are not ideal for athletes. Looking into Feddersen et al. (2008) the median of average temperature for successful bids in the past was 24.93 °C.

**Bid team composition:** High profile team members and good relationship with IOC member is important for the success of the bid.

**Communication and exposure / Image:** The city as a brand is important to attract tourist. Cities that attract tourists can therefore show the capability of hosting Olympic Games and moreover sell tickets for the events.

**Corruption:** Could indicate corruption among government officials. Feddersen et al. (2008) explains that lower corruption in the country is better for a successful bid.

**Distance from Olympic Village to venues:** The average distance of sporting venues from the Olympic Village is important for successful games. The shorter the average distances, the better.

**Distribution of Games:** IOC wants to promote sports all over the world and therefore, it could be assumed that IOC wants to have the Olympics rotate among the continents. Furthermore, in the Olympic Charter it is stated that IOC's mission is to promote Olympism throughout the world (International Olympic Committee, 2015b).

**European Identity:** Europe dominates the IOC membership with 45% of all members and that could influence the election (The International Olympic Committee, 2017b).

**Existing Venues:** How many critical sport facilities exist at the time of the bid.

**GDP:** Can measure the economic health of a country/city, as well measure country's standard of living. Since the mode of measuring GDP is standardized, GDP can be used to compare different countries with some degree of accuracy in terms of economic health. Furthermore, the IOC has a bias to select cities from countries that have sustained high rates of GDP per capita.

**Infrastructure:** IOC needs to be convinced that the city has the necessary infrastructure to host a successful Olympic Games, including the ability to deliver services, accommodation and transportation, as well as community support.

**Number of available hotels rooms within 50 km:** Important to evaluate if the city is capable of accommodate people, such as media, Olympic Family, the international federations and spectators within and around the city. This related to infrastructures but more specific.

**Political support / public support:** Refers to how the government or the city council is in supporting the Olympic Bid. It also refers to public support in the city/country towards the bid.

**Population size:** Countries/Cities that have more population usually have larger market from where there is possible to get advertising and tickets revenue. Also the countries/cities could get bigger tax bases to support government investment; thus, the IOC would be expected to select the candidate city with the largest population.

**Presidential Preference:** IOC president's influence could persuade some of the IOC members to select a particular host city.

**Reconstruction of venues:** High number of venues that needs reconstruction could indicate a risk of high cost and uncertainty for the host city.

**Relationship marketing:** Involves the power of the bid team to affect the IOC members.

**Unemployment rate:** Could indicate the ability of the city/nation to create employment and also the status of the economy in the city/nation. Feddersen et al. (2008) explained that high unemployment rate could be successful for candidate cities since cities with high unemployment rate could have placed more emphasizes on the bid than other cities.

**Venues only build on approval of bid:** As with reconstruction of venues, high number of venues that needs to be built just for the Olympics possess a risk of high cost and will have uncertainty for the host city.

## **Agenda 2020**

**Accommodation:** Similar as in Infrastructure / available hotel rooms. How many hotel rooms are within 50km from the host city?

**Athlete experience:** Related to the distance from Olympic Village to Olympic Venues and training facilities. Furthermore, it also takes into consideration, how the village is and what athletes can experience in the city.

**Discrimination:** One of the core in the Olympic charter, which states: *'Host city shall prohibit any form of discrimination with regard to country or person on grounds of race, colour, sex, sexual orientation, language, religion political or other opinion, national or social origin, property or other statuses'* (The International Olympic Committee, 2015).

**Energy capability:** Capability of generating enough energy for the games and furthermore how the energy is produced.

**Feasibility:** Indicates if the city has the capability of hosting the Olympic Games as candidate city intended and if the plan for the future use is feasible.



**Finance:** Includes the economic indicators GDP, Inflation, GDP growth and population. They are all described in BAU criteria except GDP growth, which can be described as how fast the countries/city economy is growing. Too high growth rate is not good since it is not sustainable for a long period and too low growth rate is also not good since that means that the city/country is in recession (Amadeo, 2017).

**Gender equality:** IOC wants to promote gender equality and the empowerment of women in sports. Correlates with 'Discrimination'.

**Marketing:** Estimation of number of ticket sold, merchandize sold and what sponsorships will be available for the Olympic Games.

**Media operations:** Location of media centre and accommodation of media and transport of media.

**Medical service:** How many hospitals are in the city and doctors available.

**Olympic Village:** How well the Olympic Village is located and how it can serve the athletes. Comparable to 'Distance from Olympic Village to Venues'. Also important is the design of the village but that could also be a factor in the criteria 'Athlete experience'. Furthermore it also includes size and how it will be financed.

**Peace & Humanity:** One of the core principles in the Olympic charter. The IOC's role is to work with both public and private organizations in the effort to promote peace and serve humanity (The International Olympic Committee. 2015).

**Plans for sport venues:** Related to the completed venues, reconstructing of venues, and construction of new venues in BAU.

**Political and public support:** As describe in BAU criteria.

**Safety:** Risk of natural hazard in the city and especially during the proposed games dates.

**Security:** How much will be spent on security and how high crime rate is in the city. Furthermore, how likely is a terrorist attack?

**Sport Operations:** Experience in hosting major sport events, especially the events that will be competed in the Olympic Games. Related to 'Accountability'.

**Sustainability:** Broad concept here. But includes efficient energy use, conservation of eco-system, avoid carbon footprint, education and sustainable management system.

**Transparency:** Similar to corruption. However, this is to promote transparency in information and governance at IOC.

**Transport:** How the transportation system is in the city and how well it functioning and how the transportation of athletes will be. This also includes airports capacity here.

## **SD criteria**

### ***Economy***

**GDP:** As described in BAU criteria. It is also powerful indicator of economic development, although it does not account for social or environmental cost of production and consumption.

**Inflation rate:** As described in BAU criteria. Furthermore, high inflation rates may be because of extreme financing of public debts through printing of money and can be sign of unsustainable public finance.

**Tourism:** Helps by contributing to the economy of the city/nation. Also there is an increasing general importance of tourism as a strategic sector in the national economy, as it can help to provide an important influence on the economic well-being of the population.

Tourism can also contribute to the economic objectives of governments and display its possible role as a relevant player in moving towards a more innovative economy.

This can be related to the criteria 'Communication and exposure / Image' in BAU since it is important to have good image to appeal to tourists.

**Sustainable public finance:** High and increasing debt can be seen as an indication of unsustainable public finances since it is a burden for future generations because it reduces the amount available for their consumptions and investments. Therefore, a low debt can be a sign of more sustainable finance.

**Transportation:** The use of cars for passenger transportation is generally less energy efficient and has greater environmental and social impacts, such as pollution, global warming as well as a higher accident rate, than public transport. Good system of public transport/bike/walk could indicate cities that are more sustainable. Furthermore, congestion in the city can also indicate unsustainable transportation since waiting in a car can indicate waste of time and more pollution.

**Unemployment rate:** Similar to description in BAU. However, high unemployment rate is not sustainable. Therefore, it is good to have low unemployment rate rather than high as in BAU.

### ***Environment***

**Air quality:** Could indicate health concern in the city. Improving air quality is an important factor for sustainable city.

**Biodiversity:** It is important to have good diversity of species since it prevents extinction of species. It also helps species to adapt better to changes in the environment.

**Ecosystem:** Related to Biodiversity. Protected areas are important for maintaining ecosystem diversity in countries/cities and can minimize the impacts from humans.

**Renewable energy:** Energy from renewables can increase energy security. It can also reduce environmental impact since use of non-renewable energy sources pollute more and therefore contribute to mitigation of climate change and reduce the dependency of non-renewable energy sources.

**Green Spaces:** Percentages of preserved areas for parks or waterways of total land area in the city. Access to green open space could lead to many health benefits including more physical activity, better mental health and reduce healthcare and other costs, and reduced stress (WHO, 2016b).

**Greenhouse Gas Emission:** An increase of greenhouse gasses in the atmosphere contributes to global warming.

**Land use and status:** Could indicate if the city is protective in using land resources. From an environmental perspective, unsustainable land use could indicate land degradation, which could threaten the ecosystem, and lead to natural habitat loss for some species and could also lead to landscape changes.

**Solid waste treatment:** The indicator measure the proportion of waste generated which is recycled, composted, incinerated, or landfilled on a controlled site. Can indicate the impact of the waste management on the environment in the city/country. Appropriate treatment and disposal of waste is important from an environmental and social viewpoint.

**Vulnerability to natural hazards:** Could indicate higher exposure to natural catastrophic events if there are no risk reduction measures programs in the city/country to prevent the hazard. Disaster caused by vulnerability to natural hazards has a negative impact on the development of city/country.

**Water Quality:** Could indicate the quality of life in the city/country, since diarrhoea diseases is largely the consequence of contamination of drinking-water and could also pose economic risks to the tourism sector. This could also indicate how well the waste water system is in the city.

## ***Social***

**Corruption:** Same as in BAU criteria. Also, good governance is essential for sustainable development.

**Crime:** Similar to the Security criterion in Agenda 2020 criteria. Crimes have a very significant negative impact on sustainable development. Crime creates fear and lowers the quality of life in the city.

**Education:** Cities with higher educational level has more probability of reaching their full potential.

**Equality:** Promoting gender equality and the empowerment of women. Could help with defeating poverty and promote sustainable development.

**Health:** Indicates how many have access to primary health care. Accessibility of health is of fundamental significance to reflect on health system progress, equity and sustainable development. However, in this study, the number of hospital bed per 1000 people will be measured as well as healthy life expectancy.

**Population change:** Related to the criterion in the BAU criteria, 'Population', but for SD, the concern is high growth of urban populations, which can be caused by high rate of natural increase (excess of births over deaths) in urban areas, people moving from rural to urban areas or transformation of rural areas to urban places. This can put high stress on cities infrastructures or ecosystems.

**Poverty:** Could indicate the standard of living and how progress toward poverty elimination is in the country. Furthermore, national poverty rate is one of the core measures of living standards.

**Quality public space:** This is a broader concept than Green spaces; this will in addition to green spaces include percentage of roadways in good condition. This is more towards social spaces which the public can use for various reasons.

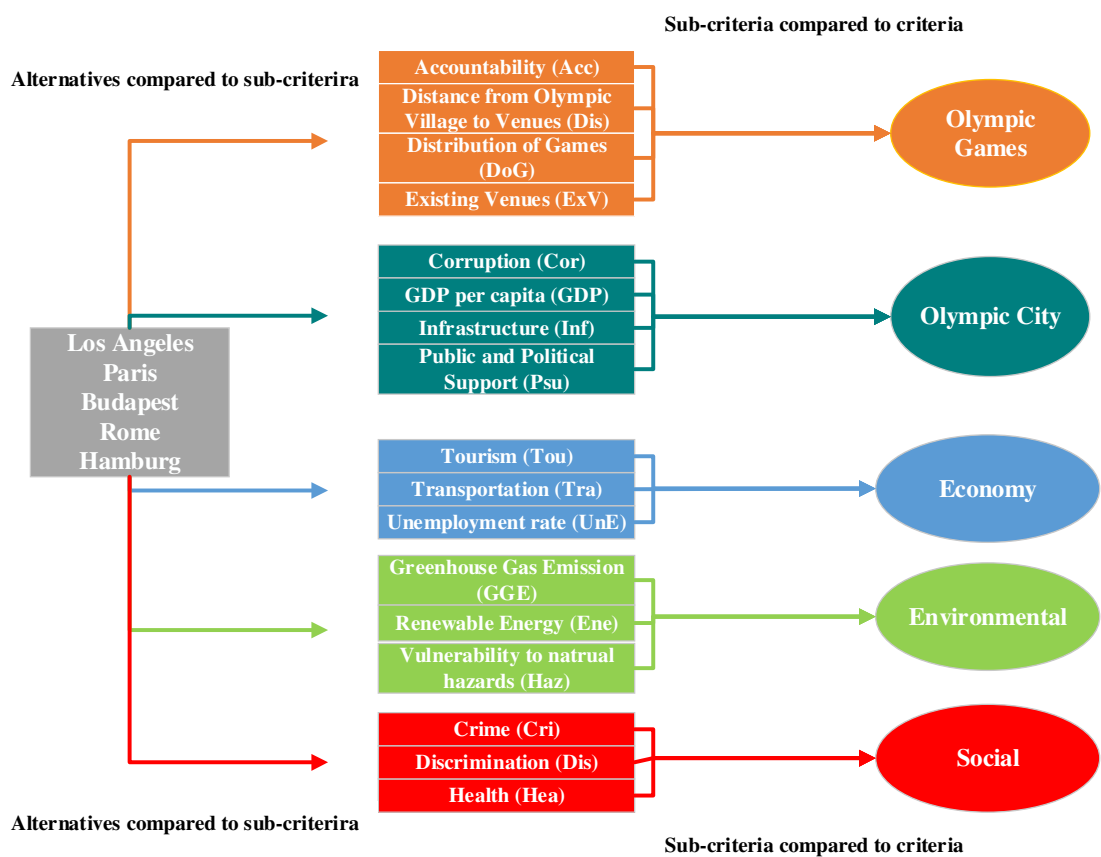
**Sanitation:** Related to water quality but more about accessibility to adequate toilets. It is also necessary for poverty elimination and to protect human health and environment.



# Appendix B - Logbook

## Description

This is a pairwise comparison logbook. Each comparison has a table with the comparison values (values from Table 2-3) and also a description why an alternative is scoring higher than another alternative or if the alternatives are equal. Alternatives are compared to each other for each sub-criterion. Sub-criteria connected together are also compared two by two to the level above, see Figure 5-2.





Accountability					
	LA	PA	BUD	ROM	HAM
LA	1	1	3	2	7
PA	1	1	3	2	7
BUD	1/3	1/3	1	1/2	5
ROM	1/2	1/2	2	1	6
HAM	1/7	1/7	1/5	1/6	1

Source: 'Past Olympic Host City Election Results', 2017; European Athletics, 2013; FINA, 2017; Formula 1®, 2017; IAAF, 2017; FIFA, 2013; 'The Oscars', 2017; 'The Grammys', 2017; 'Roland-Garros', 2017; 'Tour de France', 2017; 'LEN European Aquatics Championships', 2016; FIFA, 2017)

LA-PA	Value	1
Both cities have hosted the Olympic Games twice ('Past Olympic Host City Election Results', 2017). Both have hosted the Men's World Cup final in football (FIFA, 2013). Paris hosts the French Open in tennis every year ('Roland Garros', 2017) and has the last leg of Tour de France every year ('Tour de France', 2017). Los Angeles has hosted the Women's World Cup final in football (FIFA, 2013) and hosts some big non-sporting events such as the Oscars, Grammys and more events related to movies and music ('The Oscars', 2017; 'The Grammys', 2017). Therefore, the cities will be weighted equally.		

LA-BUD	Value	3
Los Angeles is better. Los Angeles has hosted the Olympic Games twice and the World Cup final in football both men's and women's (FIFA, 2013). Budapest will although host the World Swimming Championships in 2017 (FINA, 2017) and has the F1 every year (Formula 1®, 2017) and has hosted multiple European Championships in track and field and swimming (European Athletics, 2013; 'LEN European Aquatics Championships', 2016). But Los Angeles is better due to the hosting of Olympic Games and the World Cup.		

LA-ROM	Value	2
Both cities have hosted the Olympic Games and both have hosted the Men's World Cup final in football (FIFA, 2013). Rome has on the other hand hosted various World Championships in swimming and track and field (FINA, 2017; IAAF, 2017). On the other hand, Los Angeles hosts every year big non-sporting events and has hosted the Olympic Games twice compare to Rome hosting the Olympic Games once. As a 'gut feeling', Los Angeles will be slightly better.		

LA-HAM	Value	7
Los Angeles is a lot better. Hamburg has not hosted major events except quarter final game and stage game at the Men's World Cup in football in 2006 (FIFA, 2017).		

PA-BUD	Value	3
Paris has hosted the Olympic Games twice before and hosts every year French Open in tennis and has the last leg of Tour de France every year ('Roland Garros', 2017; 'Tour de France', 2017). Paris has hosted the final of Men's World Cup final in Football (FIFA, 2013). Budapest will host the World Swimming Championships in 2017 (FINA, 2017) and has the F1 every year (Formula 1®, 2017) and has hosted European Championships in track and field and swimming (European Athletics, 2013; 'LEN European Aquatics Championships', 2016). But as a 'gut feeling', Paris is better compared to Budapest because of the Olympic Games and the World Cup.		

PA-ROM	Value	2
Paris is slightly better. Paris has hosted the Olympic Games twice before and hosts every year French Open in tennis and has the last leg of Tour de France every year. Both of the cities have hosted the final of Men's World Cup final in football. But Paris is slightly better since it has hosted the Olympic Games twice.		

PA-HAM	Value	7
Paris is a lot better. Hamburg has not hosted major events except quarter final game and stage game at the Men's World Cup in football in 2006 (FIFA, 2017).		

BUD-ROM	Value	1/2
Rome is slightly better than Budapest. Rome has hosted the Olympic Games and multiple World Championships in track and field and swimming. Budapest will host the World Swimming Championships in 2017 (FINA, 2017) and has F1 every year (Formula 1®, 2017) and has hosted the European Championships in track and field and swimming (European Athletics, 2013; 'LEN European Aquatics Championships', 2016).		

BUD-HAM	Value	5
Budapest is stronger than Hamburg. Both cities have not hosted the Olympic Games before. However, Budapest has hosted the European Championships in swimming and track and field multiple times and hosts every year the F1. Furthermore Budapest will host the World Swimming Championships in 2017.		

ROM-HAM	Value	6
Rome is stronger compared to Hamburg. Hamburg has never hosted the Olympics and other major competitions.		

#### Scores for cities for Accountability

Alternative	Score
Los Angeles	0.325
Paris	0.325
Budapest	0.121
Rome	0.192
Hamburg	0.036

Inconsistency	0.02
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Distance from Olympic Village to Venues					
	LA	PA	BUD	ROM	HAM
LA	1	1/5	1/7	1/2	1/7
PA	5	1	1/3	4	1/3
BUD	7	3	1	7	2
ROM	2	1/4	1/7	1	1/5
HAM	7	3	1/2	5	1

**Source:** Los Angeles 2024 Exploratory Committee, 2016; *Paris Candidature File Stage 1*, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2015.

LA-PA	Value	1/5
Paris is better than Los Angeles. The average distance is 15 km in Paris ( <i>Paris Candidature File Stage 1</i> , 2016). In Los Angeles the average distance is 26 km (Los Angeles 2024 Exploratory Committee, 2016).		

LA-BUD	Value	1/7
Budapest has average distance of 8 km (Budapest 2024 Committee, 2016). Therefore, Budapest will be much stronger compared to Los Angeles.		

LA-ROM	Value	1/2
Rome is slightly better than Los Angeles. The average distance is 22 km in Rome compared to 26 km in Los Angeles (Comitato organizzatore Roma 2024, 2016; Los Angeles 2024 Exploratory Committee).		

LA-HAM	Value	1/7
Hamburg is much stronger compared to Los Angeles. The average distance in Hamburg is 10 km (Hamburg, 2015). However, the distance in Hamburg is estimated from its vision book which had proposed venue sites but distances were estimated using Google Maps.		

PA-BUD	Value	1/3
Budapest is better than Paris. The average distance in Paris is 15 km but 8 km in Budapest (Paris Candidature File Stage 1, 2016; Budapest 2024 Committee, 2016).		

PA-ROM	Value	4
Paris is better compared to Rome. The average distance in Paris is 15 km but 22 km in Rome (Paris Candidature File Stage 1, 2016; Comitato organizzatore Roma 2024, 2016).		

PA-HAM	Value	1/3
Hamburg is stronger than Paris. Average distance in Hamburg is 10 km (estimation) but 15 km in Paris (Paris Candidature File Stage 1, 2016; Hamburg, 2015).		

BUD-ROM	Value	7
Budapest is much better compared to Rome. Average distance in Budapest is 8 km while 22 km in Rome (Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016).		

BUD-HAM	Value	2
The cities are close but Budapest is slightly better compared to Hamburg (8km versus 10km) (Budapest 2024 Committee, 2016; Hamburg, 2015).		

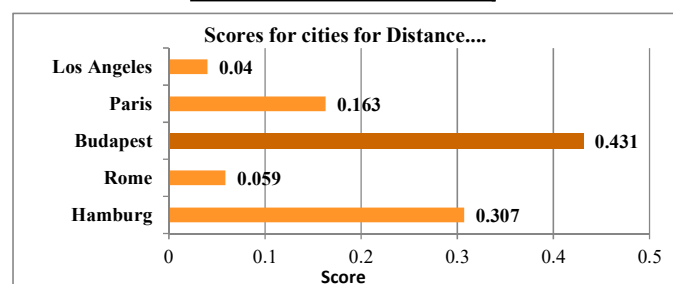
ROM-HAM	Value	1/5
Hamburg is better than Rome. The average distance in Hamburg is 10 km (estimation) but in Rome 22 km (Hamburg, 2015; Comitato organizzatore Roma 2024, 2016).		

#### Scores for cities for Distance....

\*: Distance from Olympic Village to Venues

Alternative	Score
Los Angeles	0.04
Paris	0.163
Budapest	0.431
Rome	0.059
Hamburg	0.307

Inconsistency	0.04
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Distribution of Games					
	LA	PA	BUD	ROM	HAM
LA	1	3	1/5	2	1/3
PA	1/3	1	1/7	1/2	1/5
BUD	5	7	1	5	3
ROM	1/2	2	1/5	1	1/4
HAM	3	5	1/3	4	1

Source: 'Past Olympic Host City Election Results', 2017.

LA-PA	Value	3
Los Angeles will be slightly better. It is longer time since the Olympic Games were held in America than Europe. But both cities have held the Olympic Games twice. However, the Olympic Games were held in London in 2012 which is close to Paris.		

LA-BUD	Value	1/5
Budapest is stronger than Los Angeles. The Olympic Games have never been held in Budapest and in Hungary. However it is longer since the Olympic Games have been in North America compared to Europe. But the Summer Olympic Games have only been held once before in east Europe in Moscow 1980 and furthermore Los Angeles has hosted twice before.		

LA-ROM	Value	2
Los Angeles is slightly better than Rome. Although Los Angeles has hosted the Olympic Games two times before but Rome only once it is longer since the Olympic Games were in North America than in Europe.		

LA-HAM	Value	1/3
Hamburg is better. The Olympic Games have never been held in Hamburg. However, the Olympic Games have been held in Germany before and were in Europe in 2012 in London, which is close to Hamburg. But Los Angeles has hosted twice before and therefore Hamburg is better.		

PA-BUD	Value	1/7
Budapest is much better compared to Paris. The Olympic Games have never been held in Budapest and in Hungary but two times in Paris. Furthermore, the Olympic Games were held in London 2012 which is close to Paris. The Summer Olympic Games have also only been held once before in Eastern Europe.		

PA-ROM	Value	1/2
Rome is slightly better. Rome has hosted the Olympic Games once compared to Paris hosting twice. Furthermore, the Olympic Games were held in London in 2012 which is close to Paris.		

PA-HAM	Value	1/5
Hamburg is better than Paris. Paris has hosted the Olympic Games twice but Hamburg has never hosted the Olympic Games.		

BUD-ROM	Value	5
Budapest is better. Budapest has never hosted the Olympic Games but Rome has hosted once. Also, the Summer Olympic Games have only been held once before in Eastern Europe.		

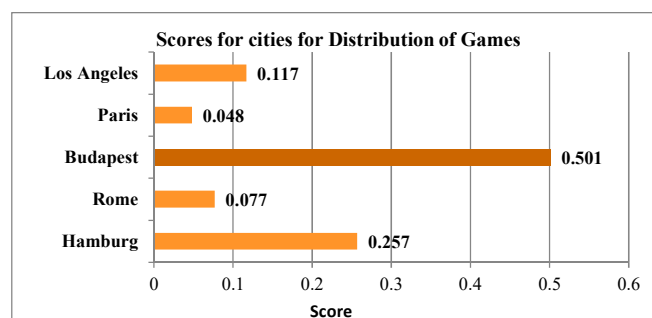
BUD-HAM	Value	3
Budapest is better than Hamburg. Both cities have never hosted the Olympic Games. Germany has, however, hosted the Olympic Games but Hungary has not. Furthermore, the Olympic Games have only been held once before in Eastern Europe.		

ROM-HAM	Value	1/4
Hamburg is better than Rome. Hamburg has never hosted the Olympic Games but Rome has hosted the Olympic Games once. Both countries have hosted the Olympic Games before.		

#### Scores for cities for Distribution of Games

Alternative	Score
Los Angeles	0.117
Paris	0.048
Budapest	0.501
Rome	0.077
Hamburg	0.257

Inconsistency	0.03
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Existing Venues					
	LA	PA	BUD	ROM	HAM
LA	1	3	7	5	7
PA	1/3	1	5	3	5
BUD	1/7	1/5	1	1/3	1
ROM	1/5	1/3	3	1	3
HAM	1/7	1/5	1	1/3	1

Source: Los Angeles 2024 Exploratory Committee, 2016; Paris Candidature File Stage 1, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2015.

LA-PA	Value	3
Los Angeles is better than Paris. Los Angeles has 63% venues already existing and 2% of venues will only need small work (Los Angeles 2024 Exploratory Committee, 2016). Paris has 41% venues already existing and 27% of venues will only need small work (Paris Candidature File Stage 1, 2016). However, additional and planned venues are similar for both cities (around 8% in Los Angeles and 10% in Paris). Paris will, however, need to construct the Olympic Village and the aquatic complex but Los Angeles will use existing UCLA campus as a Olympic Village.		

LA-BUD	Value	7
Los Angeles is stronger than Budapest. Budapest will need to build more than 40% of the venues (Budapest 2024 Committee, 2016) and only around 39% of venues exists or will need small work.		

LA-ROM	Value	5
Existing venues in Rome is 45% (Comitato organizzatore Roma 2024, 2016). Therefore, Los Angeles is stronger.		

LA-HAM	Value	7
Hamburg is estimated to be similar to Budapest area (Hamburg, 2015). Therefore, Los Angeles will be stronger.		

PA-BUD	Value	5
Paris is stronger. Paris has 41% venues already existing and 27% venues will only need small work and around 8% are additional and planned venues (Paris Candidature File Stage 1, 2016). Budapest has 39% existing venues and around 42% additional and planned venues (Budapest 2024 Committee, 2016).		

PA-ROM	Value	3
Paris is better. Rome has, however, more existing venues (45% to 41% in Paris) but Paris will upgrade more existing venues (27% in Paris compared to 16% in Rome). Paris will also build fewer new venues. (10% in Paris compared to 19% in Rome) (Paris Candidature File Stage 1, 2016; Comitato organizzatore Roma 2014, 2016).		

PA-HAM	Value	5
Hamburg is estimated to be similar to Budapest. Therefore, Paris is stronger.		

BUD-ROM	Value	1/3
Rome is better compared to Budapest due to more existing venues (45% versus 31%) and less new or planned venues (19% versus 42%) (Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016).		

BUD-HAM	Value	1
Hamburg is estimated to be similar to Budapest since the planned main Olympic Park in Hamburg is similar to the one in Budapest.		

ROM-HAM	Value	3
Hamburg is estimated to be similar to Budapest. Rome is, therefore, better compared to Hamburg.		

#### Scores for cities for Existing Venues

Alternative	Score
Los Angeles	0.514
Paris	0.258
Budapest	0.053
Rome	0.122
Hamburg	0.053

Inconsistency	0.03
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Olympic Games				
	Acc	Dis	DoG	ExV
Acc	1	1/3	1	1/5
Dis	3	1	3	1/3
DoG	1	1/3	1	5
ExV	5	3	1/5	1

Source: IOC Candidature Acceptance Working Group, 2004, 2008; 'Past bid results', 2017.

Acc-Dis	Value	1/3
Distance from Olympic Village to Venues' can be related to Olympic Village and Transport in the past screening assessment (IOC Candidature Acceptance Working Group, 2000, 2004, 2008, 2012). In these reports Olympic Village and Transport have weights of 3 out of 5. On the other hand 'Accountability' has the weight of 2 out of 5 in these reports. Therefore, 'Distance from Olympic Village to Venues' will be slightly more important than 'Accountability'.		

Acc-DoG	Value	1
There is no 'Distribution of Games' in the past IOC screening assessments. However, it is important for the IOC to rotate the Olympic Games between the continents and in the last decades, Summer Olympic Games have never been held two times in a row in the same continent ('Past bid results', 2017). However, the next three Olympic Games will all be staged in Asia (2018 Winter Olympics, 2020 Summer Olympics and 2022 Winter Olympics) (Ibid.). Furthermore, Beijing will host the Winter Olympics in 2022 just 14 years after hosting the Summer Olympics (Ibid.). This can indicate that the IOC does not look as much into the distribution as before. However, 'Accountability' and 'Distribution of the Games' will be weighted equally since it is still important to have some distribution of the Games but also having a city that is capable of hosting big events.		

Acc-ExV	Value	1/5
Existing Venues' is important to the IOC and in past screening assessments reports, sport venues got weight 4 out of 5. 'Accountability' had a weight of 2 out of 5. Therefore, 'Existing Venues' is stronger than 'Accountability' (IOC Candidature Acceptance Working Group, 2000, 2004, 2008, 2012).		

Dis-DoG	Value	3
As mentioned in 'Acc-Dis' above, 'Distance from Olympic Village to Venues' has weight 3 out of 5 in past screening reports from the IOC and as mentioned in 'Acc-DoG', 'Distribution of Games' is equal to 'Accountability'. Therefore, 'Distance from Olympic Village to Venues' will be more important than 'Distribution of Games'.		

Dis-ExV	Value	1/3
In the past screening reports, 'Existing Venues' (sport venues) has been more important than 'Distance from Olympic Village to Venues' (4 versus 3) (IOC Candidature Acceptance Working Group, 2000, 2004, 2008, 2012). Therefore 'Existing Venues' will be more important than 'Distance from Olympic Village to Venues'.		

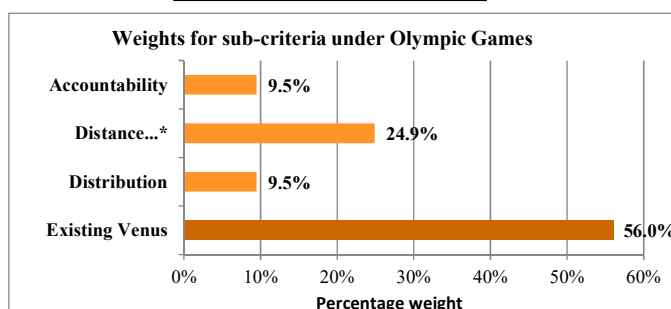
DoG-ExV	Value	5
Existing Venues' is important in the past screening reports as stated in 'Acc-ExV' and furthermore, 'Distribution of Games' is equal to 'Accountability'. Therefore 'Existing Venues' will be stronger than 'Distribution of Games'.		

#### Weights for sub-criteria under Olympic Games

Sub-criterion	Weight
Accountability	9.5%
Distance...*	24.9%
Distribution	9.5%
Existing Venus	56.0%

\*: Distance from Olympic Village to Venues

Inconsistency	0.02
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Corruption					
	LA	PA	BUD	ROM	HAM
LA	1	2	6	6	1/3
PA	1/2	1	5	5	1/4
BUD	1/6	1/5	1	1	1/7
ROM	1/6	1/5	1	1	1/7
HAM	3	4	7	7.2	1

Source: Transparency International, 2017; Nossiter, 2017.

Notes: Higher points from Transparency International are better and the highest point possible is 100. Moreover, if a nation is number 1 on the list, it means that the nation is the least corrupted country.

LA-PA	Value	2
U.S. is slightly less corrupted than France according to Transparency International (Transparency International, 2017). However it could have changed with the election of Donald Trump as president last year. However in France there has been news about politicians hiring relatives (Nossiter, 2017). Nevertheless, Los Angeles will be slightly better since U.S. is better according to Transparency International.		

LA-BUD	Value	6
Los Angeles is stronger than Budapest. U.S. is number 18 on the corruption list with 74 points and Hungary is number 57 with 48 points (Transparency International, 2017).		

LA-ROM	Value	6
Los Angeles is stronger than Rome. Italy is number 60 on the corruption list with 47 points compared to U.S. being number 18 with 74 (Transparency International, 2017). It can also be assumed that Italy and Hungary are similar since there is only 1 point between them on the corruption list.		

LA-HAM	Value	1/3
Hamburg is better than Los Angeles. Germany is number ten on the list from Transparency International with 81 points but U.S. is number 18 with 74 points (Transparency International, 2017).		

PA-BUD	Value	5
Paris is stronger than Budapest. France is number 23 on the list with 69 points and Hungary is number 57 with 48 points (Transparency International, 2017).		

PA-ROM	Value	5
Paris is stronger than Rome. Similar to PA-BUD.		

PA-HAM	Value	1/4
Hamburg is better than Paris. Hamburg has 81 points and France 69 points in the report from Transparency International. Also, in France there has been news about politicians hiring relatives (Transparency International, 2017; Nossiter, 2017).		

BUD-ROM	Value	1
These two cities are similar. Only 1 point difference between the two countries in the report from Transparency International (Transparency International, 2017).		

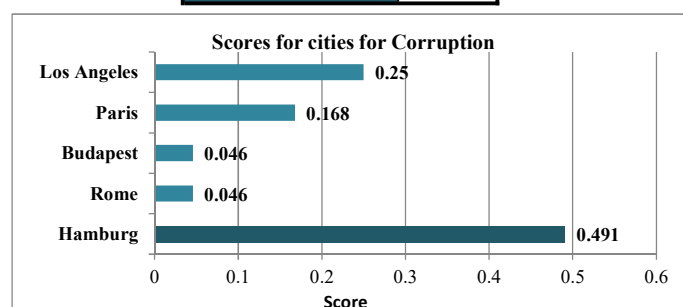
BUD-HAM	Value	1/7
Hamburg is much stronger than Budapest. Germany is number ten on the list with 81 points compared to Hungary with 48 points (Transparency International, 2017).		

ROM-HAM	Value	1/7
Hamburg is much stronger than Rome. Rome is similar to Budapest and therefore, Hamburg is stronger.		

#### Scores for cities for Corruption

Alternative	Score
Los Angeles	0.25
Paris	0.168
Budapest	0.046
Rome	0.046
Hamburg	0.491

Inconsistency	0.04
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GDP					
	LA	PA	BUD	ROM	HAM
LA	1	1/3	5	3	1/3
PA	3	1	7	5	1/2
BUD	1/5	1/7	1	1/3	1/7
ROM	1/3	1/5	3	1	1/5
HAM	3	2	7	5	1

Source: Eurostat, 2016a; 'GDP per capita for Los Angeles', 2013; 'Euro to U.S. Dollar', 2016.

LA-PA	Value	1/3
Paris is better compared to Los Angeles. Paris had a GDP of 72,000 US dollars per capita in 2014 (Eurostat, 2016a) and Los Angeles had an estimated GDP of 59,000 U.S. dollars per capita in 2014 ('GDP per capita for Los Angeles', 2013). The number for Paris was in Euros but was converted using exchange rate of 1.33 ('Euro to U.S. dollar', 2016).		

LA-BUD	Value	5
Los Angeles is stronger compared to Budapest. Los Angeles had an estimated GDP of 59,000 U.S. dollars per capita in 2014 ('GDP per capita for Los Angeles', 2013) while Budapest had GDP of 22,000 U.S. dollars per capita in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar', 2016).		

LA-ROM	Value	3
Los Angeles is better compared to Rome. Rome had GDP of 42,000 U.S. dollars per capita (Eurostat, 2016a; 'Euro to U.S. dollar', 2016). Los Angeles had an estimated GDP of 59,000 U.S. dollars per capita ('GDP per capita for Los Angeles', 2013).		

LA-HAM	Value	1/3
Hamburg is better than Los Angeles. Los Angeles had an estimated GDP of 59,000 U.S. dollars per capita in 2014 ('GDP per capita for Los Angeles', 2013) and Hamburg had GDP of 78,000 U.S. dollars per capita in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar', 2016).		

PA-BUD	Value	7
Paris is much stronger than Budapest. Paris had a GDP of 72,000 U.S. dollars per capita compared to 22,000 US dollars per capita in Budapest in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar', 2016).		

PA-ROM	Value	5
Paris is stronger than Rome. Paris had a GDP of 72,000 U.S. dollars per capita in 2014 compared to 42,000 U.S. dollars per capita in 2014 in Rome (Eurostat, 2016a; 'Euro to U.S. dollar ', 2016).		

PA-HAM	Value	1/2
Hamburg is slightly better than Paris. Hamburg had a GDP of 78,000 U.S. dollars per capita while Paris had GDP of 72,000 U.S. dollars per capita in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar', 2016).		

BUD-ROM	Value	1/3
Rome is better than Budapest, Rome had a GDP of 42,000 U.S. dollars per capita compared to 22,000 U.S. dollars per capita in Budapest in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar', 2016).		

BUD-HAM	Value	1/7
Hamburg is much better compared to Budapest. Hamburg had a GDP of 72,000 U.S. dollars per capita compared to 22,000 U.S. dollars per capita in Budapest in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar ', 2016).		

ROM-HAM	Value	1/5
Hamburg is stronger than Rome. Hamburg had a GDP of 78,000 U.S. dollars per capita compared to 42,000 U.S. dollars in Rome in 2014 (Eurostat, 2016a; 'Euro to U.S. dollar', 2016).		

#### Scores for cities for GDP

Alternative	Score
Los Angeles	0.157
Paris	0.315
Budapest	0.038
Rome	0.075
Hamburg	0.415

Inconsistency	0.04
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Infrastructure					
Infrastructure is number of hotel rooms and capacity of airport					
	LA	PA	BUD	ROM	HAM
LA	1	1/2	7	3	7
PA	2	1	8	4	8
BUD	1/7	1/8	1	1/3	1
ROM	1/3	1/4	3	1	3
HAM	1/7	1/8	1	1/3	1

**Source:** Los Angeles 2024 Exploratory Committee, 2016; *Paris Candidature File Stage 1*, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Brabant & Schwendner, 2014; Hungarian Central Statistical Office, 2017; Los Angeles World Airports, 2016, 2017; John Wayne Airport, 2017; Hamburg Airport, 2016; Aeroporti di Roma, 2017; *Paris Aéroports*, 2016.

LA-PA	Value	1/2
Paris is estimated to have more hotels rooms than Los Angeles. Paris is estimated to have 142,000 compared to 102,000 in Los Angeles before 2024 (Los Angeles 2024 Exploratory Committee, 2016; <i>Paris Candidature File Stage 1</i> , 2016). Paris had also more passengers in its airports in 2015 or 95 million passengers compared to 89 million passengers in Los Angeles (Paris Aéroports, 2016; Los Angeles World Airports, 2016, 2017; John Wayne Airport, 2017). Therefore, Paris is slightly better.		

LA-BUD	Value	7
Los Angeles is much stronger than Budapest. Budapest is estimated to have 29,000 hotel rooms before 2024 (Budapest 2024 Committee, 2016). Budapest had also only 10 million passengers in 2015 in its airport (Hungarian Central Statistical Office, 2017). Los Angeles is estimated to have 120,000 hotel rooms available before 2024 and had, also, 89 million passengers in its airports in 2015 (Los Angeles 2024 Exploratory Committee, 2016; Los Angeles World Airports, 2016, 2017; John Wayne Airport, 2017).		

LA-ROM	Value	3
Los Angeles is better than Rome. Rome is estimated to have 64,000 hotel rooms before 2024 (Comitato organizzatore Roma 2024, 2016). Also 46 million passengers went through Rome airports in 2015 (Aeroporti di Roma, 2017). Los Angeles is estimated to have 120,000 hotel rooms before 2024. Los Angeles also had 89 million passengers in 2015 in its airports (Los Angeles 2024 Exploratory Committee, 2016; Los Angeles World Airports, 2016, 2017; John Wayne Airport, 2017).		

LA-HAM	Value	7
Los Angeles is much stronger than Hamburg. Hamburg is estimated to have around 26,000 hotel rooms in the next years (Brabant & Schwendner, 2014). Hamburg airport also served 16 million passengers in 2015 (Hamburg Airport, 2016). Los Angeles is estimated to have 102,000 hotel rooms in 2024 and had 89 million passengers in 2015 in its airports (Los Angeles 2024 Exploratory Committee, 2016; Los Angeles World Airports, 2016, 2017; John Wayne Airport, 2017).		

PA-BUD	Value	8
Paris is much better than Budapest. Paris is estimated to have more hotel rooms in 2024 or 140,000 compared to 29,000 in Budapest ( <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016). Paris had also more airports passengers in 2015 or 95 million passengers compared to 10 million passengers in Budapest ( <i>Paris Aéroports</i> , 2016; Hungarian Central Statistical Office, 2017).		

PA-ROM	Value	4
Paris is stronger compared to Rome. Paris is estimated to have more hotel rooms in 2024 or 142,000 compared to 64,000 in Rome ( <i>Paris Candidature File Stage 1</i> , 2016; Comitato organizzatore Roma 2024, 2016). Paris had also more airport passengers in 2015 or 95 million passengers compared to 46 million passengers in Rome ( <i>Paris Aéroports</i> , 2016; Aeroporti di Roma, 2017).		

PA-HAM	Value	8
Paris is much stronger than Hamburg. Paris had more airport passengers in 2015 or 95 million passengers compared to 10 million passengers in Hamburg ( <i>Paris Aéroports</i> , 2016; Hamburg Airport, 2016). Paris is, also, estimated to have 142,000 rooms before 2024 compared to Hamburg with 26,000 rooms in next years ( <i>Paris Candidature File Stage 1</i> ; 2016, Brabant & Schwendner, 2014).		

BUD-ROM	Value	1/3
Rome is stronger than Budapest. Rome is estimated to have more hotel rooms in 2024 or 64,000 compared to 29,000 in Hamburg (Budapest 2024 Committee, 2016, Comitato organizzatore Roma 2024, 2016). Rome had also more airport passengers in 2015 or 46 million passengers compared to 10 million passengers in Budapest (Aeroporti di Roma, 2017; Hungarian Central Statistical Office, 2017).		

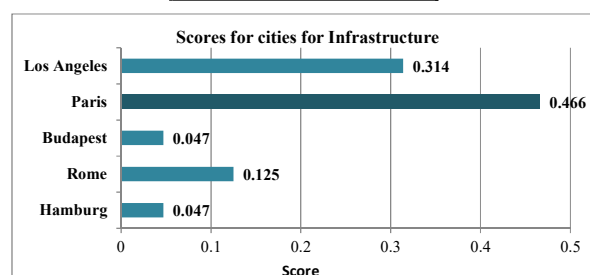
BUD-HAM	Value	1
The cities are similar. Budapest has more estimated hotel rooms or 28,000 compared to 26,000 in Hamburg (Budapest 2024 Committee, 2016, Brabant & Schwendner, 2014). Hamburg had however, more airport passengers in 2015 or 15 million passengers compared to 10 million passengers in Budapest (Hamburg Airport, 2016; Hungarian Central Statistical Office, 2017).		

ROM-HAM	Value	3
Rome is stronger than Hamburg. Rome is estimated to have 64,000 hotel rooms in 2024 but Hamburg 26,000 hotel rooms (Comitato organizzatore Roma 2024, 2016; Brabant & Schwendner, 2014). Rome had also more airport passengers in 2015 or 46 million passengers compared to 15 million passengers in Hamburg (Aeroporti di Roma, 2017; Hamburg Airport, 2016).		

#### Scores for cities for Infrastructure

Alternative	Score
Los Angeles	0.314
Paris	0.466
Budapest	0.047
Rome	0.125
Hamburg	0.047

Inconsistency	0.01
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Public and political support					
	LA	PA	BUD	ROM	HAM
LA	1	2	5	5	7
PA	1/2	1	4	4	6
BUD	1/5	1/4	1	1	3
ROM	1/5	1/4	1	1	3
HAM	1/7	1/6	1/3	1/3	1

Source: Rowbottom, 2016; Mackay, 2016; 'Over 50 Mayors from World Capitals', 2017; Dunai, 2017; Wickström, 2017; Giorgio, 2016; Huggler, 2015.

LA-PA	Value	2
Los Angeles is slightly better. Both cities have high support from the public and politicians in the cities but Los Angeles has higher percentage support compared to Paris (Rowbottom, 2016; Mackay, 2016). However, Paris has support from 50 mayors from around the world ('Over 50 Mayors From World Capitals', 2017). But the comparisons will be more about the support from the city. Therefore, Los Angeles is better.		

LA-BUD	Value	5
Los Angeles is stronger than Budapest. Budapest had a protest against the Olympic Games with more than 200,000 people signing for a referendum (Dunai, 2017). The city council of Budapest later dropped the bid in February 2017 (Wickström, 2017).		

LA-ROM	Value	5
Rome has similar case as Budapest. In Rome the city council made a vote in the city panel to drop the bid in September 2016 (Giorgio, 2016). Therefore, Los Angeles is stronger.		

LA-HAM	Value	7
Hamburg held a referendum if the city should go forward with the Olympic Bid. The public voted against hosting the Olympic Games with 51.6% against hosting the Olympic Games (Huggler, 2015). Therefore, Los Angeles is much stronger than Hamburg.		

PA-BUD	Value	4
Paris is stronger than Budapest. Paris has a high support from the public and the politicians (Rowbottom, 2016). But in Budapest the city council cancelled the bid due to protest (Wickström, 2017).		

PA-ROM	Value	4
Paris is better. Paris has high support from the public and politicians while Rome cancelled the bid (Rowbottom, 2016; Giorgio, 2016).		

PA-HAM	Value	6
Paris is much better than Hamburg. Hamburg voted in a referendum to cancel the bid while Paris has a strong support (Rowbottom, 2016; Huggler, 2015).		

BUD-ROM	Value	1
Both cities dropped their bids without referendum (Giorgio, 2016; Huggler, 2015). Therefore the cities are equal.		

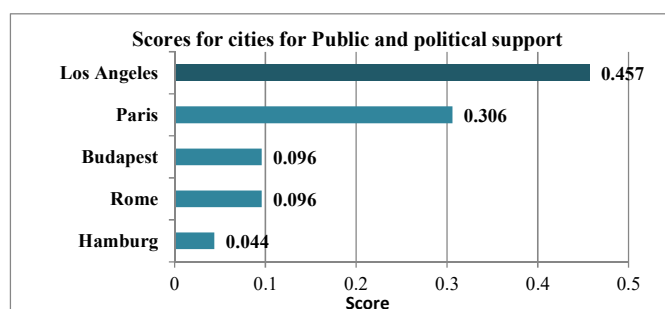
BUD-HAM	Value	3
Budapest is better. Both cities dropped their bids but Budapest did not have a referendum. Although they had over 200,000 people write their name to have a referendum (Dunai, 2017). But it is still unsure if it would have been more than 50% of people against the Olympic Games if the referendum would have been held.		

ROM-HAM	Value	3
Since Budapest and Rome are similar it can be assumed that Rome is also better than Hamburg.		

#### Scores for cities for Public and political support

Alternative	Score
Los Angeles	0.457
Paris	0.306
Budapest	0.096
Rome	0.096
Hamburg	0.044

Inconsistency	0.03
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Olympic City				
	Cor	GDP	Inf	Psu
Cor	1	1/3	1/5	1/3
GDP	3	1	1/3	2
Inf	5	3	1	3
Psu	3	1/2	1/3	1

Source: IOC Candidature Acceptance Working Group, 2000, 2004, 2008, 2012;  
Beijing awarded 2008 Olympics', 2001; 'Sochi given 2014 Winter Olympics', 2007)

Cor-GDP	Value	1/3
Finance is weighted more important than Government, Legal issues and Support in the past screening assessments from the IOC (IOC Candidature Acceptance Working Group, 2000, 2004, 2008,2012). Finance has weight 2 out of 5 while Government has 1 out of 5. 'Corruption' can be connected to the Government, Legal issues and support and 'GDP' can be connected to Finance. Therefore, 'GDP' will be more important than 'Corruption'.		

Cor-Inf	Value	1/5
Infrastructure' is accommodation and capacity of airport in this study. In the screening reports, accommodation has weight 5 out of 5. General infrastructures has also weight 5 out of 5 (IOC Candidature Acceptance Working Group, 2000, 2004, 2008,2012). Therefore, 'Infrastructure' will be stronger than 'Corruption' in this study. Also looking back to recent selections of host cities it can be argued that 'Corruption' is less important than 'Infrastructure' ('Beijing awarded 2008 Olympics', 2001; 'Sochi given 2014 Winter Olympics', 2007).		

Cor-Psu	Value	1/3
These two criteria 'Corruption' and 'Public and Political support' are in the same criteria group in the past screening reports from the IOC and should be equally weighted (IOC Candidature Acceptance Working Group, 2000, 2004, 2008,2012). But a 'gut feeling' says 'Public and Political support' is more important since it can have a saying if cities will continue with their bid and also can be a big factor for a successful Olympic Games. Moreover, as stated before, 'Corruption' has not been that important in the past selections. Therefore, 'Public and Political support' will be slightly better than 'Corruption'.		

GDP-Inf	Value	1/3
Infrastructure has 5 out of 5 in weight in the past screening reports from the IOC (IOC Candidature Acceptance Working Group, 2000, 2004, 2008,2012). Also Finance has the weight of 2 of 5. Therefore, 'Infrastructure' will be stronger than 'GDP'.		

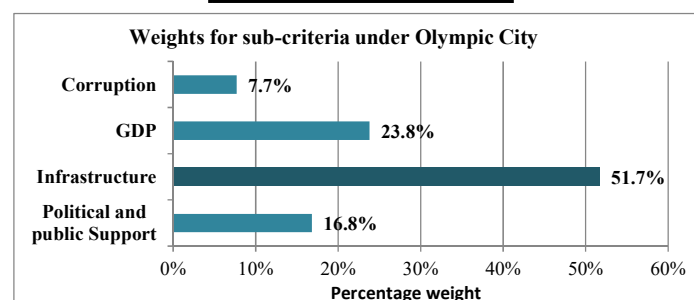
GDP-Psu	Value	2
Finance has been more important to the IOC in the past screening assessment compared to Government, Legal issues and Support (IOC Candidature Acceptance Working Group, 2000, 2004, 2008,2012). However 'Public and Political support' can be seen important today to get the bids to continue as stated in 'Cor-Psu'. However, 'GDP' will be slightly more important.		

Inf-Psu	Value	3
Infrastructure gets 5 out of 5 in weight in past screening assessments and Government, Legal issues and Support gets 2 out of 5 (IOC Candidature Acceptance Working Group,2000, 2004, 2008,2012). Furthermore 'GDP' and 'Public and Political support' were equally weighted above. Therefore, 'Infrastructure' is stronger than 'Public and Political support'.		

#### Weights for sub-criteria under Olympic City

Sub-criterion	Weight
Corruption	7.7%
GDP	23.8%
Infrastructure	51.7%
Political and public Support	16.8%

Inconsistency	0.04
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Tourism					
	LA	PA	BUD	ROM	HAM
LA	1	1/2	3	1/2	7
PA	2	1	5	2	8
BUD	1/3	1/5	1	1/5	3
ROM	2	1/2	5	1	7
HAM	1/7	1/8	1/3	1/7	1

Source: Euromonitor International, 2016.

LA-PA	Value	1/2
According to Euromonitor International, Paris had more tourists in 2015 compared to Los Angeles. However, as a 'gut feeling', U.S. is strong in marketing their products and could get many people interested to visit Los Angeles for the Olympic Games. However, Paris will be slightly better than Los Angeles because of the number of tourists and a 'gut feeling' says Paris has better image than Los Angeles as a tourist city.		

LA-BUD	Value	3
Budapest has some attractions such as the geothermal spas. However, there were more tourists going to Los Angeles according to Euromonitor International in 2015 and furthermore, a 'gut feeling' says that Los Angeles is better in marketing than Budapest.		

LA-ROM	Value	1/2
Rome has the ancient Rome. There were also more tourists going to Rome than Los Angeles according to Euromonitor International in 2015, but as a 'gut feeling' Los Angeles is stronger in marketing. However, despite that, Rome will be slightly better.		

LA-HAM	Value	7
There were more tourists going to Los Angeles in 2015. Furthermore, Hamburg is not on the top 100 list over most tourist cities in 2015. Therefore, Los Angeles is much stronger.		

PA-BUD	Value	5
Paris had more tourists in 2015 according to Euromonitor International. Both of them have some interesting attractions but Paris has a stronger image. Therefore, Paris is stronger than Budapest.		

PA-ROM	Value	2
Paris had more tourists than Rome in 2015. Both cities have many interesting attractions. However, due to more tourists in Paris, Paris will be slightly better. But a 'gut feeling' says that the image of the cities are similar.		

PA-HAM	Value	8
Hamburg was not one of the top 100 cities in the world for number of tourists in 2015. Therefore, Paris is much stronger than Hamburg. Also, the image is stronger in Paris than in Hamburg.		

BUD-ROM	Value	1/5
Rome had more tourists in 2015 and furthermore, as a 'gut feeling' has more general attractions than Budapest. Also a 'gut feeling' says Rome has better image. Therefore, Rome is stronger than Budapest.		

BUD-HAM	Value	3
Budapest had more tourists than Hamburg in 2015. Also, a 'gut feeling' says Budapest has more attractions than Hamburg. Therefore, Budapest will be better than Hamburg.		

ROM-HAM	Value	7
Rome had a lot more tourists in 2015. A 'gut feeling' also assumes that Rome has more attractions than Hamburg. Therefore, Rome is much stronger than Hamburg.		

#### Scores for cities for Tourism

Alternative	Score
Los Angeles	0.198
Paris	0.397
Budapest	0.075
Rome	0.294
Hamburg	0.035

Inconsistency	0.03
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Transportation					
	LA	PA	BUD	ROM	HAM
LA	1	1/5	1/5	1/3	1/5
PA	5	1	1	3	2
BUD	5	1	1	3	2
ROM	3	1/3	1/3	1	1/2
HAM	5	1/2	1/2	2	1

Source: Cookson & Pishue, 2017; EPOMM, 2017; City of Los Angeles, 2015; 'Rome', 2011.

**Note:** For Transport modes it was difficult to get data from the same year for the cities but it was possible to get data from websites from different years. Although the data is not from the same year for all the cities, it can indicate in some way how the split is between different transport modes in the cities.

LA-PA	Value	1/5
<b>Data for Paris is from 2008 and for Los Angeles from 2003.</b>		
Paris is stronger than Los Angeles. In Paris, 47% walked and 33% commuted using public transport and only 17% went with car in 2008 (EPOMM, 2017). In Los Angeles, 76% travelled by car and only 5% commuted using public transport in 2003 (City of Los Angeles, 2015). Paris had also less congestion according to INRIX in 2016 (Cookson & Pishue, 2017).		

LA-BUD	Value	1/5
<b>Data for Budapest is from 2014 and for Los Angeles from 2003.</b>		
Budapest is stronger than Los Angeles. In Budapest 45% commuted using public transport and only 35% travelled by car in 2014 (EPOMM, 2017). In Los Angeles 76% went by car in 2003 (City of Los Angeles, 2015). There was also less congestion in Budapest according to INRIX in 2016 (Cookson & Pishue, 2017).		

LA-ROM	Value	1/3
<b>Data for Rome is from 2013 and for Los Angeles from 2003.</b>		
Rome is better than Los Angeles. In Rome fewer people travelled by car than in Los Angeles (66% versus 76%). Also more people commuted using public transportation in Rome (28.4% versus 5%). However, there were more people walking in Los Angeles than in Rome (18% versus 5.6%) (City of Los Angeles, 2015; 'Rome', 2011). Rome had also less congestion than Los Angeles according to INRIX in 2016 (Cookson & Pishue, 2017).		

LA-HAM	Value	1/5
<b>Data for Hamburg is from 2008 and for Los Angeles from 2003.</b>		
Hamburg is stronger than Los Angeles since in Hamburg: 28% walked, 12% biked and 18% commuted using public transport in 2008 (EPOMM, 2017). In Los Angeles the numbers were: 18% walked, 1% biked and 5% went with public transport in 2003 (City of Los Angeles, 2015). Also fewer people travelled by car in Hamburg (42% in Hamburg versus 76% in Los Angeles). There was also less congestion in Hamburg than Los Angeles in 2016 (Cookson & Pishue, 2017).		

PA-BUD	Value	1
<b>Data for Paris is from 2008 and for Budapest from 2014.</b>		
Paris had fewer people travelling by car (17% versus 35%) and more people walked (28% versus 18%). But more people did commute using public transportation in Budapest (45% versus 17%) (EPOMM, 2017). Also, there was less congestion in Budapest than in Paris in 2016 (Cookson & Pishue, 2017). The cities will be weighted equally even though there is more congestion in Paris. That is because less people travelled by car in Paris.		

PA-ROM	Value	3
<b>Data for Paris is from 2008 and for Rome from 2013.</b>		
Paris is better. In Paris fewer people travelled by cars (17% versus 66%) and more people did commute using public transport (33% versus 28.4%). Also more people walked (47% versus 5.6%) (EPOMM, 2017; 'Rome', 2011). In Rome, however, there was less congestion according to INRIX in 2016 (Cookson & Pishue, 2017). Paris is just better since there were more people that did use other modes of transportation than car.		

PA-HAM	Value	2
<b>Both cities have data from 2008.</b>		
Paris is slightly better. In Paris fewer people did travel by cars (17% versus 42%) and more people walked (47% versus 28%). Also more people made trips by public transport in Paris (33% versus 18%). However in Hamburg more people biked (3 % versus 12%) (EPOMM, 2017). Hamburg had also less congestion according to INRIX in 2016 (Cookson & Pishue, 2017). However, despite more congestion, Paris will be slightly better since more people were using other transport modes than car.		

BUD-ROM	Value	3
<b>Data for Budapest is from 2014 and for Rome from 2013.</b>		
Budapest is better, since fewer people travelled by cars in Budapest (35% versus 66%) and more people walked and biked (29% versus 5.6%). Also, more people in Budapest did commute using public transport (45% versus 28.4%) (EPOMM, 2017; 'Rome', 2011). Furthermore, there was less congestion according to INRIX report in 2016 in Budapest (Cookson & Pishue, 2017).		

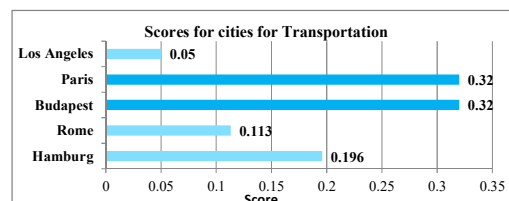
BUD-HAM	Value	2
<b>Data for Hamburg is from 2008 and for Budapest from 2014.</b>		
Budapest is slightly better. Fewer people were using cars in Budapest (35% versus 42%) and more people did use public transport in Budapest (45% versus 18%). Also, Budapest had less congestion in 2016 (Cookson & Pishue, 2017). However, more people walked in Hamburg (28% versus 18%) and biked (12% versus 2%) (EPOMM, 2017).		

ROM-HAM	Value	1/2
<b>Data for Hamburg is from 2008 and for Rome from 2013.</b>		
Hamburg is slightly better than Rome. In Hamburg fewer people travelled by cars (42% versus 66%) and more people walked and biked (40% versus 5.6%). However more people commuted using public transport in Rome (28.4% versus 18%) (EPOMM, 2017; 'Rome', 2011). Also, there were less congestion in Rome than in Hamburg in 2016 (Cookson & Pishue, 2017). But Hamburg will be slightly better because less people did travel by car and more people biked and walked.		

#### Scores for cities for Transportation

Alternative	Score
Los Angeles	0.05
Paris	0.32
Budapest	0.32
Rome	0.113
Hamburg	0.196

Inconsistency	0.02
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Unemployment rate					
	LA	PA	BUD	ROM	HAM
LA	1	3	1/2	5	1/3
PA	1/3	1	1/4	3	1/6
BUD	2	4	1	6	1/2
ROM	1/5	1/3	1/6	1	1/7
HAM	3	6	2	7	1

Source: Eurostat, 2016c; City of Los Angeles, 2016.

LA-PA	Value	3
Los Angeles had lower unemployment rate than Paris in 2015. Los Angeles had 6.8% unemployment rate in 2015 but Paris had 9.6% unemployment rate (City of Los Angeles, 2016; Eurostat, 2016c). Therefore, Los Angeles is better than Paris.		

LA-BUD	Value	1/2
Budapest will be slightly better. In Budapest area the unemployment rate in 2015 was 5.3% (Eurostat, 2016c) compared to 6.8% in Los Angeles (City of Los Angeles, 2016). Therefore, Budapest is better than Los Angeles.		

LA-ROM	Value	5
Rome had 11.8% unemployment rate in 2015 (Eurostat, 2016c) compared to 6.8% in Los Angeles (City of Los Angeles, 2016). Therefore, Los Angeles will be better than Rome.		

LA-HAM	Value	1/3
Hamburg had an unemployment rate of 4.3% in 2015 (Eurostat, 2016c) compared to 6.8% in Los Angeles (City of Los Angeles, 2016). Therefore, Hamburg will be better than Los Angeles.		

PA-BUD	Value	1/4
Paris had 9.6% unemployment rate in 2015 compared to 5.3% in Budapest (Eurostat, 2016c). Therefore, Budapest will be better than Paris.		

PA-ROM	Value	3
Paris had 9.6% unemployment rate in 2015 compared to 11.8% in Rome (Eurostat, 2016c). Therefore, Paris will be better than Rome.		

PA-HAM	Value	1/6
Paris had 9.6% unemployment rate in 2015 compared to 4.3% in Hamburg (Eurostat, 2016c). Therefore, Hamburg will be better than Paris.		

BUD-ROM	Value	6
Rome had 11.8% unemployment rate in 2015 compared to 5.3% in Budapest (Eurostat, 2016c). Therefore, Budapest will be better than Rome.		

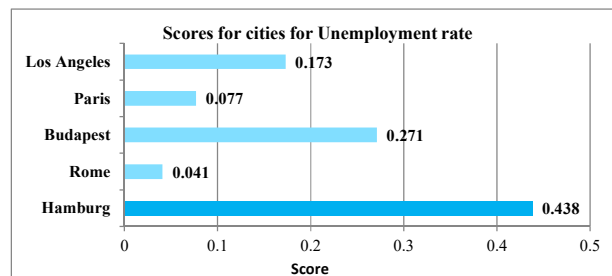
BUD-HAM	Value	1/2
Hamburg had 4.3% unemployment rate in 2015 compared to 5.3% in Budapest (Eurostat, 2016c). Therefore, Hamburg will be better than Budapest.		

ROM-HAM	Value	1/7
Rome had 11.8% unemployment rate in 2015 compared to 4.3% in Hamburg (Eurostat, 2016c). Therefore, Hamburg will be better than Rome.		

#### Scores for cities for Unemployment rate

Alternative	Score
Los Angeles	0.173
Paris	0.077
Budapest	0.271
Rome	0.041
Hamburg	0.438

Inconsistency	0.03
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### Economy

	Tou	Tra	UnE
Tou	1	1/5	1/3
Tra	5	1	2
UnE	3	1/2	1

Source: Gudmundsson et al., 2015; United Nations, 2007; Cashell, 2004.

Tou-Tra	Value	1/5
Transport is important for economic development of cities (Gudmundsson et al., 2015). But tourists are also important (United Nations, 2007). However, a 'gut feeling' would assume that 'Transport' is more important than 'Tourism'. Also, without good transportation system there would be hard to have tourists going around the city. Also it is important for the IOC to have good transportation system for athletes and spectators.		

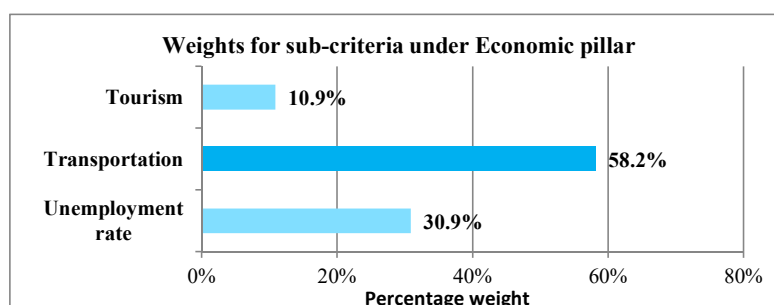
Tou-UnE	Value	1/3
For cities it is important to have relatively low unemployment rate (Cashell, 2004). But these two criteria 'Unemployment' and 'Tourism' can be related. If there are more tourists in the city, it will create jobs for the inhabitants of the city. However, for the city it is more important to have relatively low unemployment rate, since if city has few tourist and high unemployment rate the city could be depending too much on tourism. Therefore, 'Unemployment' will be more important than 'Tourism'.		

Tra-UnE	Value	2
As mentioned in 'Tou-Tra' Transportation is important for economic development. Furthermore, it is important that people have access to places without having to own a private car, which means cities should have a good mix of transportation modes. Therefore, 'Transportation' is more important than 'Unemployment rate' since without good transportation it is hard to have economic growth and furthermore it is important to have accessibility to communities even people to not own car.		

### Weights for sub-criteria under Economic pillar

Sub-criterion	Weight
Tourism	10.9%
Transportation	58.2%
Unemployment rate	30.9%

Inconsistency	0.00
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Greenhouse Gas Emission					
	LA	PA	BUD	ROM	HAM
LA	1	1/5	1/6	1/5	1/2
PA	5	1	1/2	1	4
BUD	6	2	1	2	5
ROM	5	1	1/2	1	4
HAM	2	1/4	1/5	1/4	1

**Note and source:** The GGE was a 'guesstimation' since data was mostly from 2005 for Europe and 2010 for Los Angeles. But it was possible to get emission for countries both in 2005 and 2013. And the difference in 2005 was estimated to be the same in 2013 between country and cities. Therefore, it was possible to estimate the GGE in 2013 for the cities. Numbers were calculated using data from World Bank and UCLA (World Bank, 2011, 2016; UCLA, 2015). However, by using this approach, the emission would go up in Los Angeles from 2010. Therefore, around 10.0 tCO<sub>2</sub>/capita was 'guesstimated' for Los Angeles in 2013 (was calculated to be 10.3 tCO<sub>2</sub>/capita in 2013 using the procedure above) (UCLA, 2015).

LA-PA	Value	1/5
Paris is stronger. Paris had a 'guesstimation' of 4.4 tCO <sub>2</sub> per capita emission compared to 10.0 tCO <sub>2</sub> per capita in Los Angeles.		

LA-BUD	Value	1/6
Budapest is stronger. Budapest had a 'guesstimation' of 3.3 tCO <sub>2</sub> per capita emission compared to 10.0 tCO <sub>2</sub> per capita in Los Angeles.		

LA-ROM	Value	1/5
Rome is stronger. Rome had a 'guesstimation' of 4.6 tCO <sub>2</sub> per capita emission compared to 10.0 tCO <sub>2</sub> per capita in Los Angeles.		

LA-HAM	Value	1/2
Hamburg is slightly better. In Hamburg there was a "guesstimation" of 9.3 tCO <sub>2</sub> per capita emission but 10.0 tCO <sub>2</sub> per capita in Los Angeles.		

PA-BUD	Value	1/2
Budapest is slightly better. Budapest had a 'guesstimation' of 3.3 tCO <sub>2</sub> per capita emission compared to 4.4 tCO <sub>2</sub> per capita in Paris.		

PA-ROM	Value	1
Paris and Rome are similar. In Paris there was a 'guesstimation' of 4.4 tCO <sub>2</sub> per capita emission but 4.6 tCO <sub>2</sub> per capita in Rome.		

PA-HAM	Value	4
Paris is better. Paris had a 'guesstimation' of 4.4 tCO <sub>2</sub> per capita emission but Hamburg had 9.3 tCO <sub>2</sub> per capita.		

BUD-ROM	Value	2
Budapest is slightly better. Budapest had a 'guesstimation' of 3.3 tCO <sub>2</sub> per capita emission but Rome 4.6 tCO <sub>2</sub> per capita.		

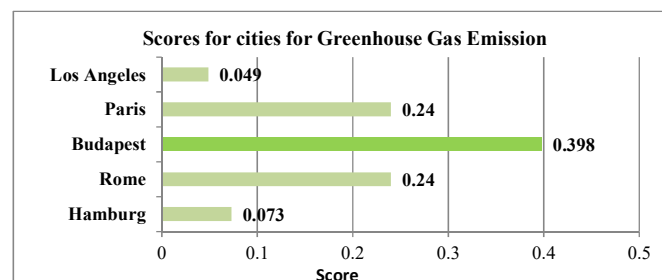
BUD-HAM	Value	5
Budapest is stronger. Budapest had a 'guesstimation' of 3.3 tCO <sub>2</sub> per capita emission but Hamburg had 9.3 tCO <sub>2</sub> per capita.		

ROM-HAM	Value	4
Rome is better. Rome had a 'guesstimation' of 4.6 tCO <sub>2</sub> per capita emission but Hamburg had 9.3 tCO <sub>2</sub> per capita.		

#### Scores for cities for Greenhouse Gas Emission

Alternative	Score
Los Angeles	0.049
Paris	0.24
Budapest	0.398
Rome	0.24
Hamburg	0.073

Inconsistency	0.02
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Renewable Energy					
	LA	PA	BUD	ROM	HAM
LA	1	3	4	4	5
PA	1/3	1	2	2	3
BUD	1/4	1/2	1	1/2	2
ROM	1/4	1/2	2	1	2
HAM	1/5	1/3	1/2	1/2	1

Source: California Energy Commission, 2016; Eurostat, 2016b; World Nuclear Association, 2017.

Note: Data is from 2014 for Europe for renewable energy and 2016 for California. Other source of energy is from year 2016.

LA-PA	Value	3
In California, 27% of energy use came from renewable energy in 2016 (California Energy Commission, 2016). However, California is also connected to other grid in U.S. and in U.S., around 67% of energy came from coal/gas and 19% from nuclear power in 2016 (World Nuclear Association, 2017). In France 14.7 % came from renewable energy in 2014 (Eurostat, 2016b). Also, 19% of energy came from coal and a lot of their energy came from nuclear power plants in 2016 (World Nuclear Association, 2017). Furthermore, France is connected to other European energy grid and gets energy from other countries. Therefore, despite Los Angeles having some energy coming from coal and gas in U.S., California uses more renewable energy than France. As a result, Los Angeles will be better than Paris.		

LA-BUD	Value	4
Hungary had 14.6% of energy use from renewable energy in 2014 (Eurostat, 2016b). Hungary had also around 33% of energy coming from coal and 33% from nuclear power in 2016 (World Nuclear Association, 2017). Hungary import energy also from other European countries (Ibid.). In California, 27% of energy use came from renewable energy in 2016 (California Energy Commission, 2016). Los Angeles is also connected to other grid in U.S. and in U.S. around 67% of energy came from coal/gas and 19% from nuclear power in 2016 (World Nuclear Association, 2017). But, Los Angeles is better than Budapest.		

LA-ROM	Value	4
Los Angeles is better than Rome. In Italy 17.1% of energy use came from renewable energy in 2014 (Eurostat, 2016b). Also around 60% of energy came from coal, gas and oil in 2016 (World Nuclear Association, 2017). In Los Angeles, 27% of energy use came from renewable energy in 2016 (California Energy Commission, 2016). Los Angeles is also connected to other grid in U.S. and around 67% of energy came from coal/gas and 19% from nuclear power (World Nuclear Association, 2017).		

LA-HAM	Value	5
Los Angeles is stronger than Hamburg. In Germany 13.8% of energy use came from renewable energy in 2014 (Eurostat, 2016b). Also, around 43% of energy came from coal and 14% from Nuclear power in 2016 (World Nuclear Association, 2017). However, as the other European countries, Germany is connected to other countries. In California, 27% of energy use came from renewable energy in 2016 (California Energy Commission, 2016). Los Angeles is also connected to other grid in U.S and around 67% came from coal/gas and 19% from nuclear power in 2016 (World Nuclear Association, 2017).		

PA-BUD	Value	2
Paris is slightly better than Budapest. In Budapest there was more renewable energy use of total energy use in 2014 (14.6% versus 14.3%) (Eurostat, 2016b). However there was less energy coming from coal in France in 2016 (19% versus 33%) (World Nuclear Association, 2017). Both countries are connected to other European energy grid.		

PA-ROM	Value	2
Paris is slightly better. Although Italy was better than France in renewable energy use (14.3% versus 17.1%) in 2014 (Eurostat, 2016b), Italy used more coal and gas (43% versus 19%) in 2016. If more detail is needed it can be seen in LA-PA and LA-ROM above.		

PA-HAM	Value	3
Paris is better. France had more percentage of renewable energy use from total consumption in 2014 (14.3% versus 13.8%) (Eurostat, 2016b). France also used less coal in 2016 (19% versus 43%)(World Nuclear Association, 2017). If more detail is needed it can be seen in LA-PA and LA-HAM above.		

BUD-ROM	Value	1/2
Rome is better. Italy had more percentage of renewable energy use from total consumption in 2014 (17.1% versus 14.6%) (Eurostat, 2016b). However, Italy also used more coal and gas in 2016 (30% versus 60%)(World Nuclear Association, 2017). However, Italy will only be better because of more renewable energy use. If more detail is needed it can be seen in LA-BUD and LA-ROM above.		

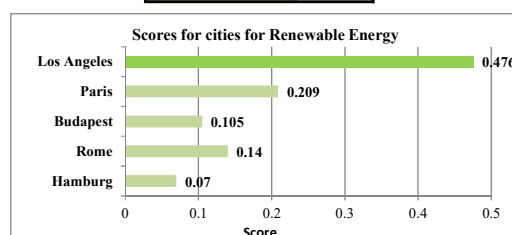
BUD-HAM	Value	2
Budapest will slightly better. Hungary had more percentage of renewable energy use from total consumption in 2014 (14.6% versus 13.8%) (Eurostat, 2016b). Also, Germany used more coal than Hungary in 2016 (43% versus 33%) (World Nuclear Association, 2017). If more detail is needed it can be seen in LA-BUD and LA-HAM above.		

ROM-HAM	Value	2
Rome will be slightly better. Italy had more percentage of renewable energy use from total consumption in 2014 (17.1% versus 13.8%) (Eurostat, 2016b). Italy used also more coal and gas in 2016 (60% versus 43%) (World Nuclear Association, 2017). However, Rome will be slightly better because of more renewable energy use. If more detail is needed it can be seen in LA-ROM and LA-HAM above.		

#### Scores for cities for Renewable Energy

Alternative	Score
Los Angeles	0.476
Paris	0.209
Budapest	0.105
Rome	0.140
Hamburg	0.070

Inconsistency	0.02
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Vulnerability to natural hazard					
	LA	PA	BUD	ROM	HAM
LA	1	1/5	1/5	1	1/5
PA	5	1	1	5	1
BUD	5	1	1	5	1
ROM	1	1/5	1/5	1	1/5
HAM	5	1	1	5	1

Source: 'Hungary - Disaster & Risk Profile', 2014; CIA, 2017; 'Tsunami Facts and Information', 2017; County of Los Angeles, 2017.

LA-PA	Value	1/5
Los Angeles is more at risk for natural hazards. Los Angeles has earthquakes, mud slides in the mountain and forest fires (County of Los Angeles, 2017). Los Angeles is also situated on the ring of fire which can lead to possible tsunami ('Tsunami Facts and Information', 2017). Paris is at risk of flood from the river (CIA, 2017). Also, in Paris there is low risk of earthquake (Ibid.). Paris is, therefore, stronger.		

LA-BUD	Value	1/5
Budapest has risks of floods but low risk of earthquakes (CIA, 2017; 'Hungary - Disaster & Risk Profile', 2014). Therefore Budapest is stronger. Los Angeles details can be seen in LA-PA.		

LA-ROM	Value	1
These two cities are similar. Los Angeles and Rome have earthquakes, but there is a volcano close to Rome and some risk of flooding and some soil instability and forest fires (CIA, 2017). However, Los Angeles is close to the ring of fire and risk of tsunami ('Tsunami Facts and Information', 2017; County of Los Angeles, 2017). Also there is some soil instability and forest fires in Los Angeles as well (CIA, 2017).		

LA-HAM	Value	1/5
Hamburg is better than Los Angeles and similar to Budapest and Paris, with risk of flooding (CIA, 2017). Los Angeles details can be seen in LA-PA.		

PA-BUD	Value	1
Paris and Budapest can be weighted equally; both are vulnerable to flooding (CIA, 2017; 'Hungary - Disaster & Risk Profile', 2014).		

PA-ROM	Value	5
Rome is similar to Los Angeles, as stated in LA-ROM and therefore, Paris is stronger than Rome.		

PA-HAM	Value	1
Paris and Hamburg are similar. Both have risk of floods (CIA, 2017). Therefore, the cities will be weighted equally.		

BUD-ROM	Value	5
Budapest has risk of floods ('Hungary - Disaster & Risk Profile', 2014). Rome has a risk of earthquakes, and there is a volcano close to Rome and some risk of flooding and some soil instability and forest fires (CIA, 2017). Therefore, Budapest is stronger.		

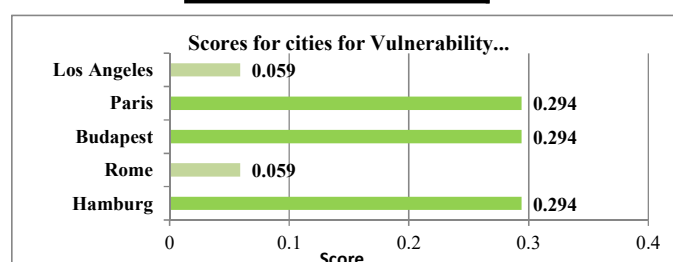
BUD-HAM	Value	1
These cities are similar, both have risk of flooding (CIA, 2017; 'Hungary - Disaster & Risk Profile', 2014).		

ROM-HAM	Value	1/5
Rome is similar to Los Angeles. Hamburg is similar to Budapest and Paris. Therefore, Hamburg is stronger than Rome. See detail in other comparisons.		

#### Scores for cities for Vulnerability...

Alternative	Score
Los Angeles	0.059
Paris	0.294
Budapest	0.294
Rome	0.059
Hamburg	0.294

Inconsistency	0.00
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## Environmental

	GGE	Ene	Haz
GGE	1	1/3	1/3
Ene	3	1	1/2
Haz	3	2	1

**Source:** European Environment Agency, 2015; Government of Canada, 2016; Nasa, n.d.

GGE-Ene	Value	1/3
Renewable Energy' and 'Greenhouse Gas Emission' can be related. If cities use more renewable energy in their energy use, cities will reduce the need for fossil fuel and, therefore, reduce greenhouse gas emissions (European Environment Agency, 2015). That is why 'Renewable Energy' will be more important than 'Greenhouse Gas Emission' since using renewable energy will reduce greenhouse gas emissions.		

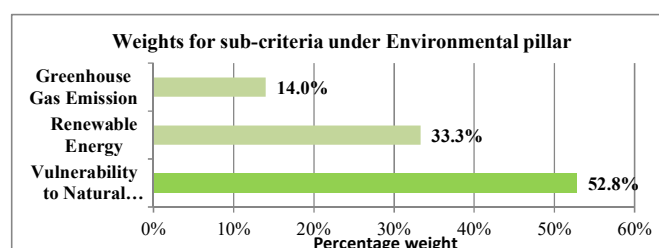
GGE-Haz	Value	1/3
These two criteria can be stated as being related. High greenhouse gas emissions in the environment have an effect on the weather and can create bad weathers, landslides, flood, or dry areas, higher sea level and more (Government of Canada, 2016). However, cities that are capable of dealing with natural hazards or does not have natural hazard can perhaps build up a better system of renewable energy and therefore reduce greenhouse gas emissions in the atmosphere. Therefore, 'Vulnerability to Natural Hazard will be more important, since if cities are protected against natural hazards, cities can build up a better energy system.		

Ene-Haz	Value	1/2
A natural hazard usually costs the society money (NASA, n.d.). Having to spent vast amount of money on natural disaster is also not sustainable and, furthermore, cities that are prone for natural disasters will not be popular. However, cities that are capable of dealing with natural hazards can probably be more sustainable. But 'Vulnerability to Natural Hazards' will be more important because cities that are prone to natural disaster will not be cities that people would like to live in and moreover it can be argued that building an expensive infrastructure for renewable energy systems is not good if there is a high risk of damage due to natural hazards. Also the IOC wants to make sure that cities are capable of dealing with natural hazards and that there is a low risk of having natural hazard before or during the Olympic Games. Once before has the Olympic Games been moved due to natural hazards in 1908 ('Past Olympic Host City Election Results', 2017).		

## Weights for sub-criteria under Environmental pillar

Sub-criterion	Weight
Greenhouse Gas Emission	14.0%
Renewable Energy	33.3%
Vulnerability to Natural Hazards	52.8%

Inconsistency	0.05
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Crime					
	LA	PA	BUD	ROM	HAM
LA	1	1	1/5	1	1/3
PA	1	1	1/5	1	1/3
BUD	5	5	1	5	3
ROM	1	1	1/5	1	1/3
HAM	3	3	1/3	3	1

**Source and notes:** 'Crime', 2017; OSAC, 2017; '1,000 mass shootings', 2016.; History.com Staff, 2010; 'Terrorism-USA travel advise', 2017. Numbeo is just a website which takes information from users and try to estimate various statistics of cities. This is not precise data but can give some hints on how safe the cities are. Also statistics from government can also be sketchy since many people will not report crimes in certain countries or are afraid of reporting it.

LA-PA	Value	1
According to the website Numbeo, Paris is safer than Los Angeles. Paris has a crime index of 54.67 compared to Los Angeles with 52.75 ('Crime', 2017). Also threats of terrorist attack is high in Paris at the moment after the terrorist attacks last year and furthermore, the increase in France citizens that went to Syria to wage jihad and returning from Syria is also of concern (OSAC, 2017). However, there is also a risk of terrorist attack in U.S. ('Terrorism-USA travel advise', 2017). Furthermore mass shootings have happen many times in the last years ('1,000 mass shootings', 2016). Also the last time a terrorist attack was made at the Olympic Games was in U.S., in Atlanta in 1996 (History.com Staff, 2010). However the cities will be similar. Although Paris is safer according to the website Numbeo, a 'gut feeling' says there is more risk of terrorist attack in France then U.S.		

LA-BUD	Value	1/5
According to the website Numbeo, Budapest has lower crime index (38.64 versus 54.67) ('Crime', 2017). Also according to OSAC, threats for terrorist attack are low in Hungary (OSAC, 2017). Therefore, Budapest is stronger than Los Angeles.		

LA-ROM	Value	1
Los Angeles and Rome have similar crime index according to the website Numbeo (54.67 versus 55.47) ('Crime', 2017). Also, according to OSAC there is a high risk of terrorist attack in Rome (OSAC, 2017; 1,000 mass shootings', 2016). Therefore, the cities will be similar.		

LA-HAM	Value	1/3
Hamburg has lower crime rate index according to the website Numbeo (47.99 versus 54.67) ('Crime', 2017). However, there is a high risk of terrorist attack in Germany at the moment according to OSAC (OSAC, 2017). However, there is also a risk in U.S. for terrorist attack ('Terrorism-USA travel advise', 2017). Also there is considerable amount of news about massive shootings in U.S. as stated in LA-PA. Therefore, Hamburg is better. That is mostly based on the numbers from the website Numbeo despite the fact there was a terrorist attack in Berlin last year.		

PA-BUD	Value	1/5
Budapest is safer according to the website Numbeo (38.64 versus 52.75) ('Crime', 2017). There is also less risk of terrorist attack in Budapest according to OSAC (OSAC, 2017). Therefore, Budapest is stronger than Paris.		

PA-ROM	Value	1
Paris has lower crime index according to the website Numbeo (52.75 versus 55.47) ('Crime', 2017). But a 'gut feeling' estimates more risk of terrorist attack in France than Italy. However, both cities have high risk of terrorist attacks according to OSAC (OSAC, 2017). But a 'gut feeling' estimates that these cities are similar.		

PA-HAM	Value	1/3
Hamburg has lower crime index according to the website Numbeo (47.99 versus 52.75) ('Crime', 2017). However, according to OSAC, both cities have high risk of terrorist attack (OSAC, 2017). However a 'gut feeling' estimates that Paris has more risk of terrorist attack. Therefore, Hamburg is better.		

BUD-ROM	Value	5
Budapest is safer according to Numbeo crime index (38.64 vs 55.47) ('Crime', 2017). Also there is a less risk of terrorist attack according to OSAC (OSAC, 2017). Therefore, Budapest is stronger than Rome.		

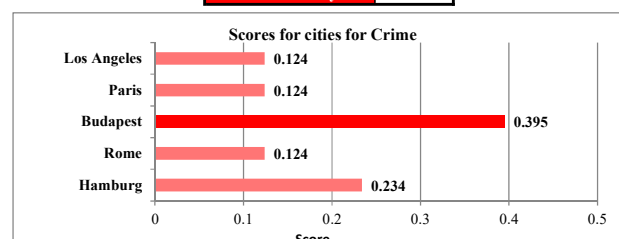
BUD-HAM	Value	3
Budapest has lower crime index according to the website Numbeo (38.64 versus 47.99) ('Crime', 2017). Also there is less risk of terrorist attack according to OSAC (OSAC, 2017). Therefore, Budapest is stronger than Hamburg.		

ROM-HAM	Value	1/3
Hamburg has lower crime index according to the website Numbeo (47.99 versus 55.47) ('Crime', 2017). Both cities and countries have high risk of terrorist attack according to OSAC (OSAC, 2017). But last year there was a terrorist attack in Germany. Despite this terrorist attack last year in Germany, Hamburg will be better. That is based mostly on the index from the website Numbeo.		

#### Scores for cities for Crime

Alternative	Score
Los Angeles	0.124
Paris	0.124
Budapest	0.395
Rome	0.124
Hamburg	0.234

Inconsistency	0.00
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Discrimination					
	LA	PA	BUD	ROM	HAM
LA	1	1/2	5	1	1/3
PA	2	1	5	2	1/3
BUD	1/5	1/5	1	1/5	1/7
ROM	1	1/2	5	1	1/3
HAM	3	3	7	3	1

Source: Amnesty International, 2017; Freedom House, 2017; World Economic Forum, 2017.

LA-PA	Value	1/2
In both countries, there are some problems with discrimination. In France the discrimination is against Roma people and there have been some problems with immigrants and how to deal with them (Amnesty International, 2017). In U.S. there are also problems with immigrants and with what Donald Trump is going to do (Ibid.). However, France has one more point on the Freedom scale (Freedom House, 2017). However that difference is small. France is also slightly higher on gender equality index from World Economic Forum (0.756 versus 0.722) (World Economic Forum, 2017). Therefore, Paris will be slightly better because of the higher point in the two reports.		

LA-BUD	Value	5
Hungary has closed its borders, and criminalized thousands of people for irregular entry. Furthermore, hate crimes continue to be a problem and there are also some problems with Roma people (Amnesty International, 2017). Also Hungary gets only 71 points compared to U.S. with 89 points in the Freedom report (Freedom House, 2017). Hungary has also lower gender equality compared to U.S. (0.669 versus 0.722) (World Economic Forum, 2017). Therefore, Los Angeles is stronger compared to Budapest.		

LA-ROM	Value	1
There is a problem in Italy with Roma people (Amnesty International, 2017). Furthermore, there have been some reports on violent from the Italian police against immigrants (Ibid.). However, Italy is the landing site for immigrants from Syria and Africa and thousands of immigrants comes every week through Italy (although not staying there). In the Freedom report they have the same points as U.S. (Freedom House, 2017). Also the gender equality is almost the same in both countries (0.719 in Italy versus 0.722 in U.S.) (World Economic Forum, 2017). Therefore, the cities will be weighted equally.		

LA-HAM	Value	1/3
There is some tension with Turkey in Germany at the moment and also some tension over the immigrants. Germany wants also to allow more surveillance camera and Germany has made some strict laws on asylum seekers (Amnesty International, 2017). However, Germany scores high in the Freedom report (95 points compared to 89 in U.S.) (Freedom House, 2017). Germany has also higher gender equality (0.768 versus 0.722) (World Economic Forum, 2017). Therefore, Hamburg is better.		

PA-BUD	Value	5
As stated in LA-BUD, Hungary has closed its borders, and criminalized thousands of people for irregular entry (Amnesty International, 2017). Furthermore, hate crimes continue to be a problem and there are some problems with Roma people (Ibid.). There are also problems in France with the discrimination against Roma people and there have been some problems with immigrants and how to react with them (Ibid.). However, France scores higher in the Freedom report (Freedom House, 2017). France also scores higher in the gender equality report (0.756 versus 0.669) (World Economic Forum, 2017). Therefore, Paris is better.		

PA-ROM	Value	2
In both countries there are problems with the Roma people and some problems with immigrants (Amnesty International, 2017). In the Freedom report France is scoring only one point higher than Italy (90 versus 89) (Freedom House, 2017). Also, France is scoring little higher in the gender equality (0.756 versus 0.719) (World Economic Forum, 2017). Therefore, Paris will be slightly better compared to Rome.		

PA-HAM	Value	1/3
There is some tension with Turkey in Germany now and tension over immigrants but there is also some tension in France over immigrants and Roma people (Amnesty International, 2017). Germany scores higher than France in Freedom report (Freedom House, 2017). Germany is also slightly higher than France in the gender equality report (0.768 versus 0.756) (World Economic Forum, 2017). Therefore, Hamburg will be better than Paris.		

BUD-ROM	Value	1/5
Hungary has closed its borders for immigrants and there are problems with Roma people (Amnesty International, 2017). Also Hungary scores lower in the Freedom report (Freedom House, 2017). Hungary also scores lower in gender equality report than Italy (0.669 versus 0.719) (World Economic Forum, 2017). Therefore, Rome is stronger.		

BUD-HAM	Value	1/7
Hamburg is better. Germany scores higher in the Freedom report (Freedom House, 2017). Also, Hungary has closed its boarder and there are some problems with Roma people (Amnesty International, 2017). Germany also scores higher in the gender equality report (0.768 versus 0.669) (World Economic Forum, 2017).		

ROM-HAM	Value	1/3
Germany scores higher than Italy in the Freedom report (Freedom House, 2017). Furthermore, in Amnesty International report, there is less discrimination in Germany than in Italy (Amnesty International, 2017). Also Germany scores higher than Rome in the gender equality report (World Economic Forum, 2017). Therefore, Hamburg is better.		

#### Scores for cities for Discrimination

Alternative	Score
Los Angeles	0.146
Paris	0.225
Budapest	0.04
Rome	0.146
Hamburg	0.442

Inconsistency	0.03
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Health					
	LA	PA	BUD	ROM	HAM
LA	1	1/5	1/5	1/2	1/3
PA	5	1	2	4	3
BUD	5	1/2	1	3	2
ROM	2	1/4	1/3	1	1/2
HAM	3	1/3	1/2	2	1

Source: Barber et al., 2017; Los Angeles 2024 Exploratory Committee, 2016; Paris Candidature File Stage 1, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2014.

LA-PA	1/5
According to a Healthcare Access Index published in Lancet Magazine there is better access to healthcare in France than in U.S. (Barber et al., 2017). Paris has also more hospital beds per 1000 people than Los Angeles. According to the bid books, Paris has 10 beds per 1000 people (Paris Candidature File Stage 1, 2016) but Los Angeles has 1.8 beds per 1000 people (Los Angeles 2024 Exploratory Committee, 2016). Therefore Paris will be stronger than Los Angeles.	

LA-BUD	Value	1/5
According to a Healthcare Access Index published in Lancet Magazine, access to healthcare is slightly better in U.S. than in Hungary (Barber et al., 2017). However Budapest has 10.3 hospital beds per 1000 people (Budapest 2024 Committee, 2016) but Los Angeles has 1.8 beds per 1000 people (Los Angeles 2024 Exploratory Committee, 2016). Because of much more available beds per 1000 people Budapest will be better since beds per 1000 people is estimated for the city but Healthcare Access Index is estimated for the whole country.		

LA-ROM	Value	1/2
Rome is slightly better than Los Angeles. According to a Healthcare Access Index published in Lancet Magazine there is better access to healthcare in Italy than in U.S. (Barber et al., 2017). Rome has also 3.4 hospital beds per 1000 people (Comitato organizzatore Roma 2024, 2016) compared to Los Angeles with 1.8 beds per 1000 people (Los Angeles 2024 Exploratory Committee, 2016).		

LA-HAM	Value	1/3
Hamburg is better. According to a Healthcare Access Index published in Lancet Magazine there is better access to healthcare in Germany than in U.S. (Barber et al., 2017). Also, Hamburg was estimated to have around 7 beds per 1000 people in 2014 (Hamburg, 2014) compared to 1.8 bed per 1000 people in Los Angeles (Los Angeles 2024 Exploratory Committee, 2016). Therefore, Hamburg is better than Los Angeles.		

PA-BUD	Value	2
Paris is slightly better. According to a Healthcare Access Index published in Lancet Magazine there is better access to healthcare in France than in Hungary (Barber et al., 2017). But the available hospital beds per 1000 people are similar, 10 beds per 1000 people in Paris (Paris Candidature File Stage 1, 2016) but 10.3 in Budapest (Budapest 2024 Committee, 2016). Paris is better because of the Healthcare Access Index since the hospital beds per 1000 people are similar between the cities.		

PA-ROM	Value	4
According to a Healthcare Access Index published in Lancet Magazine there is a similar access to healthcare in France and Italy (Barber et al., 2017). However Paris has 10 beds per 1000 people (Paris Candidature File Stage 1, 2016) and Rome has 3.4 beds per 1000 people (Comitato organizzatore Roma 2024, 2016). Therefore Paris will be better than Rome.		

PA-HAM	Value	3
According to a Healthcare Access Index published in Lancet Magazine, healthcare access is better in France than in Germany (Barber et al., 2017). Furthermore, Paris has 10 hospital beds per 1000 people (Paris Candidature File Stage 1, 2016) and Hamburg was estimated to have had 7 beds per 1000 people in 2014 (Hamburg, 2014). This means that Paris is better compared to Hamburg.		

BUD-ROM	Value	3
According to a Healthcare Access Index published in Lancet Magazine there is better healthcare access in Italy than in Hungary (Barber et al., 2017). Budapest has however 10.3 beds per 1000 people (Budapest 2024 Committee, 2016) but Rome has 3.4 beds per 1000 people (Comitato organizzatore Roma 2024, 2016). Therefore, Budapest will be better since beds per 1000 people are estimated for the city but the Healthcare Access Index is estimated for the whole country.		

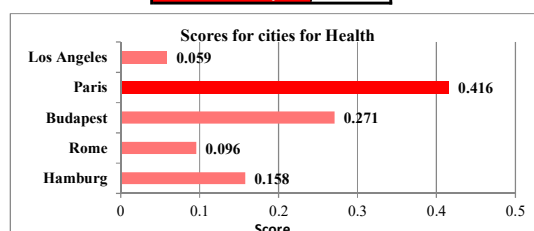
BUD-HAM	Value	2
According to a Healthcare Access Index published in Lancet Magazine there is better access to healthcare in Germany than in Hungary (Barber et al., 2017). Hamburg had around 7 beds per 1000 people in 2014 (Hamburg, 2014) and Budapest has around 10.3 beds per 1000 people (Budapest 2024 Committee, 2016). Therefore Budapest is slightly better since beds per 1000 people are estimated for the city but Healthcare Access Index is estimated for the whole country.		

ROM-HAM	Value	1/2
According to a Healthcare Access Index published in Lancet Magazine there is slightly better access to healthcare in Italy than in Germany (Barber et al., 2017). However, Hamburg had around 7 beds per 1000 people in 2014 (Hamburg, 2014) and Rome has 3.4 beds per 1000 people (Comitato organizzatore Roma 2024, 2016). Therefore, Hamburg is slightly better than Rome.		

#### Scores for cities for Health

Alternative	Score
Los Angeles	0.059
Paris	0.416
Budapest	0.271
Rome	0.096
Hamburg	0.158

Inconsistency	0.02
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## Social

	Cri	Dis	Hea
Cri	1	1/2	2
Dis	2	1	1/3
Hea	1/2	3	1

Source: United Nations, 2017b; United Nations, 2007.

Cri-Dis	Value	1/2
<p>Access to basic human needs should be human rights in all countries. But in some places there is a discrimination against certain people which will result in inequality among people in the society. Therefore, it is essential to reduce discrimination and inequality for sustainability (United Nations, 2017b). However, it is also important to reduce crime in cities since fear of crimes can keep people away from certain areas or cities. However, these two criteria 'Discrimination' and 'Crime' can be said to be closely related as if there is a discrimination against people, these people will not get opportunities in the society and will perhaps go to a criminal life instead. Therefore, 'Discrimination' will be more important than 'Crime'.</p>		

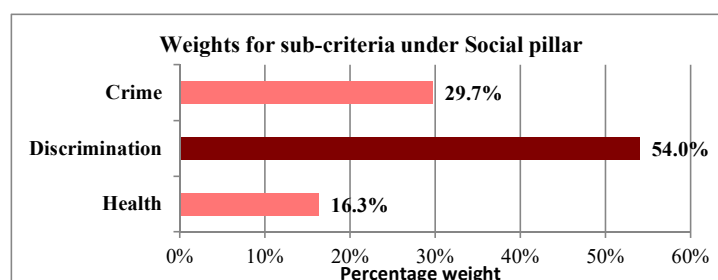
Cri-Hea	Value	2
<p>Accessibility to health care can show equality in the city and how developed the health care system is (United Nations, 2007). And as stated in 'Cri-Dis', crime or fear of crime can reduce people going to certain areas. However, 'Crime' will be valued more important here. The IOC wants to be sure that athletes and spectators are protected and there are millions of dollars spent on safety for the Olympic Games. Furthermore, city that has a high crime rate and high risk of terrorist attack can be said to be unsustainable since many people would probably move away or not come at all.</p>		

Dis-Hea	Value	1/3
<p>Discrimination is more important than 'Health'. This is because, if there is discrimination in the society, people will perhaps not have access to the healthcare system. However, 'Health' is also important but inequality can lead to people not affording to go to doctors or even worse, are not allowed to seek doctors because of their religion, sex or colour.</p>		

## Weights for sub-criteria under Social pillar

Sub-criterion	Weight
Crime	29.7%
Discrimination	54.0%
Health	16.3%

Inconsistency	0.01
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## **Appendix C - Revised Pairwise Comparisons**



Accountability					
Reconsidered					
	LA	PA	BUD	ROM	HAM
LA	1	2	3	2	5
PA	1/2	1	3	1	5
BUD	1/3	1/3	1	1/3	3
ROM	1/2	1	3	1	5
HAM	1/5	1/5	1/3	1/5	1

Source: 'Past Olympic Host City Election Results', 2017; European Athletics, 2013; FINA, 2017; Formula 1®, 2017; IAAF, 2017; FIFA, 2013; 'The Oscars', 2017; 'The Grammys', 2017; 'Roland-Garros', 2017; 'Tour de France', 2017; 'LEN European Aquatics Championships', 2016; FIFA, 2017; UEFA, 2017.

LA-PA	Value
2	
Both cities have hosted the Olympic Games twice ('Past Olympic Host City Election Results', 2017). Both have hosted the Men's World Cup Final in football (FIFA, 2013). However, Paris hosts the French Open in tennis every year ('Roland Garros', 2017) and has the last leg of Tour de France every year ('Tour de France', 2017). Paris has also hosted the European Championships Final in football (UEFA, 2017). Los Angeles on the other hand, has hosted the Women World Cup Final in football (FIFA, 2013) and some big non-sporting events, such as the Oscars, Grammy and more events related to movies and music ('The Oscars', 2017; 'The Grammys', 2017). Moreover, it is shorter since Los Angeles hosted the Olympic Games and they have more venues ready. Therefore, Los Angeles will be slightly better.	

LA-BUD	Value
3	
Los Angeles is better since it has hosted the Olympic Games twice and also hosted the World Cup in football both men's and women's (FIFA, 2013). Los Angeles also hosts some big non-sporting events every year such as the Oscars, Grammy and more events related to movies and music ('The Oscars', 2017; 'The Grammys', 2017). Budapest will although host the World Swimming Championships in 2017 (FINA, 2017) and has the F1 every year (Formula 1®, 2017). Budapest has also hosted European Championships in track and field and swimming (European Athletics, 2013; 'LEN European Aquatics Championships', 2016).	

LA-ROM	Value
2	
Both have hosted the Olympic Games and both have hosted the Men's World Cup final in football ('Past Olympic Host City Election Results', 2017; FIFA, 2013). Rome has on the other hand hosted various World Championships in swimming and track and field (FINA, 2017; IAAF, 2017) and the European Championships Final in football (UEFA, 2017). On the other hand, Los Angeles hosts every year big non-sporting events and has hosted the Olympic Games twice compare to Rome hosting the Olympic Games once and it is shorter since Los Angeles hosted the Olympic Games and as a 'gut feeling' Los Angeles will be better.	

LA-HAM	Value
5	
Los Angeles is a lot better. Hamburg has not hosted major events except quarter final game and stage game at the Men's World Cup in football in 2006 (FIFA, 2017).	

PA-BUD	Value
3	
Paris has hosted the Olympic Games twice before and also hosts every year French Open in tennis and has the last leg of Tour de France every year ('Past Olympic Host City Election Results', 2017; 'Roland Garros', 2017; 'Tour de France', 2017). Paris has also hosted the final of Men's World Cup final and European final in football (FIFA, 2013; UEFA, 2017). Budapest will although host the World Swimming Championships in 2017 (FINA, 2017) and has the F1 every year (Formula 1®, 2017). Budapest has also hosted various European Championships in track and field and swimming (European Athletics, 2013; 'LEN European Aquatics Championships', 2016). But as a 'gut feeling', Paris is better compared to Budapest.	

PA-ROM	Value
1	
Paris has hosted the Olympic Games twice before and also hosts every year French Open in tennis and has the last leg of Tour de France every year ('Past Olympic Host City Election Results', 2017; 'Roland Garros', 2017; 'Tour de France', 2017). Both of them have hosted the final of Men's World Cup final and European Final in football (FIFA, 2013; UEFA, 2017). Rome has hosted the Olympic Games once before and it is shorter since they hosted the Olympic Games ('Past Olympic Host City Election Results', 2017). Rome has also hosted various World Championships in swimming and track and field (FINA, 2017; IAAF, 2017). But a 'gut feeling' says the cities are equal.	

PA-HAM	Value
5	
Paris is a lot better. Hamburg has not hosted major events except quarter final game and stage game at the Men's World Cup in football in 2006 (FIFA, 2017).	

BUD-ROM	Value
1/3	
Rome is better than Budapest. Rome has hosted the Olympic Games and multiple World Championships in track and field and swimming and both World Cup Final and European Final in football ('Past Olympic Host City Election Results', 2017; FIFA, 2013; UEFA, 2017; FINA, 2017; IAAF, 2017). But Budapest will host the World Swimming Championships in 2017 (FINA, 2017) and has F1 every year (Formula 1®, 2017) and has hosted European Championships in track and field and swimming (European Athletics, 2013; 'LEN European Aquatics Championships', 2016).	

BUD-HAM	Value
3	
Budapest is stronger than Hamburg although both cities have not hosted the Olympic Games ('Past Olympic Host City Election Results', 2017). Budapest has hosted European Championships in swimming and track and field multiple times and hosts every year the F1 (European Athletics, 2013; 'LEN European Aquatics Championships', 2016; Formula 1®, 2017). Furthermore, Budapest will host the World Swimming Championships in 2017 (FINA, 2017).	

ROM-HAM	Value
5	
Rome is stronger compared to Hamburg, since Hamburg has never hosted the Olympic Games and other major competitions. See detail in other comparisons.	

#### Scores for cities for Accountability

Alternative	Score
Los Angeles	0.368
Paris	0.239
Budapest	0.105
Rome	0.239
Hamburg	0.05

Inconsistency	0.05
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Distance from Olympic Village to Venues					
Reconsidered					
	LA	PA	BUD	ROM	HAM
LA	1	1/2	1/3	2	1/3
PA	2	1	1/3	2	1/3
BUD	3	3	1	3	2
ROM	1/2	1/2	1/3	1	1/3
HAM	3	3	1/2	3	1

**Source:** Los Angeles 2024 Exploratory Committee, 2016; *Paris Candidature File Stage 1*, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Hamburg, 2015.

LA-PA	Value	1/2
The average distance is 15 km in Paris ( <i>Paris Candidature File Stage 1</i> , 2016). In Los Angeles it is 26 km (Los Angeles 2024 Exploratory Committee, 2016). However, in Los Angeles, it can be argued that there is a bigger highway system which is possible to close down to be able to move athletes and the IOC members to venues. Therefore, the distance will not be as important. As a result, it could be argued that Los Angeles is stronger than indicated in the previous comparisons. Therefore, Paris will be just slightly better but not much better as previously stated.		

LA-BUD	Value	1/3
Budapest has average distance of 8 km (Budapest 2024 Committee, 2016). Therefore, Budapest will be better compared to Los Angeles. But as mentioned in 'LA-PA', highways could be closed just for athletes and the IOC members and as such, Los Angeles can be stronger than indicated. However, Budapest will be better than Los Angeles. That is due to the fact that Budapest would construct an Olympic Park and many venues would be in walking distance from the Olympic Village (Budapest 2024 Committee, 2016).		

LA-ROM	Value	2
Rome has an average distance of 22 km compared to 26 km in Los Angeles (Comitato organizzatore Roma 2024, 2016; Los Angeles 2024 Exploratory Committee, 2016). However, it could be argued as stated in 'LA-PA' that there is bigger highway system in Los Angeles that could be closed down just for athletes and the IOC members. And as such, Los Angeles will be better than Rome.		

LA-HAM	Value	1/3
Hamburg is better compared to Los Angeles since the average distance in Hamburg is 10 km (Hamburg, 2015). However, the distance in Hamburg is an estimation from a vision book which had proposed venue sites but was estimated using Google Maps. But since the proposed site in Hamburg had many venues close to the Olympic Village, Hamburg is better.		

PA-BUD	Value	1/3
Budapest is better than Paris. The average distance in Paris is 15 km but 8 km in Budapest ( <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016).		

PA-ROM	Value	2
Paris is slightly better compared to Rome, since the average distance in Paris is 15 km but 22 km in Rome ( <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016).		

PA-HAM	Value	1/3
Hamburg is stronger than Paris. Average distance in Hamburg is around 10 km (estimation) but 15 km in Paris (Hamburg, 2015; <i>Paris Candidature File Stage 1</i> , 2016).		

BUD-ROM	Value	3
Budapest is better compared to Rome. Average distance in Budapest is 8 km while it is 22 km in Rome (Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016).		

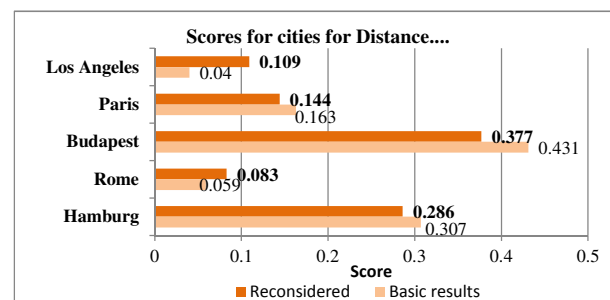
BUD-HAM	Value	2
The cities are close but Budapest is slightly better compared to Hamburg since it is with average distance of 8 km compared to Hamburg of 10 km (estimation) (Budapest 2024 Committee, 2016; Hamburg, 2015).		

ROM-HAM	Value	1/3
Hamburg will be better than Rome, since the average distance in Hamburg is 10 km (estimation) but in Rome 22 km (Hamburg, 2015; Comitato organizzatore Roma 2024, 2016).		

#### Scores for cities for Distance....

Alternative	Score
Los Angeles	0.109
Paris	0.144
Budapest	0.377
Rome	0.083
Hamburg	0.286

Inconsistency	0.04
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GDP					
Reconsidered					
	LA	PA	BUD	ROM	HAM
LA	1	3	7	5	2
PA	1/3	1	3	2	1/3
BUD	1/7	1/3	1	1/2	1/7
ROM	1/5	1/2	2	1	1/5
HAM	1/2	3	7	5	1

Source: Eurostat, 2016a; Los Angeles 2024 Exploratory Committee, 2016; Paris Candidature File Stage 1, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016.

LA-PA	Value	3
Los Angeles is better. The GDP per capita from the bid book from Los Angeles was 86,965 USD in 2014 (Los Angeles 2024 Exploratory Committee, 2016). The GDP per capita for Paris was 41,363 USD in 2014 (Paris Candidature File Stage 1, 2016).		

LA-BUD	Value	7
Los Angeles is stronger compared to Budapest since Los Angeles had a GDP per capita of 86,965 US dollars in 2014 (Los Angeles 2024 Exploratory Committee, 2016). Budapest had GDP of 29,369 US dollars per capita in 2014 (Budapest 2024 Committee, 2016).		

LA-ROM	Value	5
Los Angeles is better compared to Rome. Rome had a GDP of 35,364 US dollars per capita in 2014 (Comitato organizzatore Roma 2024, 2016). Los Angeles had a GDP of 86,965 US dollars per capita in 2014 (Los Angeles 2024 Exploratory Committee, 2016).		

LA-HAM	Value	2
Los Angeles is slightly better than Hamburg. Los Angeles had a GDP of 86,965 US dollars per capita in 2014 (Los Angeles 2024 Exploratory Committee, 2016). Hamburg had GDP of 78,000 US dollars per capita in 2014 (Eurostat, 2016a).		

PA-BUD	Value	3
Paris is better than Budapest since Paris had GDP of 41,363 US dollars per capita compared to 29,369 US dollars per capita in Budapest in 2014 (Paris Candidature File Stage 1, 2016; Budapest 2024 Committee, 2016).		

PA-ROM	Value	2
Paris is stronger than Rome (41,363 US dollars versus 35,364 US dollars per capita in 2014) (Paris Candidature File Stage 1, 2016; Comitato organizzatore Roma 2024, 2016).		

PA-HAM	Value	1/3
Hamburg is better than Paris since Hamburg had GDP of 78,000 US dollars per capita while Paris had GDP of 41,363 US dollars per capita in 2014 (Paris Candidature File Stage 1, 2016; Eurostat, 2016a).		

BUD-ROM	Value	1/2
Rome is better than Budapest, Rome had GDP of 35,364 US dollars per capita compared to 29,369 US dollars per capita in Budapest in 2014 (Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016).		

BUD-HAM	Value	1/7
Hamburg is much better compared to Budapest since Hamburg had a GDP of 78,000 US dollars per capita compared to 29,369 US dollars per capita in Budapest in 2014 (Budapest 2024 Committee, 2016; Eurostat, 2016a).		

ROM-HAM	Value	1/5
Hamburg is stronger than Rome since Hamburg had a GDP per capita of 78,000 US dollars compared to 35,364 US dollars in Rome in 2014 (Eurostat, 2016a; Comitato organizzatore Roma 2024, 2016).		

#### Scores for cities for GDP

Alternative	Score
Los Angeles	0.426
Paris	0.132
Budapest	0.046
Rome	0.075
Hamburg	0.321

Inconsistency	0.02
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Temperature and weather					
Replacing 'Distribution of Olympic Games'					
	LA	PA	BUD	ROM	HAM
LA	1	1	2	3	3
PA	1	1	2	3	3
BUD	1/2	1/2	1	3	3
ROM	1/3	1/3	1/3	1	1
HAM	1/3	1/3	1/3	1	1

Source: Los Angeles 2024 Exploratory Committee, 2016; *Paris Candidature File Stage 1*, 2016; Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016; Holiday Weather, 2017; Norwegian Meteorological Institute, 2017.

LA-PA	Value	1
Paris is closer to 25 °C than Los Angeles but only slightly, Paris has highest average temperature of 23.5 °C during the proposed competition period compared to 27.6 °C in Los Angeles. On the other hand there is less chance of a rain in Los Angeles (Los Angeles 2024 Exploratory Committee; <i>Paris Candidature File Stage 1</i> , 2016). Therefore, the cities will be equal.		

LA-BUD	Value	2
Budapest is closer to 25 °C than Los Angeles (26.8 °C compared to 27.6 °C). However, the chance of rain is more in Budapest (Los Angeles 2024 Exploratory Committee; Budapest 2024 Committee, 2016). As such, Los Angeles will be slightly better.		

LA-ROM	Value	3
The highest average temperature is higher in Rome than in Los Angeles (33 °C versus 27.6 °C). There is also more chance of rain in Rome (Los Angeles 2024 Exploratory Committee; Comitato organizzatore Roma 2024, 2016). Therefore, Los Angeles will be better.		

LA-HAM	Value	3
Los Angeles and Hamburg are similar distance from 25 °C. However, there is more chance of rain in Hamburg than in Los Angeles (Los Angeles 2024 Exploratory Committee; Holiday Weather, 2017; Norwegian Meteorological Institute, 2017). Also, the temperature was a 'guesstimation' in Hamburg. Therefore, Los Angeles is better than Hamburg.		

PA-BUD	Value	2
The cities are within similar range from 25 °C. Paris is slightly closer. Also there is a little bit more chance of rain in Budapest ( <i>Paris Candidature File Stage 1</i> , 2016; Budapest 2024 Committee, 2016). As a result, Paris is slightly better.		

PA-ROM	Value	3
Paris is closer to 25 °C than Rome. On the other hand, there is less chance of rain in Rome ( <i>Paris Candidature File Stage 1</i> , 2016; Comitato organizzatore Roma 2024, 2016). However, Paris will better since the average high temperature in Rome is too high (33 °C).		

PA-HAM	Value	3
Paris is closer to 25 °C. The chance of rain is little bit more in Hamburg than in Paris ( <i>Paris Candidature File Stage 1</i> , 2016; Holiday Weather, 2017; Norwegian Meteorological Institute, 2017). As such, Paris is better.		

BUD-ROM	Value	3
Budapest is closer to 25 °C but there is less chance of rain in Rome (Budapest 2024 Committee, 2016; Comitato organizzatore Roma 2024, 2016). However, Budapest will better since the average high temperature in Rome is too high (33 °C).		

BUD-HAM	Value	3
Budapest is closer to 25 °C than Hamburg. The chance of rain is little bit more in Hamburg than in Budapest (Budapest 2024 Committee, 2016; Holiday Weather, 2017; Norwegian Meteorological Institute, 2017). As such, Budapest will be better.		

ROM-HAM	Value	1
Hamburg is closer to 25 °C than Rome. However, there is less chance of rain in Rome than in Hamburg (Comitato organizzatore Roma 2024, 2016; Holiday Weather, 2017; Norwegian Meteorological Institute, 2017). However, the cities will be equal. The temperature is too high in Rome but there is also less chance of rain in Rome. Also, the temperature is a 'guesstimation' in Hamburg.		

#### Scores for cities for Temp...

Alternative	Score
Los Angeles	0.308
Paris	0.308
Budapest	0.206
Rome	0.089
Hamburg	0.089

Inconsistency	0.02
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