

The following presentation was given at:

SCAF Workshop
**“The SCAF 2018 Cost Estimating
Challenge”**

Tuesday 24th April 2018
Aerospace Bristol

Released for distribution by the Author
www.scaf.org.uk/library



The Team

Joe Avis

*Finance & Business Management (F&BM) Graduate – 7 Months Experience
Nottingham Trent University – BA Economics, Finance and Banking*

Ed Cawley

*F&BM Graduate – 15 Months Experience
Loughborough University – BSc Mathematics*

Hazel Coaley

*F&BM Graduate – 19 Months Experience
Winchester University – BA Accounting and Finance*

Jazmin Johnson

*F&BM Graduate – 6 Months Experience
Aberystwyth University – BSc Business with German*

Chelsea Mills

Project Controls Apprentice – 7 Months Experience

Brandon Smith

Project Controls Apprentice – 7 Months Experience





Contents

1. Introduction
2. Purpose and Scope
3. Data Gathering Approach
4. Data Analysis
5. Assumptions Details
6. Decision
7. Further Considerations
8. Lessons Learnt
9. Q&A
10. Appendix

The Challenge

Generate the cost of providing security at the 2018 FIFA World Cup in Russia



Benefits

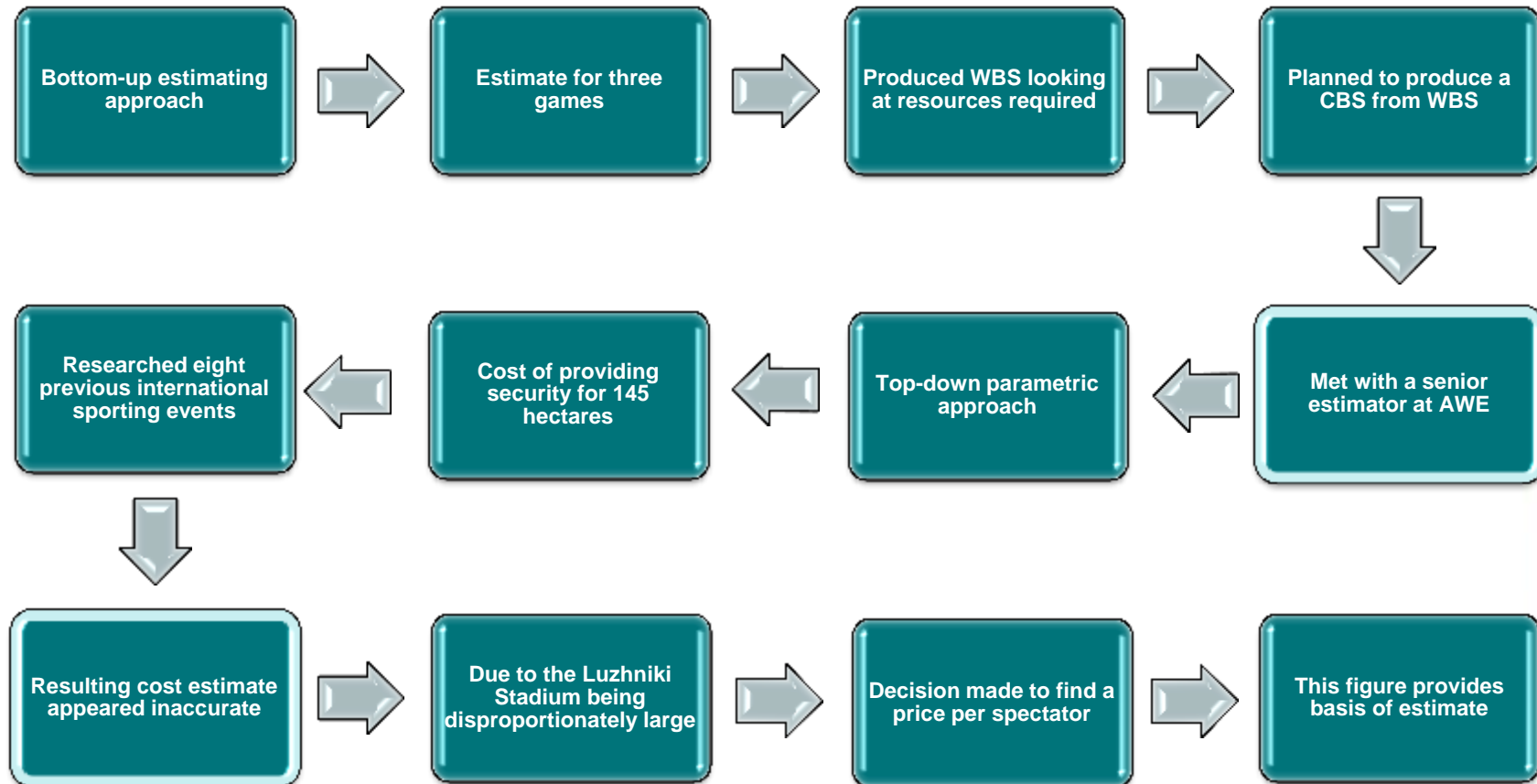
- Use a fun, real life example to expand our knowledge on estimating techniques
- Appreciate the process that estimators and cost analysts go through to produce a final estimate



Challenges

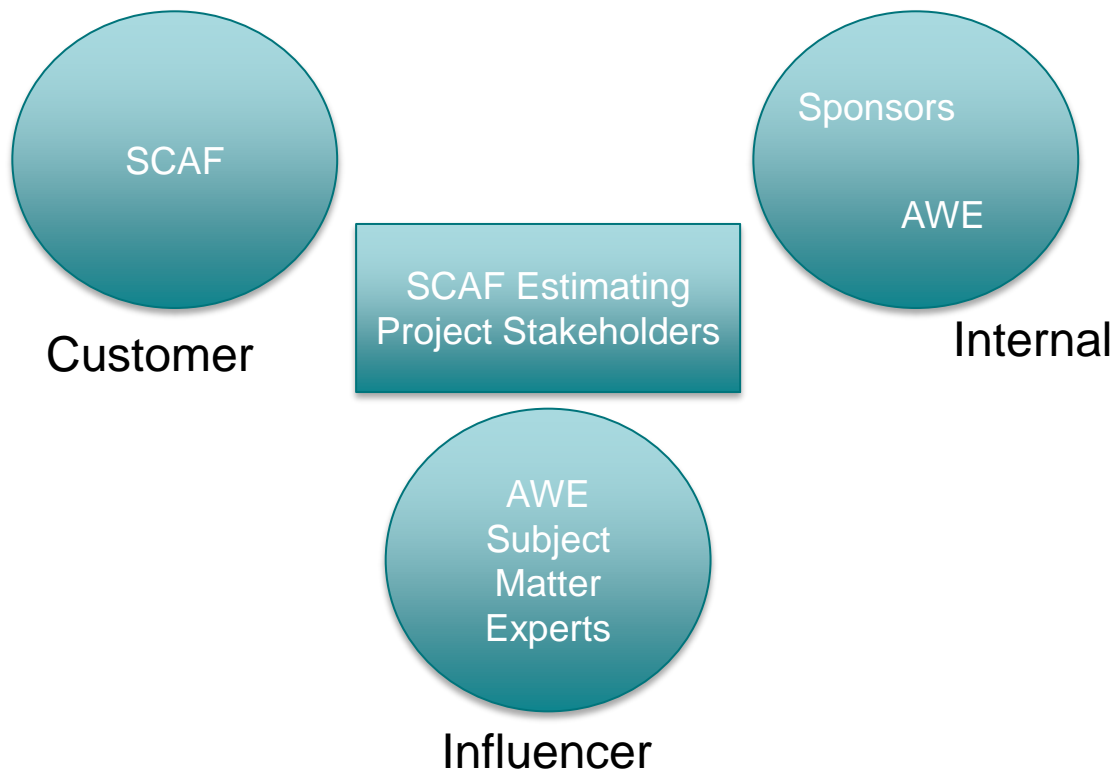
- Relatively small amount of knowledge and experience in estimating costs
- Limited available data
- Time restrictions

Our Thought Process





Stakeholder Map



Assumptions

- Security is being costed for 12 stadiums and the 64 games that will be played throughout the tournament.
- Current infrastructure adequate for World Cup 2018.
- Past and present events are at maximum capacity
- 10% increase of cost at 4 games including the 3 games mentioned in the brief.
 - Opening ceremony, 2 semi-finals, final
- Cost of security is relative to capacity of stadium.
- Exchange rate will remain unchanged between time of producing estimate and time of event.
- The security costs at other events includes the cost of security for the whole life of the project





Exclusions

- Risk mitigation budgets were not included
- Difference in security considerations for sites beyond attendance
- Haven't compared to women's football events as these have less coverage/lower popularity
- Security for sporting representatives of each nation, outside of the 64 games and 12 stadiums, will not be accounted for in our estimate.
- Bar & Catering staff not included in capacity



Method

- Gather historical data from previous large scale events
- Normalize the data to a common scale, before averaging
- Ask Subject Matter Experts (SME) the cost impact of the highest visibility games
- Adjust the estimate to incorporate any cost changes
- Calculate a range of cost estimates using an established model

As a result of this method, we reached a cost estimate of **£530.5m**



Cost Inclusions

Based on our findings on previous events, for **£530.5m** we can reasonably expect to provide:

- Police
- Armed Police
- Special Forces
- Unarmed match day stewards
- Cybersecurity
- Security technology



Data Sources

- Online newspapers
- Online sports websites
- Project Controls Textbooks
- Union of European Football Association
- National Statistics
- Industrial & commercial construction data

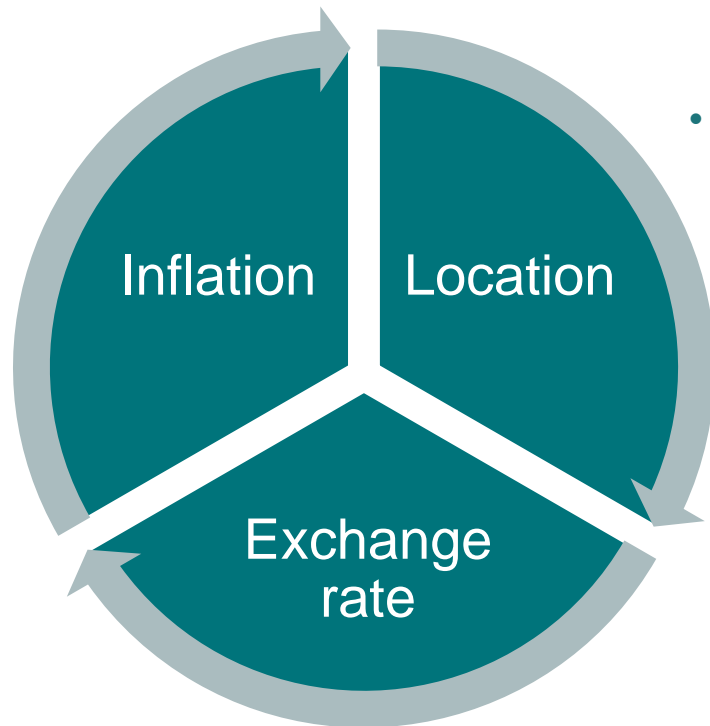


Data Gathering Approach

- Examining existing data in the form of databases and financial reports
- Researched 8 previous events on similar security scale:
 - South Africa WC 2010
 - Canada Winter Olympics 2010
 - London Olympics 2012
 - Poland/Ukraine Euros 2012
 - Brazil WC 2014
 - Sochi Winter Olympics 2014
 - France Euros 2016
 - Rio Olympics 2016

Data Normalisation

To normalise our data to today's current cost we used:



- Productivity
- Materials
- Labour



Data Normalisation

An Example: Brazil World Cup 2014 - Security budget = **£498,000,000**

1. Local exchange rate at time of event = £1 / BRL 3, 78

$$£498,000,000 * 3.78 = \text{BRL } 1,882,440,000$$

2. UK inflation Mid 2014 – Mid 2015 = 5.9%

$$\text{BRL } 1,882,440,000 * (1+5.9\%) = \text{BRL } 1,992,562,740$$

3. Location factor for Brazil vs Russia is 1.03

$$\text{BRL } 1,992,562,740 * 1.03 = \text{BRL } 2,060,491,015$$

4. Exchange rate at mid 2015 = BRL 1 / RUB 17, 79

$$\text{BRL } 2,060,491,015 * 17.79 = \text{RUB } 36,658,161,873$$

5. Russian escalation from mid 2015 to mid 2018 at 8.7%

$$\text{RUB } 36,658,161,873 * (1+11.7\%) = \text{RUB } 40,954,278,725$$

6. Exchange rate at mid 2018 RUB 1/ £0.012

$$\text{RUB } 40,954,278,725 * 0.012 = \text{£}504,363,038$$

Data Normalisation

Event	Brazil Summer Olympics 2016	France Euros 2016	Russia Winter Olympics 2014	Brazil World Cup 2014
Budget (£)	£635,450,000	£20,960,000	£1,364,620,000	£498,000,000
Fans (millions)	6.80	2.75	2.00	3.46
Hectares	11	17	3	20
Per Person Attending (£)	£93.45	£7.63	£682.31	£143.97
Local Exchange Rate	4.30	1.19	59.57	3.78
Local Cost	BRL 2,732,435,000	EUR 24,942,400.00	RUB 81,290,413,400	BRL 1,882,440,000
Local Escalation from date to Mid 2015	-4.7%	-2.0%	6.7%	5.9%
Local Cost Mid 2015	BRL 2,604,010,555	EUR 24,456,023	RUB 86,736,871,098.00	BRL 1,992,562,740
Location Factor	1.03	0.95	1.00	1.03
Country Cost Mid 2015	BRL 2,692,783,642	EUR 23,182,272	RUB 86,736,871,098	BRL 2,060,491,015
Exchange Rate 2015	17.79	61.57	1.00	17.79
Russian Cost Mid 2015	RUB 47,907,269,633	RUB 1,427,436,055	RUB 86,736,871,098	RUB 36,658,161,873
Russian Escalation from 2015 to 2018	11.7%	11.7%	11.7%	11.7%
Russian Cost 2018	RUB 53,521,714,489	RUB 1,594,723,005	RUB 96,901,912,512	RUB 40,954,278,725
Exchange Rate to GBP	0.012	0.012	0.012	0.012
Russian Cost in £ 2018	£659,134,415	£19,639,446	£1,193,373,307	£504,363,038
Per Person Attending after Russian Costs (£)	£96.93	£7.15	£596.69	£145.81

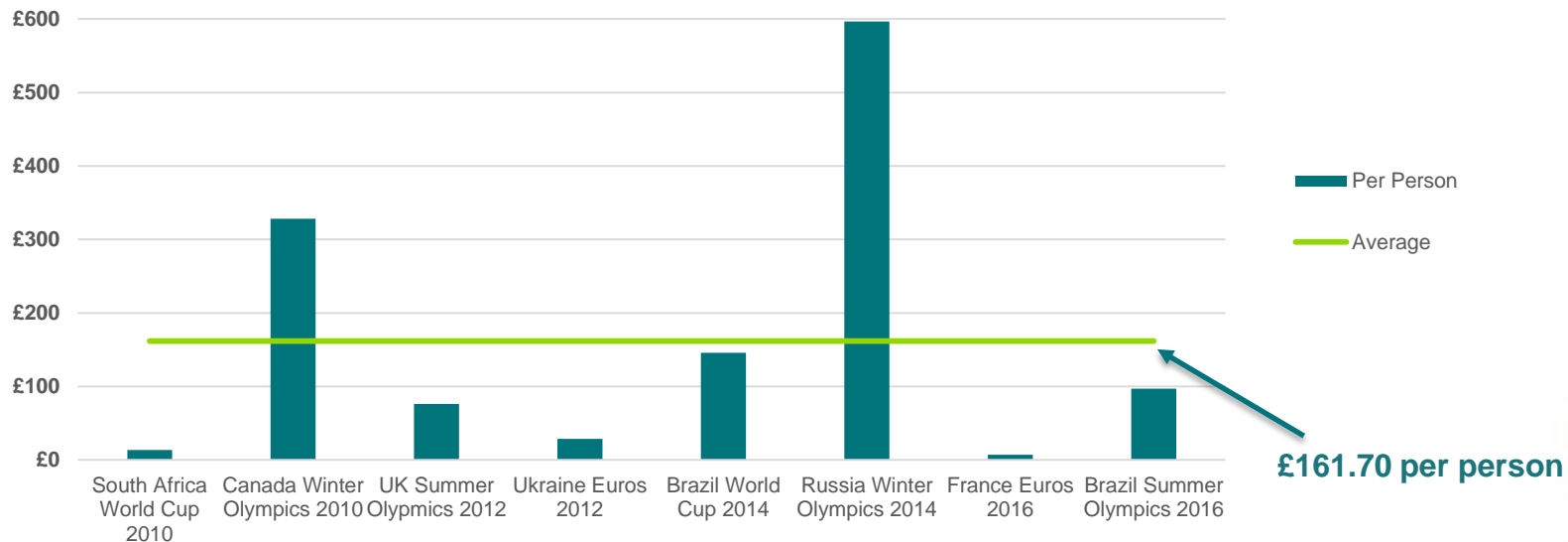
Initial Figures

Event	Per Person
South Africa World Cup 2010	£13.68
Canada Winter Olympics 2010	£328.42
UK Summer Olympmics 2012	£76.37
Ukraine Euros 2012	£28.55
Brazil World Cup 2014	£145.81
Russia Winter Olympics 2014	£596.69
France Euros 2016	£7.15
Brazil Summer Olympics 2016	£96.93
Average	£161.70
Fans	3,249,848
Russia World Cup 2018	£525,499,946.39

Mean

Multiply

Explanation of Initial Figures



$£161.70 * 3,249,848$ (no. of tickets available) = **£525.5m**



High Visibility Games

To accommodate for the extra security threat in the highest visibility games, including the 3 mentioned in the brief:

- Luzhniki Stadium: Opening Ceremony, Semi-final and Final
- Krestovsky Stadium (St. Petersburg): Semi-final

We are contributing an extra 10% of security costs to these games.

Calculation to find increased cost of this added security provision

Initial Figure - (Cost per person * capacity of 4 games) = x

x + ((Cost per person * 1.1) * capacity of 4 games) = y



High Visibility Games

$$£525.5m - (161.70 * 310,000) = £475.4m$$

$$£475.4m + ((161.70 * 1.1) * 310,000) = £530.5m$$

Initial Cost (assuming standard security for four games)	Cost Per Person	Total Capacity (for four games on higher alert)	x (cost for other 60 games only)	y (new cost with added 10% for four games)
£ 525.5m	£ 161.70	310,000	£ 475.4m	£ 530.5m

Initial cost = £525.5m

Cost after 10% increase for four high alert games = **£530.5m**

Cost Impact of providing more security for four games = £5m



Final Figure

As highlighted before, we are estimating to incur an additional 10% cost for the four games on higher security alert.

As a result:

Final Cost Estimate = **£525.5m + £5m**

= £530,500,000



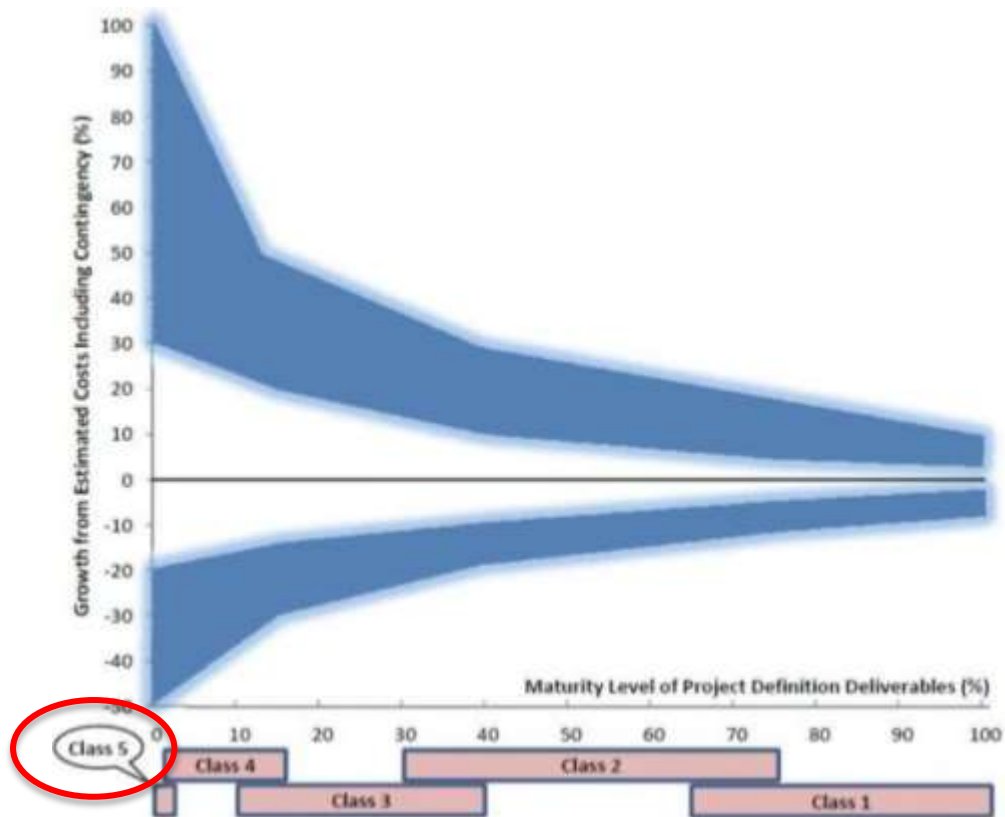
Final Figure Range

Due to the lack of maturity of this estimate, we are implementing a range classification.

- We are using a method outlined by the American Association of Cost Engineers which they call the Cost Estimate Classification System

	<i>Primary Characteristic</i>	<i>Secondary Characteristic</i>		
ESTIMATE CLASS	DEGREE OF PROJECT DEFINITION Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges ¹⁴
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 70%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	70% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Final Figure Range



100% = **£1.06b**

30% = **£689.7m**

0% = **£530.5m**

- 20% = **£424.4m**

- 50% = **£265.3m**



Impact of Assumptions

- Costing for the entire World Cup rather than the 3 games mentioned in the brief has an impact on our final figure
- The 10% increase in cost of the high visibility games increased our estimate by £5m
- Our estimate assumes that cost of security is relevant to capacity
- Exchange rates are known for their volatility

Estimating Techniques Considered

Comparative Estimating

Uses a similar project to compare 'like for like'

Previous events were in different years & countries, not enough data available, different threat risk

Expert Judgement

Experts suggest estimates for the project

No one available to us who had completed a similar project

Top down Estimating

Estimates given to each project work item

Limited information within requirements and time limitations

Bottom Up Estimating

Estimate given to individual tasks

Limited information regarding the cost of security at other events meant that this was not a feasible option



Estimating Techniques Used

Parametric Estimating

- Using past projects to get an average cost
- Allowed us to normalise the data
- Most accurate for this project based on data limitations



Considerations made

Consideration	Reasons for Dismissal
Contingency for possibility of Russia Vs. England match	<ul style="list-style-type: none">• Probability of match happening is low• English fans advised not to travel
Location of fan zones	<ul style="list-style-type: none">• Unable to provide security for such a large area
Aspect of surrounding area	<ul style="list-style-type: none">• Stadium is based within a complex.



Cost Estimates of Whole Life Cost

- Whole Life Cost takes into account the total cost of a product or service over it's lifetime.
- With more time and available data, we would have looked into:
 - Cost of upkeep of any systems or infrastructure we implemented
 - Duration of security



Sensitivity Analysis

- How uncertainty in an output can be apportioned to uncertainty in an input
- Not meaningful to apply to Estimates developed using a parametric technique
- Confidence modelling will look at the likelihood of risks randomly occurring and the impact this has on time/cost
- Parametric is using all in costs from prior projects, hence all risk mitigation budget is assumed to be included
- Important tool when more detail is available for individual activities within an estimate (3 Point Estimating)

Lessons Learnt



Areas for Future Improvement:

Assign roles from the start.

- Huge amount of work duplication
- Wasted time that could have been better spent working on other elements of the task.

Communicate effectively

- Too often achievements, or lack of, weren't being communicated to other teammates.
 - Led to further work duplication
- Knock-on impact on team morale.

Dedicate enough time to this project in the early stages

- We often prioritised day to day activities over this project
- Ended up with a number of tasks to complete at the back end of the project as the deadline got closer.



Questions

Appendix 1. Data Sources



Website/Book	Source Type	Information Obtained from Data Source
http://inflation.iamkate.com/	Database	Inflation rates for different years
Stadiumdb.com	Database	Stadium guide to all football stadia
Compass	Database	Location factors
Statista.com	Database	London 2012 and Rio 2016 Capacity
NBC Sports	News Article	Winter Olympics Capacity
Xe.com	Database	Exchange rates
American Association of Cost Engineers	Database	Cost Estimates Classifications
APMG Programme & Project Controls Course Textbook	Textbook	Information re. different estimating methods

Appendix 2. Stakeholder Plan



Grouping	Stakeholder	Points of Contact	Stakeholder Interest & Motivation	Influence	Methods of Communication
Customer	Society for Cost analysis & Forecasting (SCAF)	Neil Morrill	The customer (SCAF) will have an interest in the delivery of the task and compliance to stated requirements and outputs	Customer for SCAF project	Emails when required
Internal	AWE	Jeff Maple	The main internal stakeholder has an interest in the way in which AWE is represented at an external event	Influence over direction of project & those involved	Emails when required
Internal	Project Sponsors	Richard Allard, Matthew Finnemore, Stuart Freer, Philip McIntyre, Helen Liddiard, Paul Dunbar, Mike Semmons, Jeff Maple, Mike Slater	The project sponsors have an interest in the way in which the project is completed, the methods used and how AWE is represented at an external event	Influence over direction of project	Formal Meetings
Influencer	AWE Subject Matter Experts	Stuart Freer, Ashley Covington	Stuart Freer – Head of Estimating, AWE Ashley Covington – Business Modelling Specialist, AWE	Influence over methods used to estimate cost and methods used to analyse confidence of estimate.	Adhoc meetings