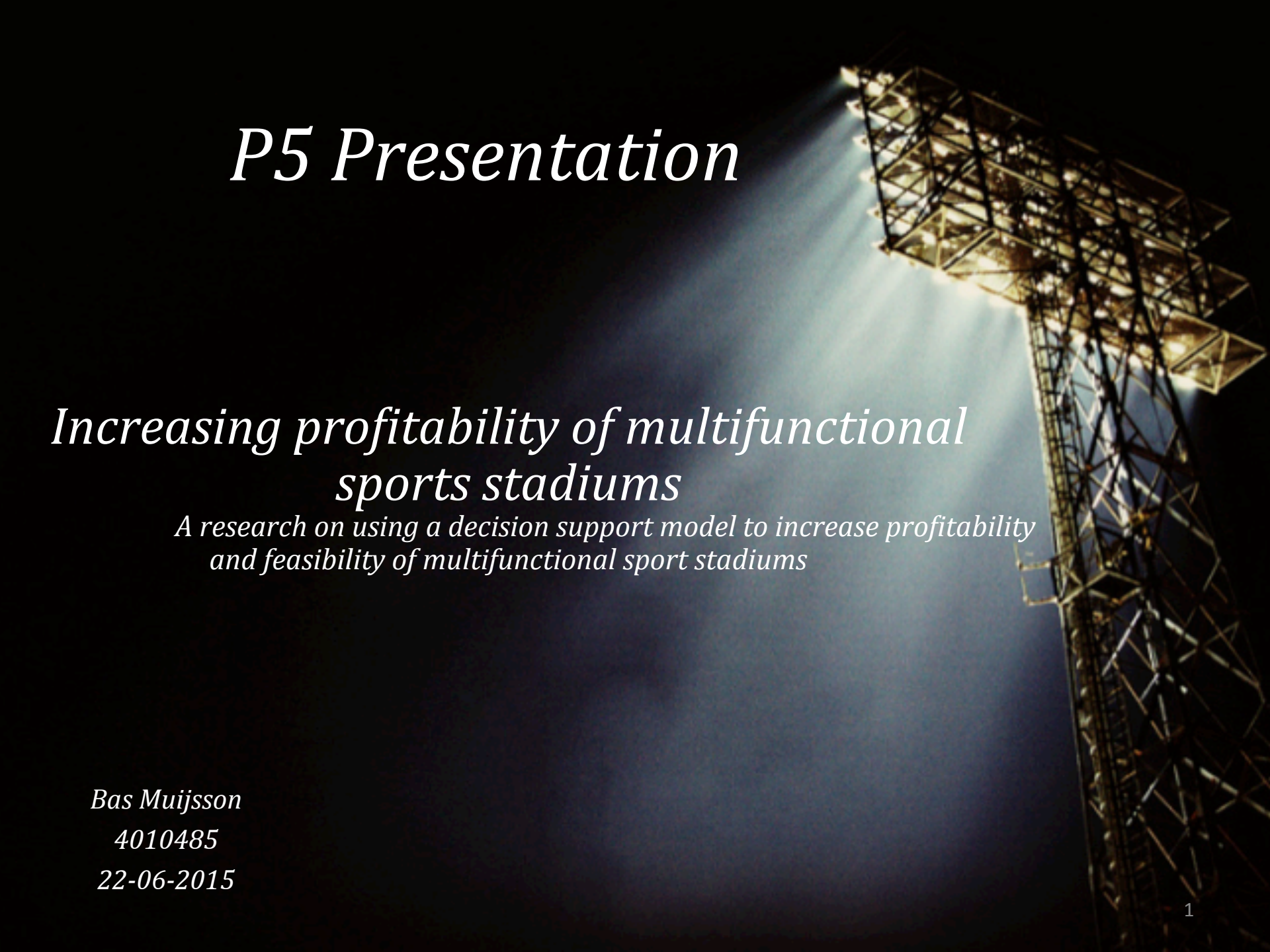


P5 Presentation

Increasing profitability of multifunctional sports stadiums

A research on using a decision support model to increase profitability and feasibility of multifunctional sport stadiums

Bas Muijsson
4010485
22-06-2015

Content

- *Introduction*
- *Problem Analysis*
- *Problem Statement*
- *Research Question*
- *Theoretical Framework*
- *Research Methods*
- *Case Description*
- *Model Explanation*
- *Results*
- *Conclusions*
- *Reflection*

Introduction

Motivation

- *High interest in sports in general*
- *High interest in real estate*

*'**Stadiums** are sports' real estate'*

Problem Analysis

Sports trends

FOOTBALL RICH LIST 2012/13 (2011/12)

Real Madrid's record signing **Gareth Bale**

1 (1)	Real Madrid	€518.9m	(512.6)
2 (2)	FC Barcelona	€482.6m	(483)
3 (4)	Bayern Munich	€431.2m	(368.4)
4 (3)	Manchester United	€423.8m	(395.9)
5 (10)	PSG	€398.8m	(220.5)
6 (7)	Manchester City	€316.2m	(285.6)
7 (5)	Chelsea	€303.4m	(322.6)
8 (6)	Arsenal	€284.3m	(290.3)
9 (13)	Juventus	€272.4m	(195.4)
10 (8)	AC Milan	€263.5m	(256.9)
11 (12)	Borussia Dortmund	€256.2m	(196.7)
12 (9)	Liverpool	€240.6m	(233.2)
13 (15)	Schalke 04	€198.2m	(174.5)
14 (14)	Tottenham Hotspur	€172m	(178.2)
15 (11)	Internazionale	€168.8m	(200.6)
16 (19)	Galatasaray	€157m	(129.7)
17 (20)	Hamburger SV	€135.4m	(121.1)
18 (n)	Fenerbahçe	€126.4m	(103.2)
19 (n)	AS Roma	€124.4m	(115.9)
20 (n)	Atlético de Madrid	€120m	(107.9)

- *Vastly improved financial structure*
- *Significant rise in available financial revenues*

Problem Analysis

Sports trends

Problem Analysis

Sports trends

Premier League lands £3bn TV rights bonanza from Sky and BT

New entrant BT to launch sports channel, as Premier League hails 71% income boost from live TV rights auction

Owen Gibson
Follow @owen_g Follow @guardian_sport
The Guardian, Wednesday 13 June 2012 19.30 BST
Jump to comments (294)

Manchester City finishing top of the league made for an exciting climax that helped fuel bidding war. Photograph: Michael Regan/Getty Images

Problem Analysis

Sports trends

Problem Analysis

Sports trends

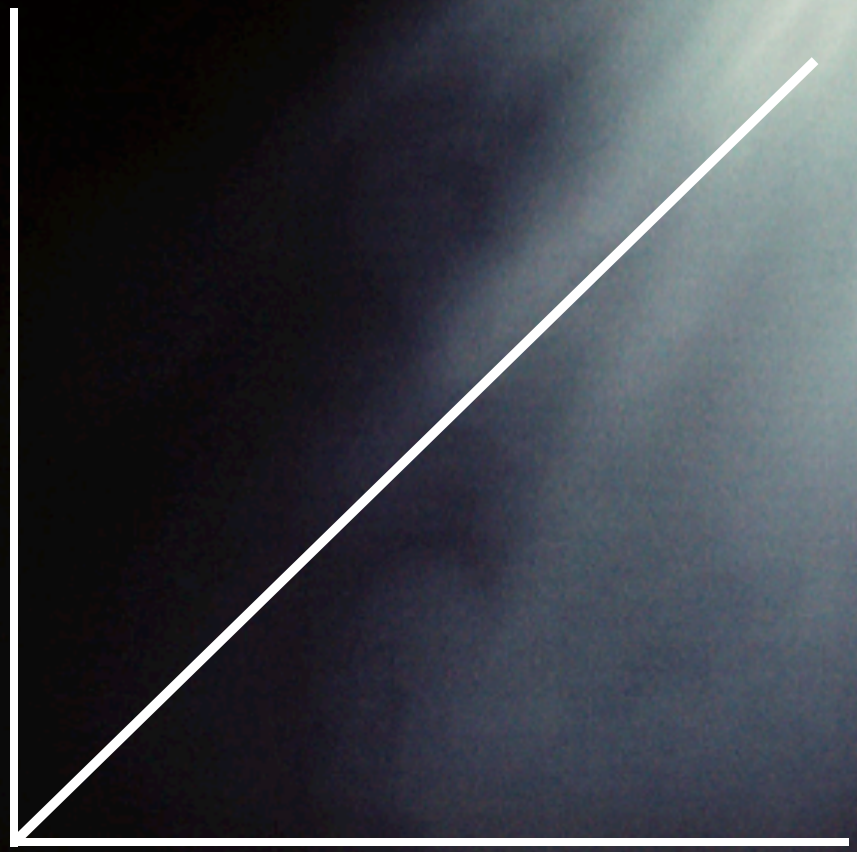
€93 Million

€106 Million

€89 Million

Problem Analysis

Sports trends



Problem Analysis

Sports trends

Rapidly growing finances in sports industry has effects on stadiums:

*Stadium **expansions/renovations** are needed*

Not only for capacity reasons, but also to encourage visitors to keep coming to the stadium

*Growing interest from **private investment** parties in stadium projects*

Problem Analysis

Sports trends

Shift from

Municipality

Investors

Problem Analysis

Sports trends

Shift from

Municipality
Social point of view

Investors

Problem Analysis

Sports trends

Shift from

Municipality
Social point of view

Investors
Financial point of view

Problem Analysis

Sports trends

Match Days €+

€

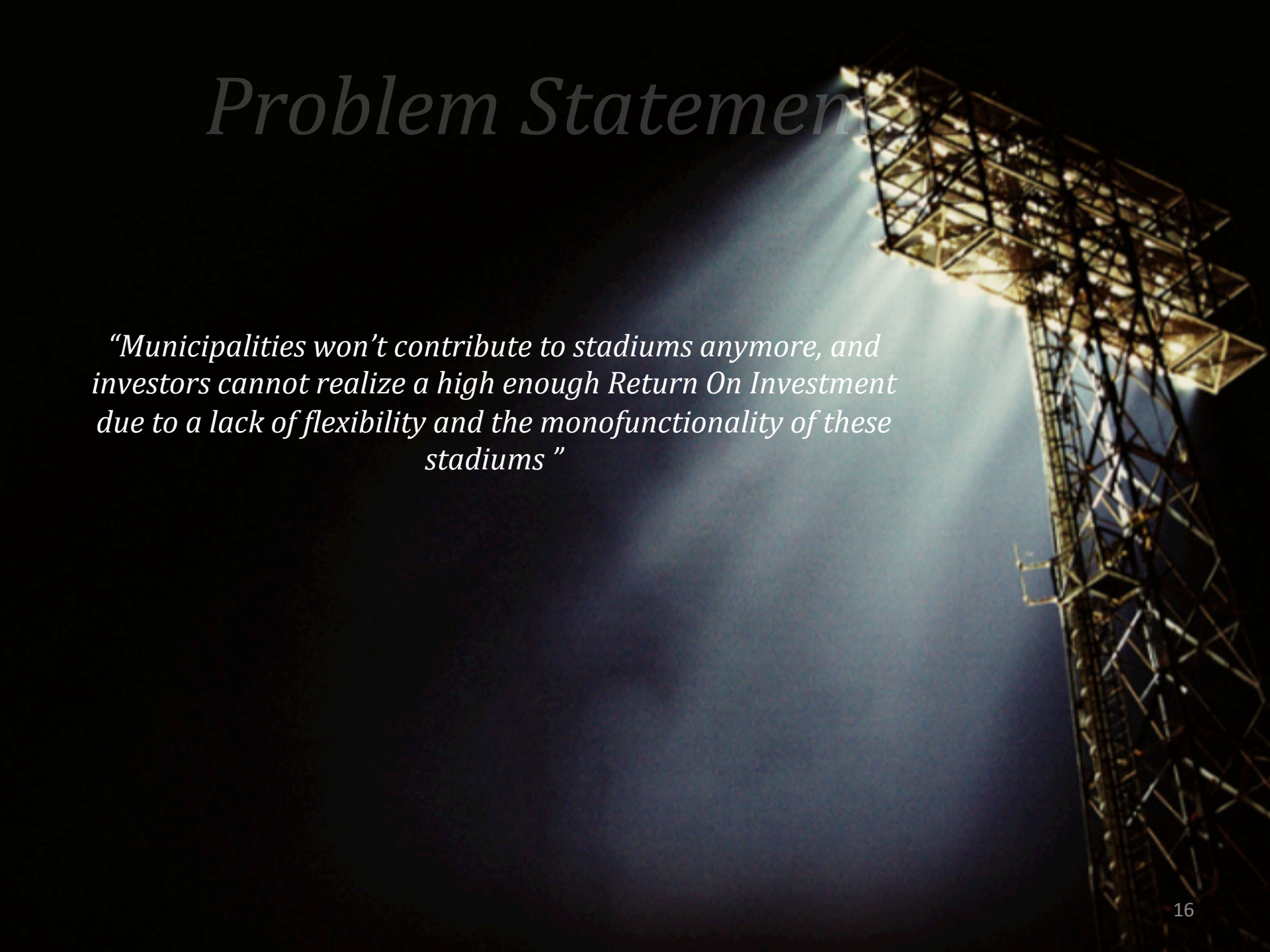
Problem Analysis

Sports trends

Concerts	€
Events	€
Meetings	€
Other	€
Match Days	€+
	€ € € € €

Problem Statement

"Municipalities won't contribute to stadiums anymore, and investors cannot realize a high enough Return On Investment due to a lack of flexibility and the monofunctionality of these stadiums "



Research Question

"How can a decision support model contribute in enlarging the return on investment, based on the lay-out of flexible and multifunctional sports stadium projects, in order to increase feasibility? "

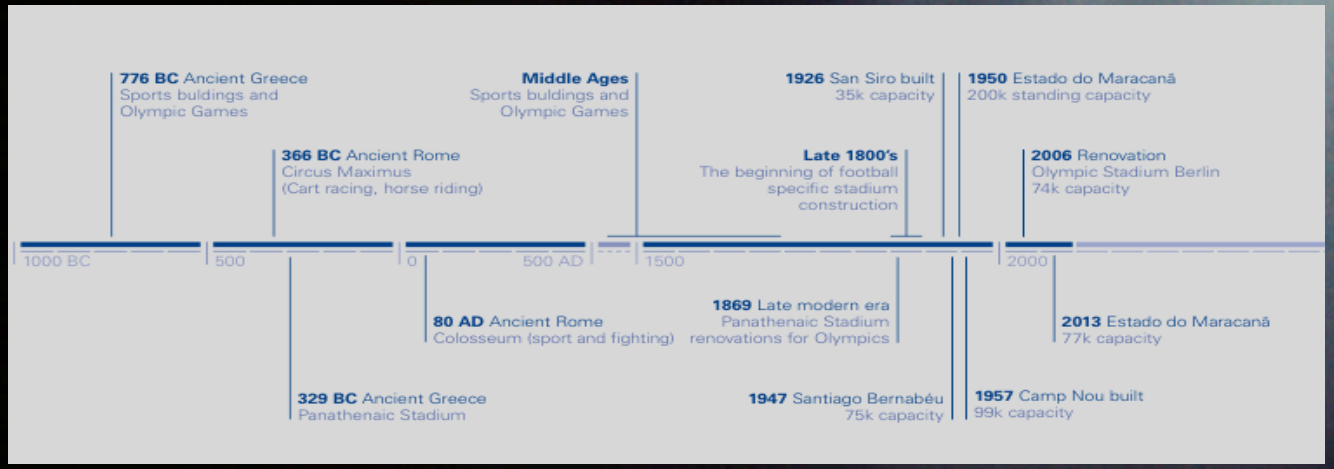
Decision support model:	Computer-based information system that supports business or organizational decision-making activities
Return on Investment:	A performance measure used to evaluate the efficiency of an investment
Lay-out:	The design of the stadium, on different levels of scale
Flexible:	The ability to adapt to changes, in this case multiple events
Multifunctional:	The ability to host different types of events
Sports Stadium:	A large structure for open-air sports or entertainment
Feasibility:	The determination as to whether the assigned tasks could be accomplished by using available resources

Theoretical Framework

History of stadium design

Originates in ancient Greece

Evolves into the stadiums that we know now through in different configurations and stereotypes



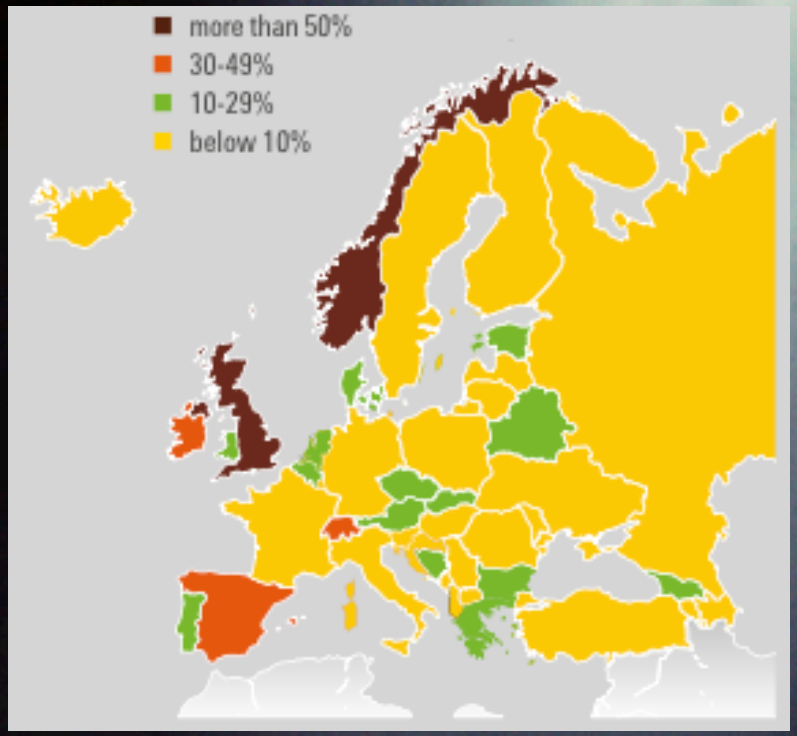
Theoretical Framework

Ownership situations

Big Five competitions (Eng, Esp, Fr, Ge, It) working towards private ownership

England as an example

Dutch market above average



Theoretical Framework

FIFA/UEFA

Very strictly regulated

Specific stadium demands for organizing international matches

Field of Play	105 m long, 68 m wide
Minimum size of referees' dressing room	20 m^2
Minimum floodlighting	1400 lux, all directions
VIP Parking	150
Spectator standing allowed	No
Minimum Seated capacity	8,000
Minimum total VIP seats	500
VIP seats for visiting team	100
VIP hospitality area	400 m^2
Minimum media working area	200 m^2 for 75 people
Minimum number of photographers	25
Minimum space for main camera platform	10 m^2 for 4 cameras
Minimum number of seats in the press box	100, 50 with desks (covered)
Minimum number of commentary positions	25
Minimum number of TV studios	2 with pitch view (2,3x5x5 m)
Minimum post-match interview positions	4 (2,5x2,5m)
Minimum outside broadcast van area	1,000 m^2
Minimum number of seats in press conference room	75

Research Fields

Design and Decision Systems

Used to accommodate the lack of decision systems usage in the field of stadium design

Building Economics

The research field which the decision model will try to recreate and enhance on stadium level

Design and Decision Systems

Mathematical Decision Modeling

Part of Operations Research

'The application of scientific method by interdisciplinary teams to problems involving the control of organized (man-machine) systems so as to provide solutions which best serve the purpose of the organization as a whole'. (Ackoff, 1956)

Design and Decision Systems

Mathematical Decision Modeling

Part of Operations Research

'The application of scientific method by interdisciplinary teams to problems involving the control of organized (man-machine) systems so as to provide solutions which best serve the purpose of the organization as a whole'. (Ackoff, 1956)

$U = f(x,y)$

U= Utility
F= Function
X= Controllable Variables
Y= Incontrollable Variables

Research Methods

Method: *Optimization process*
Program: *Microsoft Excel*
Tool: *'What'sBest!' plugin*

'The What'sBest! Plugin What'sBest! is an add-in to Excel that allows you to build large scale optimization models in a free form layout within a spreadsheet.'

What's Best!

Excel Plugin

The What'sBest! model operates according to a predefined formula, the ABC, which stands for Adjustable, Best and Constraints. The model creation follows these steps:

What's Best!

Excel Plugin

The What'sBest! model operates according to a predefined formula, the ABC, which stands for Adjustable, Best and Constraints. The model creation follows these steps:

Identify Adjustable Cells

What's Best!

Excel Plugin

The What'sBest! model operates according to a predefined formula, the ABC, which stands for Adjustable, Best and Constraints. The model creation follows these steps:

Identify Adjustable Cells
Define Best *(Optimal solution in solution space)*

What's Best!

Excel Plugin

The What'sBest! model operates according to a predefined formula, the ABC, which stands for Adjustable, Best and Constraints. The model creation follows these steps:

Identify Adjustable Cells
Define Best *(Optimal solution in solution space)*
Specify Constraints *(Define the solution space)*

What's Best!

Example: Two types of housing (Type 1 and Type 2)

	A	B	C	D	E	F
1	Endogenous Variables	Type 1	Type 2			
2	Outcome	6	4			
3						
4	Objective Function (Return in €)	2.5	1.5	21		
5						
6				Required		Available
7	Max. Area	1	2	14	=<=	14
8	Max. Time	2	1	16	=<=	16
9	Max. Costs	8	5	68	<=	80

Adjustable Cells

What's Best!

Example

	A	B	C	D	E	F
1	Endogenous Variables	Type 1	Type 2			
2	Outcome	6	4			
3						
4	Objective Function (Return in €)	2.5	1.5	21		
5						
6				Required		Available
7	Max. Area	1	2	14	=<=	14
8	Max. Time	2	1	16	=<=	16
9	Max. Costs	8	5	68	<=	80

'Best' cell

Return in €: Type 1 generates 2.5 and Type 2 generates 1.5 return

What's Best!

Example

	A	B	C	D	E	F
1	Endogenous Variables	Type 1	Type 2			
2	Outcome	6	4			
3						
4	Objective Function (Return in €)	2.5	1.5	21		
5						
6				Required		Available
7	Max. Area	1	2	14	=<=	14
8	Max. Time	2	1	16	=<=	16
9	Max. Costs	8	5	68	<=	80

Constraints

The program will try to find the optimal solution within the defined solution space (Area, Time, Costs)

What's Best!

The developed model follows the same structure on a greater scale

This example had:

2 adjustable cells
3 Constraints

The developed model has:

200+ adjustable cells
300+ constraints

Case Description

Feijenoord stadium 'De Kuip'

Case Description

Feijenoord stadium 'De Kuip'

Chosen because of:

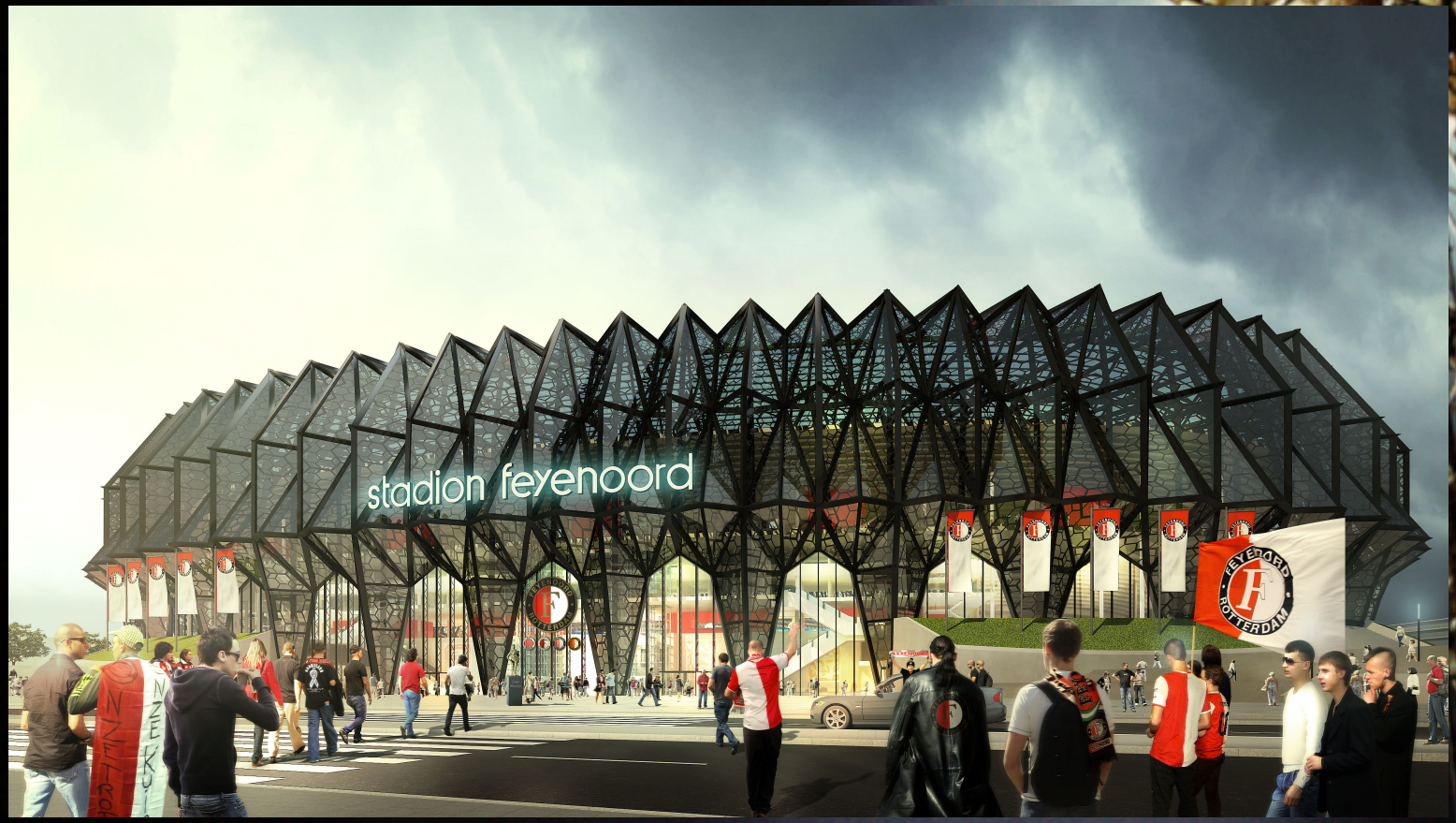
Proximity to Delft

One of the biggest stadiums in The Netherlands

Subject of renovation/new built plans

Case Description

Feijenoord stadium 'De Kuip'



Case Description

Feijenoord stadium 'De Kuip'

Case Description

Feijenoord stadium 'De Kuip'

Case Description

Feijenoord stadium 'De Kuip'

Case Description

Feijenoord stadium 'De Kuip'

Case Description

Feijenoord stadium 'De Kuip'

Planned Stadium Renovation:

20.000 Extra Seats
Largest stadium in The Netherlands
Retractable roof
2 Extra adjacent buildings
Public space also reconstructed
Open Plinth
Media Facade

Case Description

Feijenoord stadium 'De Kuip'

Case Description

Feijenoord stadium 'De Kuip'

Results

Adjusted Research Strategy

Result of high amount of sensitive financial information

New strategy:
Two extra case studies

- *The Amsterdam ArenA* *(Ajax Amsterdam)*
- *The GelreDome* *(Vitesse Arnhem)*

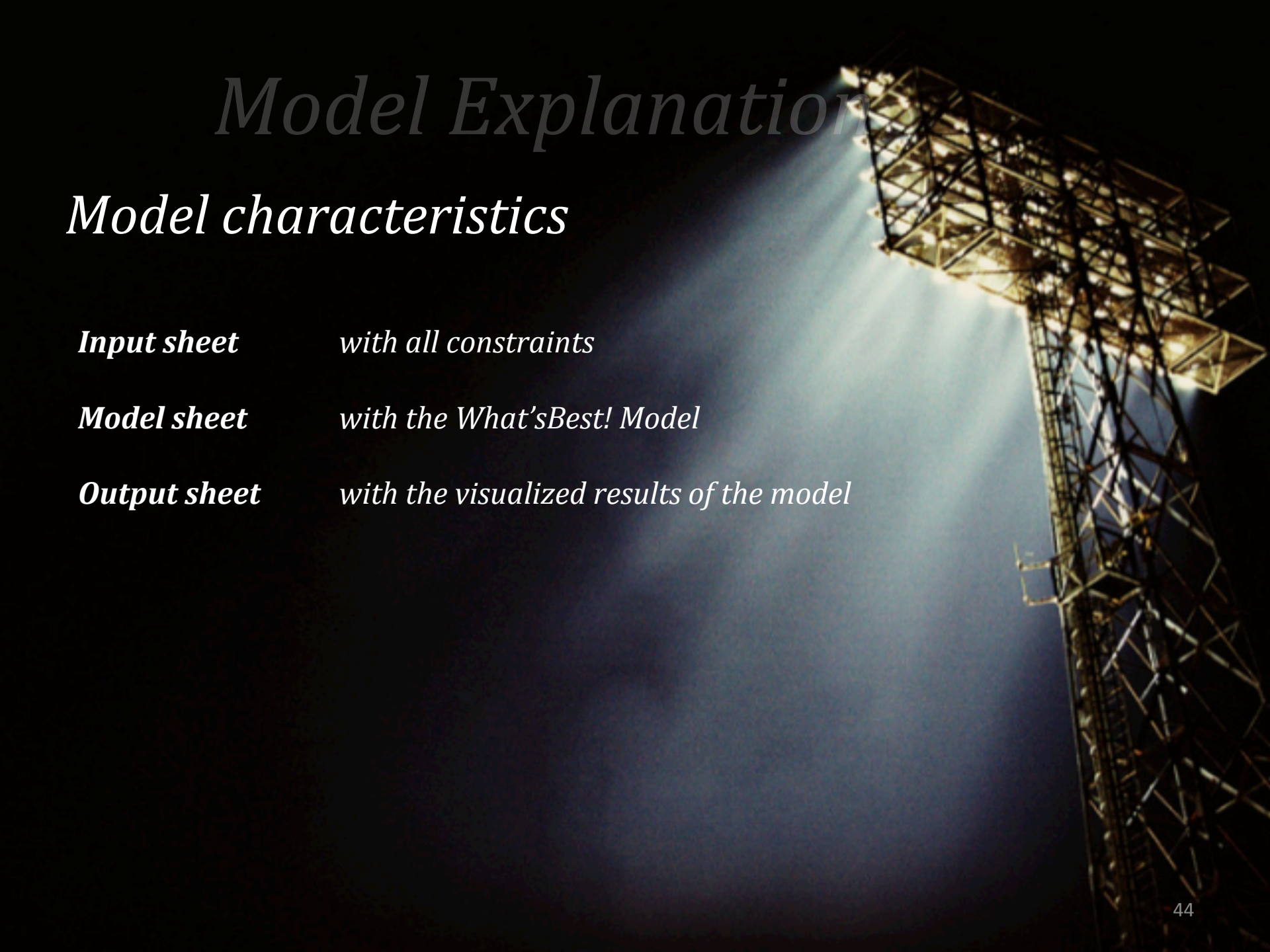
Used for:

- *Comparison*
- *Data enrichment*
- *Example of inductive nature*

Model Explanation

Model characteristics

Input sheet	*with all constraints*
Model sheet	*with the What'sBest! Model*
Output sheet	*with the visualized results of the model*



Model Explanation

Input sheet

Constraints in different categories:

General
Spectators
Events
Other Commercial
Sponsors
Operating Costs
Phasing

Stadium Financing
Corporate Clients
Sporting Events
Lease of commercial areas
FIFA/UEFA regulations
Facilities

**All constraints are connected to the different stakeholders within the project*

Model Explanation

Input sheet

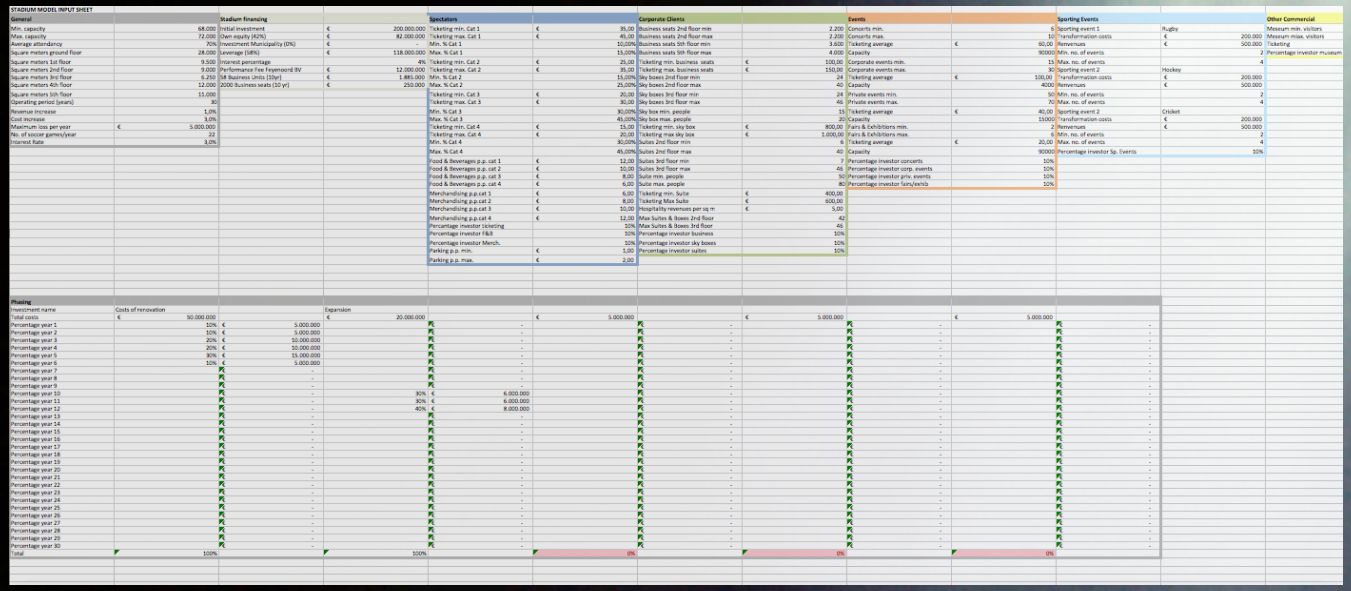
Involved stakeholders:

Municipality
Police & Fire Department
Stadium Owner
National Government
Sports Club (user)
Sports Club(other potential users)
Event organizers
Guests/Fans
Employees
Surrounding residents
Shop owners within the stadium

**All constraints are connected to the different stakeholders within the project*

Model Explanation

Input sheet



STADIUM MODEL INPUT SHEET

General		Stadium financing		Spectators		Corporate Clients		Events		Sporting Events			Other Commercial
Min. capacity	68.000	Initial investment	€ 200.000.000	Ticketing min. Cat 1	€ 35,00	Business seats 2nd floor min	2.200	Concerts min.	6	Sporting event 1	Rugby		Museum min. visitors
Max. capacity	72.000	Own equity (40%)	€ 82.000.000	Ticketing max. Cat 1	€ 45,00	Business seats 2nd floor max	2.200	Concerts max.	10	Transformation costs	€	200.000	Museum max. visitors
Average attendancy	70%	Investment Municipality (0%)	€ -	Min. % Cat 1	10,00%	Business seats 5th floor min	3.650	Ticketing average	€ 60,00	Revenues	€	500.000	Ticketing
Square meters ground floor	28.000	Leverage (58%)	€ 118.000.000	Max. % Cat 1	15,00%	Business seats 5th floor max	4.000	Capacity	90000	Min. no. of events		2	Percentage investor museum
Square meters 1st floor	9.500	Interest percentage	4%	Ticketing min. Cat 2	€ 25,00	Ticketing min. business seats	€ 100,00	Corporate events min.	15	Max. no. of events		4	
Square meters 2nd floor	9.000	Performance Fee Feyenoord BV	€ 12.000.000	Ticketing max. Cat 2	€ 35,00	Ticketing max. business seats	€ 150,00	Corporate events max.	30	Sporting event 2	Hockey		
Square meters 3rd floor	6.250	58 Business Units (10yr)	€ 1.881.000	Min. % Cat 2	15,00%	Sky boxes 2nd floor min	24	Ticketing average	€ 100,00	Transformation costs	€	200.000	
Square meters 4th floor	12.000	2000 business seats (10 yr)	€ 250.000	Max. % Cat 2	25,00%	Sky boxes 2nd floor max	40	Capacity	4000	Revenues	€	500.000	
Square meters 5th floor	11.000			Ticketing min. Cat 3	€ 20,00	Sky boxes 3rd floor min	24	Private events min.	50	Min. no. of events		2	
Operating period (years)	30			Ticketing max. Cat 3	€ 30,00	Sky boxes 3rd floor max	46	Private events max.	70	Max. no. of events		4	
Revenue increase	1,0%			Min. % Cat 3	30,00%	Sky box min. people	15	Ticketing average	€ 40,00	Sporting event 2	Cricket		
Cost increase	3,0%			Max. % Cat 3	45,00%	Sky box max. people	20	Capacity	15000	Transformation costs	€	200.000	
Maximum loss per year	€ 5.000.000			Ticketing min. Cat 4	€ 15,00	Ticketing min. sky box	€ 800,00	Fairs & Exhibitions min.	2	Revenues	€	500.000	
No. of soccer games/year	22			Ticketing max. Cat 4	€ 20,00	Ticketing max sky box	€ 1.000,00	Fairs & Exhibitions max.	6	Min. no. of events		2	
Interest Rate	3,0%			Min. % Cat 4	30,00%	Suites 2nd floor min	6	Ticketing average	€ 20,00	Max. no. of events		4	
				Max. % Cat 4	45,00%	Suites 2nd floor max	40	Capacity	90000	Percentage investor Sp. Events		10%	
				Food & Beverages p.p. cat 1	€ 12,00	Suites 3rd floor min	7	Percentage investor concerts	10%				
				Food & Beverages p.p. cat 2	€ 10,00	Suites 3rd floor max	46	Percentage investor corp. events	10%				
				Food & Beverages p.p. cat 3	€ 8,00	Suite min. people	50	Percentage investor priv. events	10%				
				Food & Beverages p.p. cat 4	€ 6,00	Suite max. people	80	Percentage investor fairs/exhib.	10%				
				Merchandising p.p.cat 1	€ 6,00	Ticketing min. Suite	€ 400,00						
				Merchandising p.p.cat 2	€ 8,00	Ticketing Max Suite	€ 600,00						
				Merchandising p.p.cat 3	€ 10,00	Hospitality revenues per sq m	€ 5,00						
				Merchandising p.p.cat 4	€ 12,00	Max Suites & Boxes 2nd floor	42						
				Percentage investor ticketing	10%	Max Suites & Boxes 3rd floor	46						
				Percentage investor F&B	10%	Percentage investor business	10%						
				Percentage investor Merch.	10%	Percentage investor sky boxes	10%						
				Parking p.p. min.	€ 1,00	Percentage investor suites	10%						
				Parking p.p. max.	€ 2,00								

Phasing													
Investment name	Costs of renovation		Expansion										
Total costs	€ 50.000.000		€ 20.000.000			€ 5.000.000		€ 5.000.000		€ 5.000.000			
Percentage year 1	10%	€ 5.000.000		-			-		-		-		-
Percentage year 2	10%	€ 5.000.000		-			-		-		-		-
Percentage year 3	20%	€ 10.000.000		-			-		-		-		-
Percentage year 4	20%	€ 10.000.000		-			-		-		-		-
Percentage year 5	30%	€ 15.000.000		-			-		-		-		-
Percentage year 6	10%	€ 5.000.000		-			-		-		-		-
Percentage year 7		-		-			-		-		-		-
Percentage year 8		-		-			-		-		-		-
Percentage year 9		-		-			-		-		-		-
Percentage year 10		-	30%	€ 6.000.000			-		-		-		-
Percentage year 11		-	30%	€ 6.000.000			-		-		-		-
Percentage year 12		-	40%	€ 8.000.000			-		-		-		-
Percentage year 13		-		-			-		-		-		-
Percentage year 14		-		-			-		-		-		-
Percentage year 15		-		-			-		-		-		-
Percentage year 16		-		-			-		-		-		-
Percentage year 17		-		-			-		-		-		-
Percentage year 18		-		-			-		-		-		-
Percentage year 19		-		-			-		-		-		-
Percentage year 20		-		-			-		-		-		-
Percentage year 21		-		-			-		-		-		-
Percentage year 22		-		-			-		-		-		-
Percentage year 23		-		-			-		-		-		-
Percentage year 24		-		-			-		-		-		-
Percentage year 25		-		-			-		-		-		-
Percentage year 26		-		-			-		-		-		-
Percentage year 27		-		-			-		-		-		-
Percentage year 28		-		-			-		-		-		-
Percentage year 29		-		-			-		-		-		-
Percentage year 30		-		-			-		-		-		-
Total	100%		100%		0%		0%		0%				

Model Explanation

Model sheet

*Based on the input the model is programmed to find the optimal ROI for the **stadium owner**, whilst complying to all the given constraints*

The model is capable of determining the ROI, including:

Phasing over 30 years
Revenue reduction
Floor by floor planning through function allocation
Revenues from fans
Revenues from corporate clients
Revenues from extra events
Revenues from other sporting events
Revenues from sponsorships
Operating costs

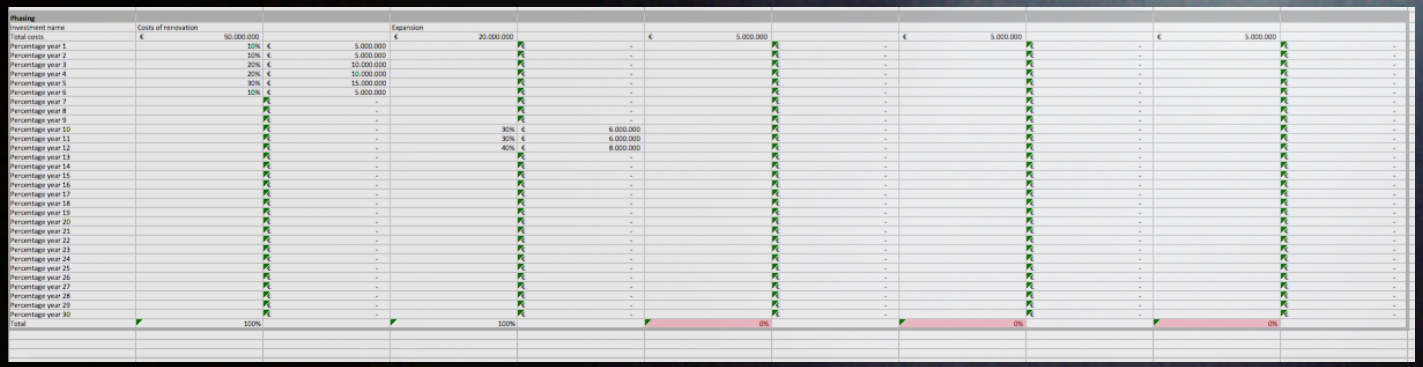
Model Explanation

Model sheet

Revenue Reduction

Loss of profit due to various reasons, like:

Decrease in ticket sales
Unavailable conference rooms
Roof construction
Etc.
Etc.



Phasing										
Investment name	Costs of renovation		Expansion							
Total costs	€ 50.000.000		€ 20.000.000		€ 5.000.000		€ 5.000.000		€ 5.000.000	
Percentage year 1	10%	€ 5.000.000	-	-	-	-	-	-	-	-
Percentage year 2	10%	€ 5.000.000	-	-	-	-	-	-	-	-
Percentage year 3	20%	€ 10.000.000	-	-	-	-	-	-	-	-
Percentage year 4	20%	€ 10.000.000	-	-	-	-	-	-	-	-
Percentage year 5	30%	€ 15.000.000	-	-	-	-	-	-	-	-
Percentage year 6	10%	€ 5.000.000	-	-	-	-	-	-	-	-
Percentage year 7	-	-	-	-	-	-	-	-	-	-
Percentage year 8	-	-	-	-	-	-	-	-	-	-
Percentage year 9	-	-	-	-	-	-	-	-	-	-
Percentage year 10	-	-	30%	€ 6.000.000	-	-	-	-	-	-
Percentage year 11	-	-	30%	€ 6.000.000	-	-	-	-	-	-
Percentage year 12	-	-	40%	€ 8.000.000	-	-	-	-	-	-
Percentage year 13	-	-	-	-	-	-	-	-	-	-
Percentage year 14	-	-	-	-	-	-	-	-	-	-
Percentage year 15	-	-	-	-	-	-	-	-	-	-
Percentage year 16	-	-	-	-	-	-	-	-	-	-
Percentage year 17	-	-	-	-	-	-	-	-	-	-
Percentage year 18	-	-	-	-	-	-	-	-	-	-
Percentage year 19	-	-	-	-	-	-	-	-	-	-
Percentage year 20	-	-	-	-	-	-	-	-	-	-
Percentage year 21	-	-	-	-	-	-	-	-	-	-
Percentage year 22	-	-	-	-	-	-	-	-	-	-
Percentage year 23	-	-	-	-	-	-	-	-	-	-
Percentage year 24	-	-	-	-	-	-	-	-	-	-
Percentage year 25	-	-	-	-	-	-	-	-	-	-
Percentage year 26	-	-	-	-	-	-	-	-	-	-
Percentage year 27	-	-	-	-	-	-	-	-	-	-
Percentage year 28	-	-	-	-	-	-	-	-	-	-
Percentage year 29	-	-	-	-	-	-	-	-	-	-
Percentage year 30	-	-	-	-	-	-	-	-	-	-
Total	100%		100%		0%		0%		0%	

Model Explanation

Model sheet

Floor by floor planning through function allocation

According to the PvE an allocation model for the different functions within the stadium is made, with a bandwidth for every function and a preferred floor allocation.

Function Distribution						
	Promenade		**F&B**		**1600000**	**1600000**
	Min	Max	Min	Max	Min	Max
Ground floor	9.000	11.000	1.200	1.800	2.400	3.000
1st floor						
2nd floor	1.500	3.000				
3rd floor						
4th floor	3.500	5.500	800	1.600		
5th floor	7.500	10.200	800	1.600		
Total	**21.500**	**29.700**	**2.800**	**5.000**	**2.400**	**3.000**
#/sq.m	50		200		200	
	Commercial		**Merchandise shop**		**Kitchen**	
	Min	Max	Min	Max	Min	Max
Ground floor	2.000	2.600	300	600	200	500
1st floor	2.600	3.000				
2nd floor					300	600
3rd floor					300	600
4th floor						
5th floor						
Total	**4.600**	**5.600**	**300**	**600**	**800**	**1.700**
#/sq.m	300		300		280	

Model Explanation

Model sheet

*Revenues from fans**

Ticket sales in 4 categories
F&B in 4 categories
Merchandise sales in 4 categories
Seat distribution in 4 categories
Museum revenues

STADIUM MODEL INPUT SHEET											
General		**Stadium financing**		**Spectators**		**Corporate Clients**		**Events**	
Min. capacity	68.000	Initial investment	200.000.000	Ticketing min. Cat 1	45,00	Business seats 2nd floor min	2.200	Concerts min.	4
Max. capacity	72.000	Own equity (42%)	82.000.000	Ticketing max. Cat 1	60,00	Business seats 2nd floor max	2.200	Concerts max.	6
Average attendancy	70%	Investment Municipality (0%)	-	Min. % Cat 1	10,00%	Business seats 5th floor min	3.600	Ticketing average	60,00
Square meters ground floor	28.000	Leverage (58%)	118.000.000	Max. % Cat 1	15,00%	Business seats 5th floor max	4.000	Capacity	90000
Square meters 1st floor	9.500	Interest percentage	4%	Ticketing min. Cat 2	35,00	Ticketing min. business seats	100,00	Corporate events min.	10
Square meters 2nd floor	9.000	Performance Fee Feyenoord E	12.000.000	Ticketing max. Cat 2	45,00	Ticketing max. business seats	150,00	Corporate events max.	20
Square meters 3rd floor	6.250	58 Business Units (10yr)	1.885.000	Min. % Cat 2	15,00%	Sky boxes 2nd floor min	24	Ticketing average	100,00
Square meters 4th floor	12.000	2000 Business seats (10 yr)	250.000	Max. % Cat 2	25,00%	Sky boxes 2nd floor max	40	Capacity	4000
Square meters 5th floor	11.000			Ticketing min. Cat 3	25,00	Sky boxes 3rd floor min	24	Private events min.	40
Operating period (years)	30			Ticketing max. Cat 3	35,00	Sky boxes 3rd floor max	46	Private events max.	50
Revenue increase	1,0%			Min. % Cat 3	30,00%	Sky box min. people	15	Ticketing average	40,00
Cost increase	3,0%			Max. % Cat 3	45,00%	Sky box max. people	20	Capacity	15000
Maximum loss per year	5.000.000			Ticketing min. Cat 4	20,00	Ticketing min. sky box	800,00	Fairs & Exhibitions min.	2
No. of soccer games/year	22			Ticketing max. Cat 4	25,00	Ticketing max sky box	1.000,00	Fairs & Exhibitions max.	4
Interest Rate	3,0%			Min. % Cat 4	30,00%	Suites 2nd floor min	6	Ticketing average	20,00
				Max. % Cat 4	45,00%	Suites 2nd floor max	40	Capacity	90000
				Food & Beverages p.p. cat 1	12,00	Suites 3rd floor min	7	Percentage investor concerts	10%
				Food & Beverages p.p. cat 2	10,00	Suites 3rd floor max	46	Percentage investor corp. even	10%
				Food & Beverages p.p. cat 3	8,00	Suite min. people	50	Percentage investor priv. even	10%
				Food & Beverages p.p. cat 4	6,00	Suite max. people	80	Percentage investor fairs/exhit	10%
				Merchandising p.p.cat 1	6,00	Ticketing min. Suite	400,00		
				Merchandising p.p.cat 2	8,00	Ticketing Max Suite	600,00		
				Merchandising p.p.cat 3	10,00	Hospitality revenues per sq m	5,00		
				Merchandising p.p.cat 4	12,00	Max Suites & Boxes 2nd floor	62		
				Percentage investor ticketing	10%	Max Suites & Boxes 3rd floor	46		
				Percentage investor F&B	10%	Percentage investor business	10%		
				Percentage investor Merch.	10%	Percentage investor sky boxes	10%		
				Parking p.p. min.	1,00	Percentage investor suites	10%		
				Parking p.p. max.	2,00				

**Of which a percentage is calculated as profit for the stadium owner*

Model Explanation

Model sheet

*Revenues from corporate clients**

Business seats
Suites
Sky Boxes
Hospitality

STADIUM MODEL INPUT SHEET

General		Stadium financing		Spectators		Corporate Clients		Events	
Min. capacity	68.000	Initial investment	200.000.000	Ticketing min. Cat 1	45,00	Business seats 2nd floor min	2.200	Concerts min.	4
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Square meters 3rd floor	6.250	58 Business Units (10yr)	1.885.000	Min. % Cat 2	15,00%	Sky boxes 2nd floor min	24	Ticketing average	100,00
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				Percentage investor Merch.	10%	Percentage investor sky boxes	10%		
				Parking p.p. min.	1,00	Percentage investor suites	10%		
				Parking p.p. max.	2,00				

**Of which a percentage is calculated as profit for the stadium owner*

Model Explanation

Model sheet

*Revenues from extra events**

Concerts
Private events
Corporate events
Fairs & Exhibitions

STADIUM MODEL INPUT SHEET

General		Stadium financing		Spectators		Corporate Clients		Events	
Min. capacity	68.000	Initial investment	200.000.000	Ticketing min. Cat 1	45,00	Business seats 2nd floor min	2.200	Concerts min.	4
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				Percentage investor ticketing	10%	Max Suites & Boxes 3rd floor	46		
				Percentage investor F&B	10%	Percentage investor business	10%		
				Percentage investor Merch.	10%	Percentage investor sky boxes	10%		
				Parking p.p. min.	1,00	Percentage investor suites	10%		
				Parking p.p. max.	2,00				

**Of which a percentage is calculated as profit for the stadium owner*

Model Explanation

Model sheet

*Revenues from other sporting events**

Sporting events, for which the stadium has to be transformed to a certain extend. Mostly reserved for sports like:

Rugby
American Football
Field Hockey
Cricket.

Sporting Events			Other Commercial		Lease of Commercial Area		Sponsors		FIFA/UEFA Regulations	
Sporting event 1	Rugby		Meseum min. visitors	30000	Min. sq. m. outside stadium	1000	Naming rights min.	800.000	TV-studio sq. m.	50
Transformation costs		200.000	Meseum max. visitors	50000	Lease revenues per sq.m	150,00	Naming rights max.	1.000.000	Min. no. TV-studios	2
Revenues		500.000	Ticketing	10,00	Percentage investor lease con	100%	Sponsorship min.	2.000.000	Max. no. TV-studios	4
Min. no. of events		2	Percentage investor museum	10%			Sponsorship max.	4.000.000	Min seat capacity	8000
Max. no. of events		4					Advertising min.	800.000	Min. no. of toilets areas	35
Sporting event 2	Hockey						Advertising max.	1.000.000	Max. no. of toilets areas	50
Transformation costs		200.000					Percentage investor naming ri	80%	Toilet area sq. m.	75
Revenues		500.000					Percentage investor sponsors	80%	No. of private toilets	15
Min. no. of events		2					Percentage investor advertisin	80%	Private toilet sq. m.	15
Max. no. of events		4							Min. no. of F&B sales points	72
Sporting event 2	Cricket									
Transformation costs		200.000								
Revenues		500.000								
Min. no. of events		2								
Max. no. of events		4								
Percentage investor Sp. Event		10%								

**Of which a percentage is calculated as profit for the stadium owner*

Model Explanation

Model sheet

Revenues from sponsorships

Naming Rights
Stadium sponsors
Advertising

Sporting Events			Other Commercial		Lease of Commercial Area		Sponsors		FIFA/UEFA Regulations	
Sporting event 1	Flugby		Meseum min. visitors	30000	Min. sq. m. outside stadium	1000	Naming rights min.	800.000	TV-studio sq. m.	50
Transformation costs		200.000	Meseum max. visitors	50000	Lease revenues per sq m	150,00	Naming rights max.	1.000.000	Min. no. TV-studios	2
Renvenues		500.000	Ticketing	10,00	Percentage investor lease con	100%	Sponsorship min.	2.000.000	Max. no. TV-studios	4
Min. no. of events		2	Percentage investor museum	10%			Sponsorship max.	4.000.000	Min seat capacity	8000
Max. no. of events		4					Advertising min.	800.000	Min. no. of toilets areas	35
Sporting event 2	Hockey						Advertising max.	1.000.000	Max. no. of toilets areas	50
Transformation costs		200.000					Percentage investor naming ri	80%	Toilet area sq. m.	75
Renvenues		500.000					Percentage investor sponsors	80%	No. of private toilets	15
Min. no. of events		2					Percentage investor advertisin	80%	Private toilet sq. m.	15
Max. no. of events		4							Min. no. of F&B sales points	72
Sporting event 2	Cricket									
Transformation costs		200.000								
Renvenues		500.000								
Min. no. of events		2								
Max. no. of events		4								
Percentage investor Sp. Event		10%								

Model Explanation

Model sheet

Operating costs

Taking into account:

FTE's
PTE's
Maintenance costs
Cleaning costs
Marketing costs
Utility costs
Management costs
Suppliers costs

Operating Costs	
FTE	110
FTE salaries	50.000
PTE	600
PTE salaries	3.000
Maintenance/repairs min.	3.000.000
Maintenance/repairs max.	4.000.000
Cleaning min.	3.500.000
Cleaning max.	4.000.000
Marketing events min.	3.500.000
Marketing events max.	4.500.000
Utilities min.	3.000.000
Utilities max.	4.000.000
Management min.	4.000.000
Management max.	5.000.000
Suppliers min.	4.500.000
Suppliers max.	6.000.000

Model Explanation

Output sheet

Concluding sheet with the results of the model runs

Will automatically display:

IRR
Cash flows (visualized)
Total ROI per year
Function allocation per floor (visualized)

IRR:
'The interest rate at which the Net Present Value (NPV) of all the cash flows (both positive and negative) from a project or investment equal zero. '

Model Explanation

Output sheet

IRR:
'The interest rate at which the Net Present Value (NPV) of all the cash flows (both positive and negative) from a project or investment equal zero. '

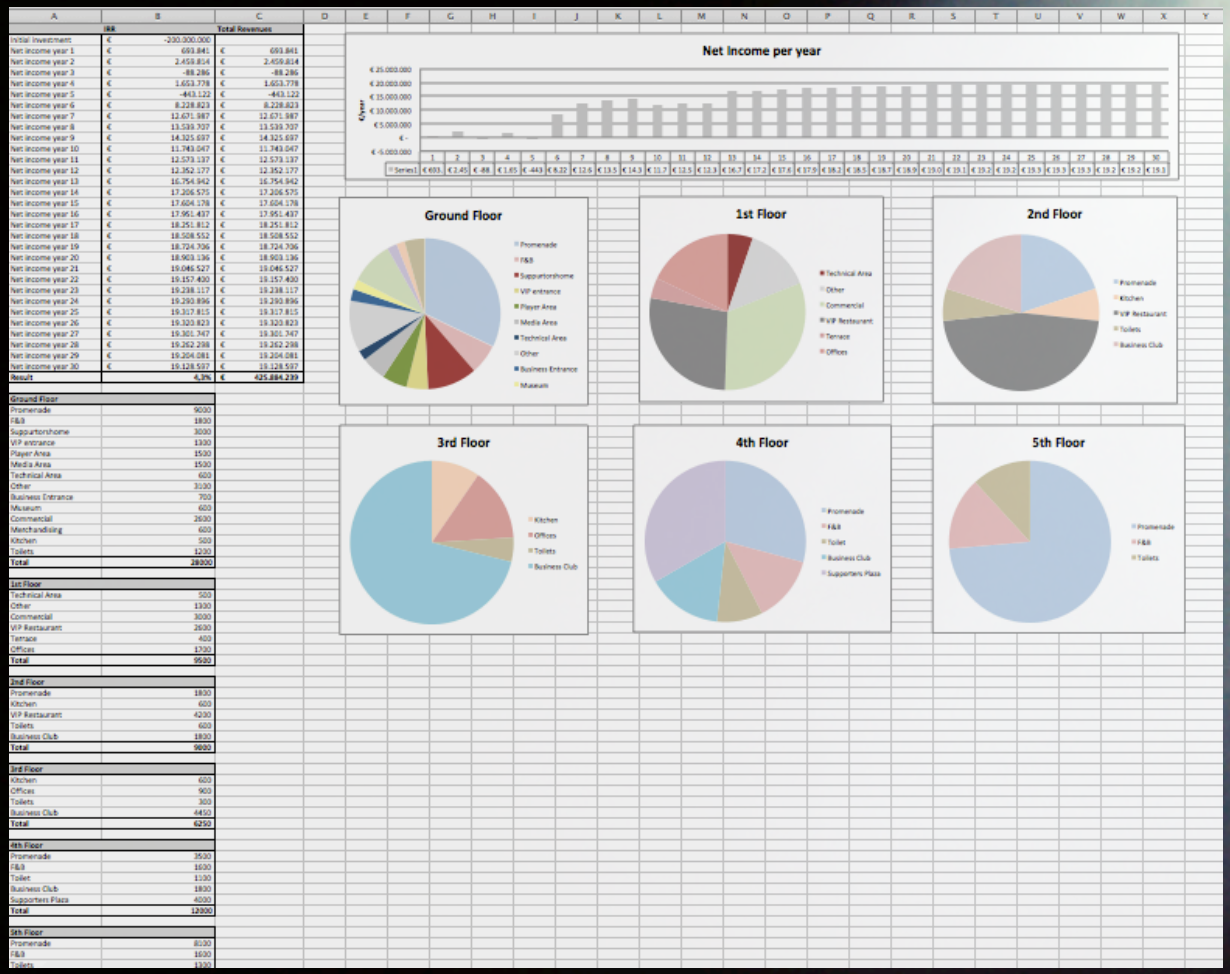
Investors should invest in projects with a positive IRR, but often have a personal 'MIRR' or 'MARR':

MIRR: Minimal Internal Rate of Return
MARR: Minimum Attractive Rate of Return

This is a specific IRR for each investor. For this research, the MIRR for all investors is set at 4%
Model outcomes should therefore have a IRR of 4% or higher in order to be attractive for the investor

Model Explanation

Output sheet



Results

Amsterdam ArenA

Capacity	*53.346 (90.000)*
Year built	*1996*
Initial construction costs	*€140 million*

Characteristics

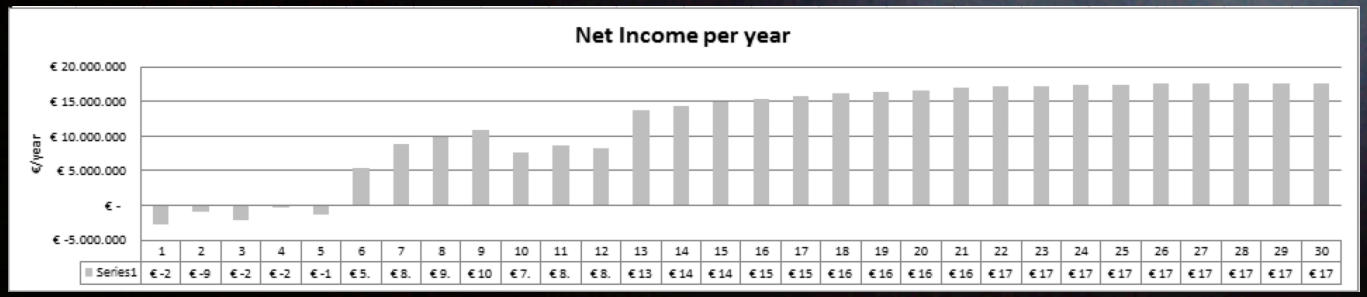
- *Roof*
- *Biggest stadium in the Netherlands*
- *Issues with grass growth*
- *Issues with Acoustics*

Results

Amsterdam ArenA

	IRR	Total Revenues
Initial investment	€ -140.000.000	
Net income year 1	€ -2.814.276	€ -2.814.276
Net income year 2	€ -915.085	€ -915.085
Net income year 3	€ -2.083.508	€ -2.083.508
Net income year 4	€ -293.620	€ -293.620
Net income year 5	€ -1.233.026	€ -1.233.026
Net income year 6	€ 5.326.359	€ 5.326.359
Net income year 7	€ 8.888.658	€ 8.888.658
Net income year 8	€ 9.913.523	€ 9.913.523
Net income year 9	€ 10.848.733	€ 10.848.733
Net income year 10	€ 7.584.745	€ 7.584.745
Net income year 11	€ 8.597.437	€ 8.597.437
Net income year 12	€ 8.306.276	€ 8.306.276
Net income year 13	€ 13.803.986	€ 13.803.986
Net income year 14	€ 14.371.297	€ 14.371.297
Net income year 15	€ 14.878.931	€ 14.878.931
Net income year 16	€ 15.330.881	€ 15.330.881
Net income year 17	€ 15.730.899	€ 15.730.899
Net income year 18	€ 16.082.507	€ 16.082.507
Net income year 19	€ 16.389.012	€ 16.389.012
Net income year 20	€ 16.653.519	€ 16.653.519
Net income year 21	€ 16.878.944	€ 16.878.944
Net income year 22	€ 17.068.024	€ 17.068.024
Net income year 23	€ 17.223.325	€ 17.223.325
Net income year 24	€ 17.347.259	€ 17.347.259
Net income year 25	€ 17.442.085	€ 17.442.085
Net income year 26	€ 17.509.924	€ 17.509.924
Net income year 27	€ 17.552.765	€ 17.552.765
Net income year 28	€ 17.572.473	€ 17.572.473
Net income year 29	€ 17.570.796	€ 17.570.796
Net income year 30	€ 17.549.372	€ 17.549.372
Result	**4,9%**	**€ 349.082.214**

4,9%



Results

GelreDome Arnhem

Capacity	*29.600 (41.000)*
Year built	*1998*
Initial construction costs	*€95 million*

Characteristics

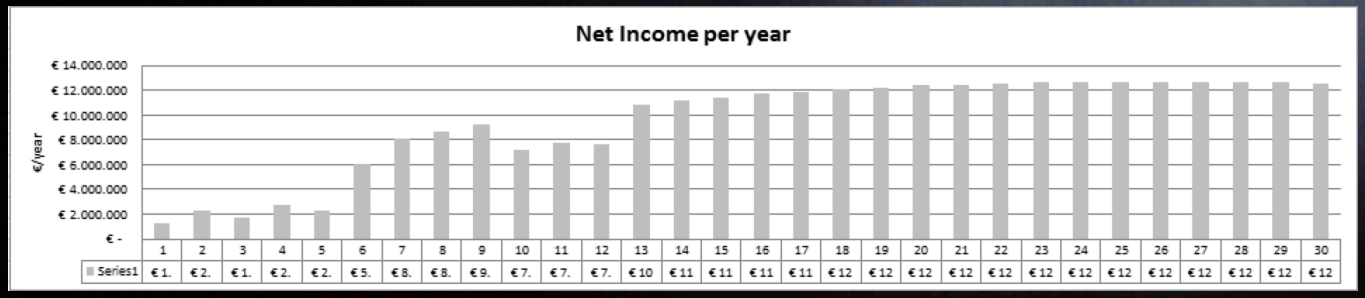
- *Roof*
- *Event stadium with only 20% match day income*
- *Floating stand and moveable pitch*
- *Conversion time of 6 hours*
- *Subject to financial crisis and sold to private investor*

Results

GelreDome Arnhem

	IRR	Total Revenues
Initial investment	€ -95.000.000	
Net income year 1	€ 1.200.555	€ 1.200.555
Net income year 2	€ 2.326.907	€ 2.326.907
Net income year 3	€ 1.693.967	€ 1.693.967
Net income year 4	€ 2.745.569	€ 2.745.569
Net income year 5	€ 2.232.075	€ 2.232.075
Net income year 6	€ 5.998.498	€ 5.998.498
Net income year 7	€ 8.047.565	€ 8.047.565
Net income year 8	€ 8.642.282	€ 8.642.282
Net income year 9	€ 9.181.704	€ 9.181.704
Net income year 10	€ 7.200.247	€ 7.200.247
Net income year 11	€ 7.783.565	€ 7.783.565
Net income year 12	€ 7.583.462	€ 7.583.462
Net income year 13	€ 10.855.685	€ 10.855.685
Net income year 14	€ 11.168.780	€ 11.168.780
Net income year 15	€ 11.445.277	€ 11.445.277
Net income year 16	€ 11.687.666	€ 11.687.666
Net income year 17	€ 11.898.282	€ 11.898.282
Net income year 18	€ 12.079.320	€ 12.079.320
Net income year 19	€ 12.232.838	€ 12.232.838
Net income year 20	€ 12.360.769	€ 12.360.769
Net income year 21	€ 12.464.928	€ 12.464.928
Net income year 22	€ 12.547.015	€ 12.547.015
Net income year 23	€ 12.608.626	€ 12.608.626
Net income year 24	€ 12.651.261	€ 12.651.261
Net income year 25	€ 12.676.322	€ 12.676.322
Net income year 26	€ 12.685.127	€ 12.685.127
Net income year 27	€ 12.678.909	€ 12.678.909
Net income year 28	€ 12.658.826	€ 12.658.826
Net income year 29	€ 12.625.961	€ 12.625.961
Net income year 30	€ 12.581.331	€ 12.581.331
Result	**6,7%**	**€ 284.543.318**

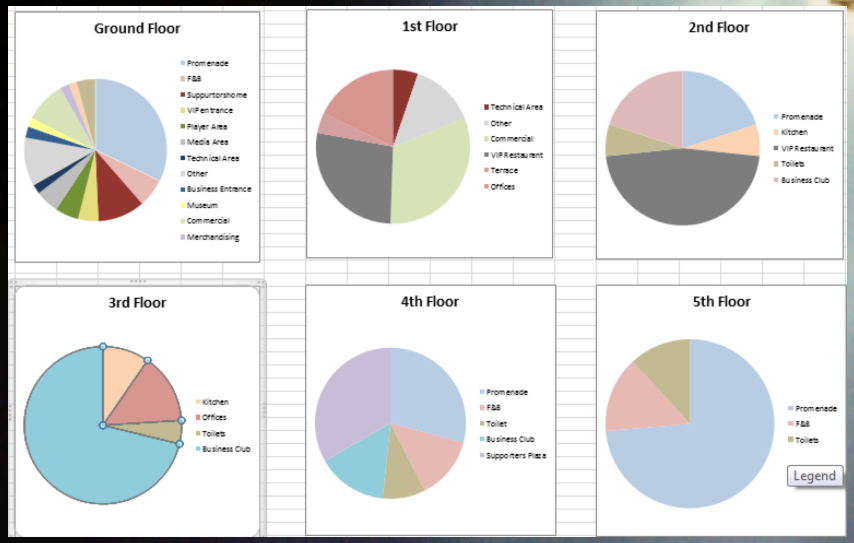
6,7%



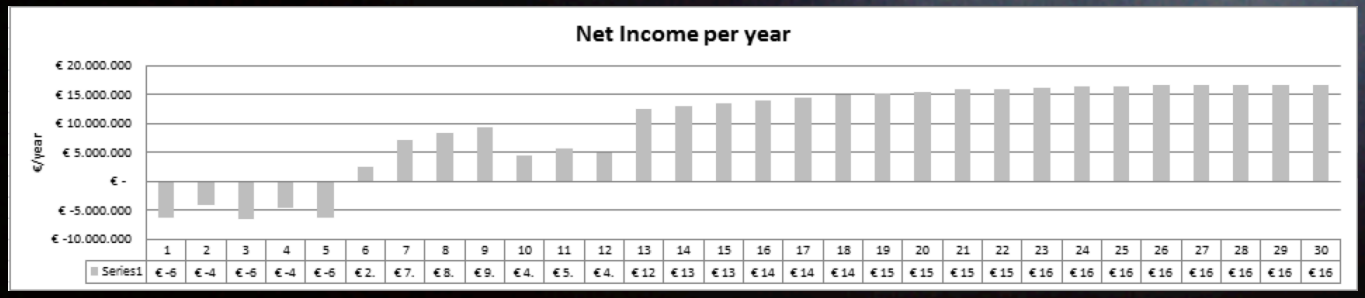
Results

De Kuip/Stadion Feijenoord

	IRR		Total Revenues
Initial investment	€	-200.000.000	
Net income year 1	€	-6.270.515	€ -6.270.515
Net income year 2	€	-4.223.021	€ -4.223.021
Net income year 3	€	-6.503.588	€ -6.503.588
Net income year 4	€	-4.507.211	€ -4.507.211
Net income year 5	€	-6.362.294	€ -6.362.294
Net income year 6	€	2.539.654	€ 2.539.654
Net income year 7	€	7.201.653	€ 7.201.653
Net income year 8	€	8.277.645	€ 8.277.645
Net income year 9	€	9.261.919	€ 9.261.919
Net income year 10	€	4.398.897	€ 4.398.897
Net income year 11	€	5.552.720	€ 5.552.720
Net income year 12	€	4.908.685	€ 4.908.685
Net income year 13	€	12.394.765	€ 12.394.765
Net income year 14	€	13.002.254	€ 13.002.254
Net income year 15	€	13.548.540	€ 13.548.540
Net income year 16	€	14.037.688	€ 14.037.688
Net income year 17	€	14.473.520	€ 14.473.520
Net income year 18	€	14.859.622	€ 14.859.622
Net income year 19	€	15.199.364	€ 15.199.364
Net income year 20	€	15.495.911	€ 15.495.911
Net income year 21	€	15.752.233	€ 15.752.233
Net income year 22	€	15.971.118	€ 15.971.118
Net income year 23	€	16.155.186	€ 16.155.186
Net income year 24	€	16.306.891	€ 16.306.891
Net income year 25	€	16.428.540	€ 16.428.540
Net income year 26	€	16.522.296	€ 16.522.296
Net income year 27	€	16.590.187	€ 16.590.187
Net income year 28	€	16.634.117	€ 16.634.117
Net income year 29	€	16.655.869	€ 16.655.869
Net income year 30	€	16.657.116	€ 16.657.116
Result		**1,7%**	**€ 290.959.761**



1,7%



Results

De Kuip/Stadion Feijenoord

In order to increase feasibility, the solution space of the model had to be widened to be able to increase the IRR to the MIRR.

Constraints on the following subjects have been widened:

Constraint	Old Value
Capacity	72.000
Construction Costs	€200.000.000
Revenue increase	1,0%
Ticketing Category 1	€60 (max)
No. of Business Seats	6200 (max)
No. of Suites and Sky Boxes	88 (max combined)
No. of Concerts	6 (max)
Corporate Events	50
Fairs & Exhibitions	4
Sponsorship	€4.000.000
FTE's	110
Cost Increase	3,0%
Operating Costs	€21.500.000 (min)
IRR	1,7%

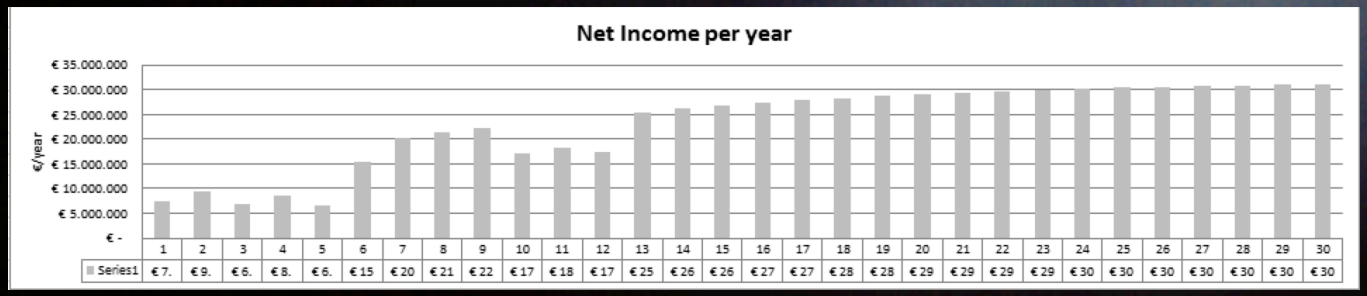
Results

De Kuip/Stadion Feijenoord

	IRR	Total Revenues
Initial investment	€ -185.000.000	
Net income year 1	€ 7.426.567	€ 7.426.567
Net income year 2	€ 9.270.328	€ 9.270.328
Net income year 3	€ 6.741.644	€ 6.741.644
Net income year 4	€ 8.578.162	€ 8.578.162
Net income year 5	€ 6.477.403	€ 6.477.403
Net income year 6	€ 15.524.407	€ 15.524.407
Net income year 7	€ 20.267.018	€ 20.267.018
Net income year 8	€ 21.310.623	€ 21.310.623
Net income year 9	€ 22.279.066	€ 22.279.066
Net income year 10	€ 17.048.537	€ 17.048.537
Net income year 11	€ 18.200.127	€ 18.200.127
Net income year 12	€ 17.437.400	€ 17.437.400
Net income year 13	€ 25.480.791	€ 25.480.791
Net income year 14	€ 26.131.304	€ 26.131.304
Net income year 15	€ 26.728.426	€ 26.728.426
Net income year 16	€ 27.275.145	€ 27.275.145
Net income year 17	€ 27.774.289	€ 27.774.289
Net income year 18	€ 28.228.534	€ 28.228.534
Net income year 19	€ 28.640.417	€ 28.640.417
Net income year 20	€ 29.012.339	€ 29.012.339
Net income year 21	€ 29.346.574	€ 29.346.574
Net income year 22	€ 29.645.273	€ 29.645.273
Net income year 23	€ 29.910.475	€ 29.910.475
Net income year 24	€ 30.144.108	€ 30.144.108
Net income year 25	€ 30.348.000	€ 30.348.000
Net income year 26	€ 30.523.880	€ 30.523.880
Net income year 27	€ 30.673.384	€ 30.673.384
Net income year 28	€ 30.798.062	€ 30.798.062
Net income year 29	€ 30.899.380	€ 30.899.380
Net income year 30	€ 30.978.726	€ 30.978.726
Result	**8,8%**	**€ 693.100.389**

*Results of the model run with **all** widened constraints enabled and **maximized***

8,8%



Results

De Kuip/Stadion Feijenoord

The solution space was made smaller by toning down the extreme constraints in order to find the alterations that have to be made to the stadium to come to the desired MIRR of 4%

Constraint	Old Value	New Value
Capacity	72.000	74.000
Construction Costs	€200.000.000	€195.000.000
Revenue increase	1,0%	1,3%
Ticketing Category 1	€60 (max)	€70 (max)
No. of Business Seats	6200 (max)	6700 (max)
No. of Suites and Sky Boxes	88 (max combined)	91 (max combined)
No. of Concerts	6 (max)	8 (max)
Corporate Events	50	55
Fairs & Exhibitions	4	6
Sponsorship	€4.000.000	€4.000.000
FTE's	110	100
Cost Increase	3,0%	2,6%
Operating Costs	€21.500.000 (min)	€19.000.000 (min)
IRR	1,7%	4,0%

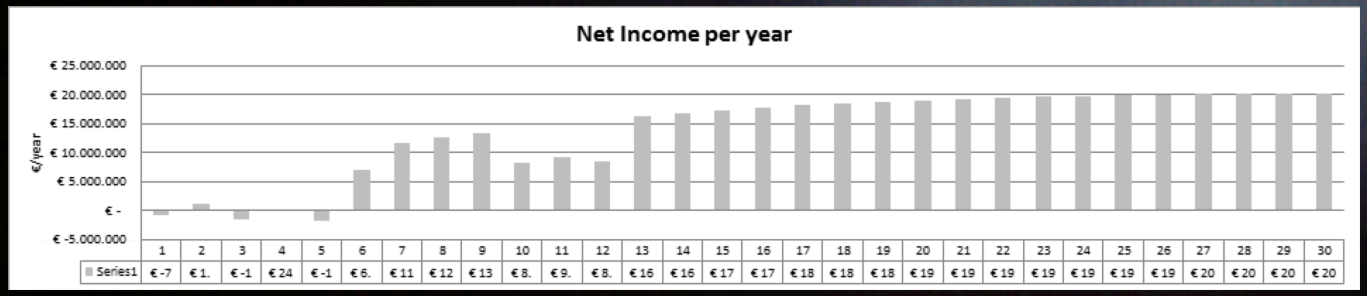
Results

De Kuip/Stadion Feijenoord

	IRR	Total Revenues
Initial investment	€ -195.000.000	
Net income year 1	€ -739.123	€ -739.123
Net income year 2	€ 1.043.834	€ 1.043.834
Net income year 3	€ -1.526.912	€ -1.526.912
Net income year 4	€ 241.823	€ 241.823
Net income year 5	€ -1.894.184	€ -1.894.184
Net income year 6	€ 6.989.734	€ 6.989.734
Net income year 7	€ 11.594.151	€ 11.594.151
Net income year 8	€ 12.540.943	€ 12.540.943
Net income year 9	€ 13.410.228	€ 13.410.228
Net income year 10	€ 8.203.121	€ 8.203.121
Net income year 11	€ 9.257.469	€ 9.257.469
Net income year 12	€ 8.440.243	€ 8.440.243
Net income year 13	€ 16.201.364	€ 16.201.364
Net income year 14	€ 16.747.787	€ 16.747.787
Net income year 15	€ 17.240.944	€ 17.240.944
Net income year 16	€ 17.684.121	€ 17.684.121
Net income year 17	€ 18.080.418	€ 18.080.418
Net income year 18	€ 18.432.758	€ 18.432.758
Net income year 19	€ 18.743.902	€ 18.743.902
Net income year 20	€ 19.016.453	€ 19.016.453
Net income year 21	€ 19.252.868	€ 19.252.868
Net income year 22	€ 19.455.463	€ 19.455.463
Net income year 23	€ 19.626.422	€ 19.626.422
Net income year 24	€ 19.767.807	€ 19.767.807
Net income year 25	€ 19.881.559	€ 19.881.559
Net income year 26	€ 19.969.511	€ 19.969.511
Net income year 27	€ 20.033.388	€ 20.033.388
Net income year 28	€ 20.074.819	€ 20.074.819
Net income year 29	€ 20.095.336	€ 20.095.336
Net income year 30	€ 20.096.385	€ 20.096.385
Result	**4,0%**	**€ 407.962.634**

Results of the model run with all widened constraints enabled

4,0%



Results

De Kuip/Stadion Feijenoord

The question may rise why the initial bid had been accepted since it proves to be infeasible

Therefore, a model of the initial BAM bid has been made. This was done to see why the contract with BAM initially had been accepted and if that program of requirements indeed was feasible.

Constraint	Old Value	New Value
Square Meters Ground Floor	18.000	30.000
Square Meters 1st Floor	9.500	12.000
Square Meters 2nd Floor	9.000	12.000
Square Meters 3rd Floor	6.250	8.000
Square Meters 4th Floor	12.000	14.000
Square Meters 5th Floor	11.000	14.000
Max. Square Meters Commercial Ground Floor	2.600	5.000
Max. Square Meters Commercial 1st Floor	3.000	5.000
Max. Square Meters F&B 1st Floor	1.800	3.000
Max. Square Meters F&B 4th Floor	1.600	2500
Max. Square Meters F&B 5th Floor	1.600	2.500
Revenue Increase	1,0%	1,5%
IRR	1,7%	4,1%

Results

Monte Carlo Simulation

Monte Carlo simulation is a quantitative risk analysis technique in which uncertain inputs in a model (in this case an Excel spreadsheet) are represented by probability distributions instead of by one value such as the most likely value.

Value	Most likely value	Range/Bandwith
Average attendancy	70%	65%-85%
Revenue increase	1,3%	1,0%-1,5%
Cost Increase	2,6%	2,0%-2,8%
Interest Rate	3,0%	2,2%-3,4%
Initial investment	€195.000.000	€190.000.000-€215.000.000

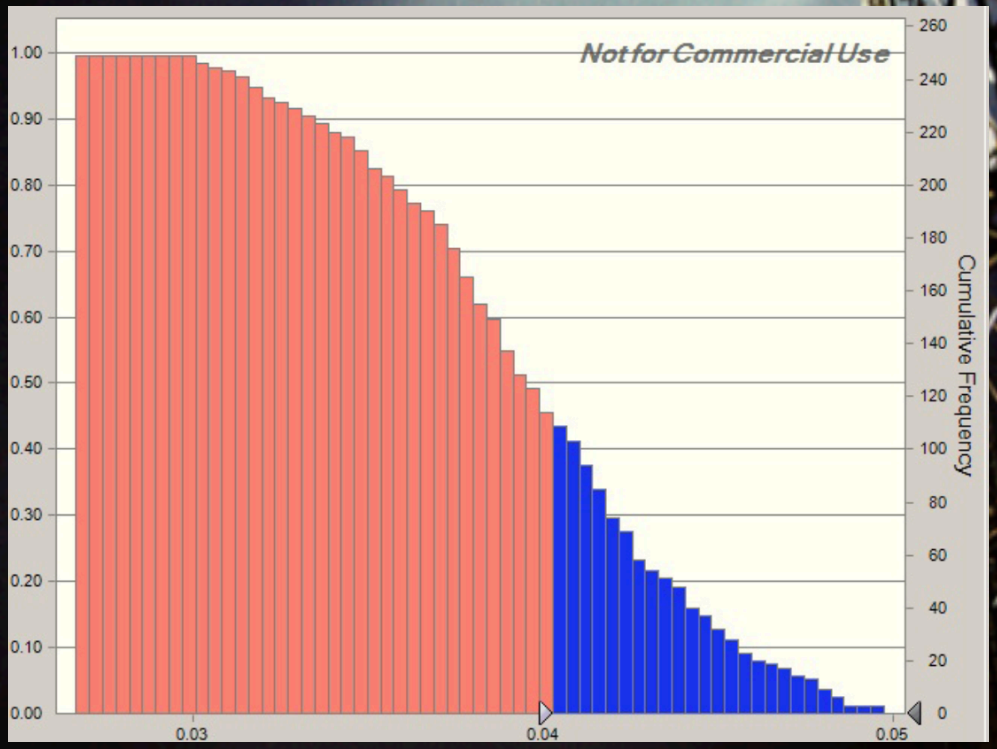
Results

Monte Carlo Simulation

Result of 250 runs with randomly chosen set of values:

40% over 4% IRR
60% under 4% IRR

No results under 0% IRR



Conclusions

- *A (fully) operating tool is created*
- *Decision support tools did not exist for stadium projects until now*
- *The tool can be implemented on various moments in the design, planning and negotiation phase*
- *Transparency in all stages of the project will be enlarged*
- *Without steering for certain results, the model showed the same issues as encountered in real life*
- *The model is inductive and can be adjusted to fit other projects fairly easily*

Conclusions

- *Cash flows are projected 30 years into the future. Most DCF models only apply a 10 year time frame, but stadium projects are long-term commitments and standard DCF models can not be used*

- *The model is fairly sensitive for certain input adjustments and changes in the results can be analyzed well (dual value)*

- *Results of the two other cases also display reality well in terms of feasibility, revenues and certain pitfalls*

- *To come to a feasible design for the Feijenoord stadium the solution space had to be enlarged and shrunken again, making use of the capabilities of the model approach*

- *Adjustments also show that the initial bid of BAM looked to be feasible before further design*

Conclusions

Limitations/Further Research

- *Further research must be carried out to increase realism and accurateness*
- *Availability of data*
- *Limitations of the model are the way in which it displays ownership. Only one method is incorporated as of now*
- *The size of the model is a limitation. Not only for the What'sBest! Plugin, but also for the time it takes to fill in or alter the model once it is made larger*
- *The types of input are limited to the ones with financial influence*

Reflection

- *Transparency is not always desirable. However, the main stakeholders can benefit from this transparency and should be able to convey other stakeholders.*
- *The realism of the outcomes is highly dependent on the accuracy and availability of the input*
- *Input can be provided anonymously per stakeholder if wished*
- *A choice in the way the model incorporates certain financial structures within the organization is desirable*
- *The choice for the 4% MIRR stays arbitrary, but this percentage had to be determined for the sake of the research. However, other MIRR goals can be set accordingly*
- *Other configurations of the stadium could also lead to a feasible design solution, besides the one proposed in the report*


Questions
Questions?