A proposal for building a football "brand" for Rarita in the next decade

Team: NKwings

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Executive Summary

This report details how we construct a “competitive” national team to boost Rarita’s football economy under financial constraints and how will this plan affect economic development. We develop a “Positional coefficients” based rating method to evaluate the performance of the provided players. Selections of team members are grounded on the financial constraint and different milestones for the FSA competition in 10 years. Elo-rating system and Monte-Carlo simulation are adopted to simulate the future performance of the national team. The result predicts a probability range of 84.85% to 90.13% of being competitive. To make the budget balance, we reinvest initial funding and net revenue into investment products, achieving excellent financial performance.

Furthermore, this report discovers the statistical regularity between the rank and the number of followers, the average attendances. It also details the relationship between these indicators and the matchday, broadcast, commercial revenue. Using the classic I-O model, we apply the concept of “multiplier” to describe the indirect and induced effect of building a football “brand”. The result reveals that an approximate 2.2% to 5.4% of GDP and 0.63% of new employment are contributed by building a football “brand”. Also, risks like suspension due to covid-19, recruitment failure are considered and corresponding mitigation methods are discussed in this report to help Rarita response the uncertainty in future promptly.

1. Objectives of Analysis

Football economy plays an important role in promoting the development in tourism, entertainment and political influence. Statistics shows the gross value of football industry reaches nearly one trillion in 2018, which is of great significance to a nation's economy. Therefore, it has become a consensus for countries to develop football economy. Nowadays, Rarita considers to construct a national team to participate in international competition. This report focuses on the two key objectives below.

1.1 Team construction

We provide a feasible plan of team selection in the next decade, considering the potential of players and financial situation of Rarita. We conduct thoughtful financial planning to balance the budget and make sure Rarita achieves its goal with high probability.

1.2 Economic impact analysis

We discuss the economic impact of building a football in aspects of different sources of revenue in detail. Economic indices like GDP, employment, tax will be fully analyzed and the mechanism of influence should be discussed.

2. Team Selection

2.1 Criteria for Selection

Individual valuation criteria

Referring to the information provided by the famous football game *FIFA21*， we rate a player based on their positions. Certain statistics are given as "Positional Coefficients" which are multiplied and added to assign every player an overall score[1].

In our report, we assess the performance of players excluding goalkeepers from three dimensions, 'shooting', 'passing' and 'defense'. And the performance of goalkeepers is evaluated from simply their 'goalkeeping' abilities. Moreover, we divide each

[1] The idea is inspired by FIFA player ratings explained: How are the card number & stats decided? | Goal.com

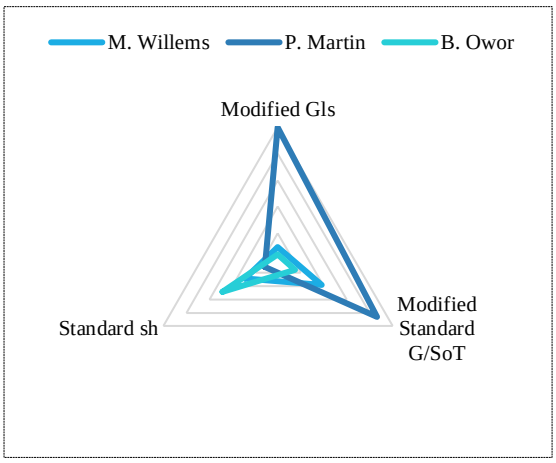
dimension into various sub-dimensions to portray detailed characters.[2]

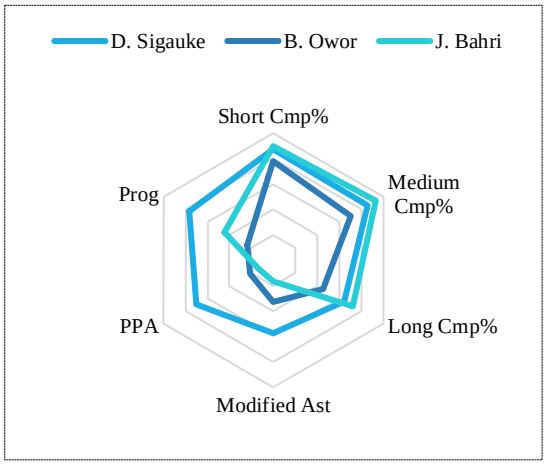
Table 2-1Weights of shooting, passing, and defense in different positions

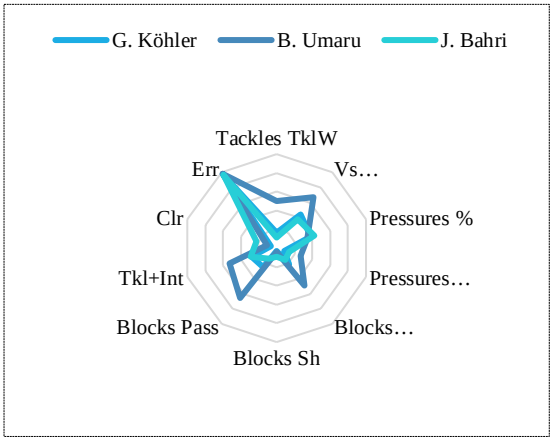
Position	Shooting	Passing	Defense
FW	0.5	0.35	0.15
FWMF	0.45	0.35	0.2
FWDF	0.4	0.4	0.2
MFFW	0.35	0.45	0.2
MF	0.3	0.5	0.2
MFDF	0.25	0.45	0.2
DFFW	0.2	0.4	0.4
DFMF	0.15	0.35	0.5
DF	0.1	0.3	0.6

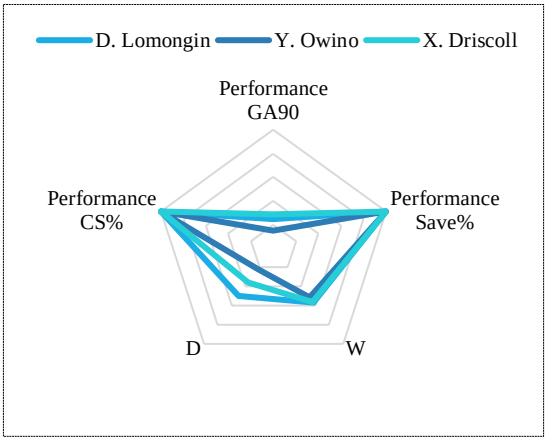
Table 2-2 Weights of Reflex, Diving, and Outcome

Position	Reflex	Diving	Outcome
GK	0.4	0.4	0.2









[2] We will explain the weight of detailed indexes and the way to calculate them in the Appendix A

Figure 2-1 Radar charts of some top player's sub-dimensional indexes

For those players who play in both positions, we allocate their weights considering the comprehensive skills of both positions. A similar approach can be also found in a topic concerning the rating of players in FIFA Forums.

Team selection criteria

Excellent individuals constitute a great team. After calculating the rating of every player in leagues and tournaments, we take the average ratings in tournament and league as their ratings in FSA for 2022. In the future, the ratings will change with players' age, so we plan to upgrade the lineup of our team every three years and adjust our lineup in the last year. We aim to maximize the comprehensive ratings of Rarita within limited initial resources and funding sources.

Table 2-3 Specific team selection criteria

Lineup	Rating	Price-Performance Ratio	age
lineup1(2022-2024)	top 50%	top 30%	<35
lineup2(2025-2027)	top 30%	top 25%	<35
lineup3(2028-2030)	top 25%	top 20%	<35
lineup4(2031)	top 15%		<35

2.2 Probability Ranges of the "success" of Being Competitive

In our previous work, we have selected the squads of the participating teams for the next ten years and have simulated and analyzed the league results and final ranking using Monte Carlo simulations[3].

The result of simulations shows that the existing lineup achieves great progress in rank as the FSA competition goes. We forecast the rank of Rarita will fluctuate around 10 in the first three years and gradually progress to around 5 in the next three years. In the last two years, our prediction displays that it's of high probability for Rarita to achieve an FSA championship, which is almost 100%.

[3] The specific algorithms and programming are explained in the Appendix A.

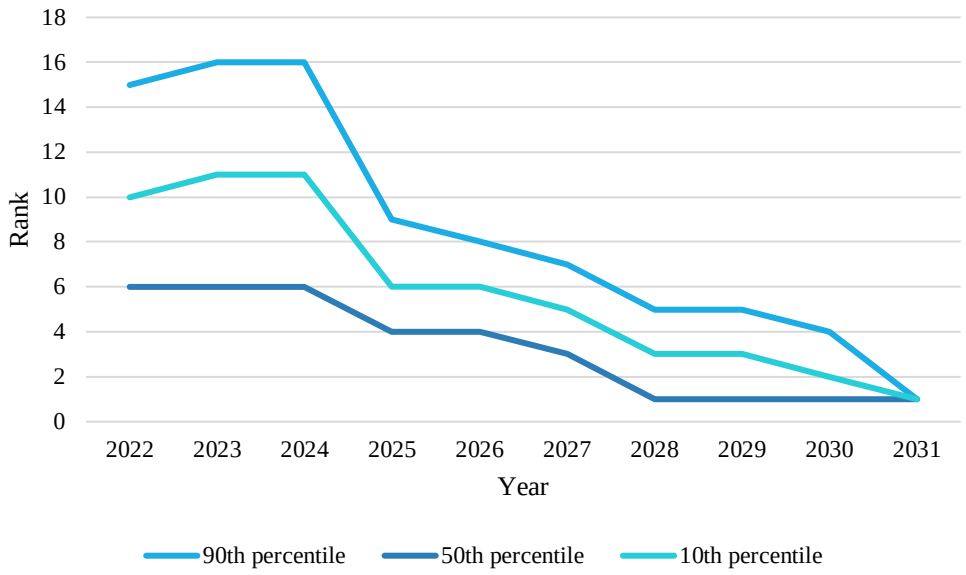


Figure 2 Different predictions of ranks of Rarita within the next ten years

We consider the simulation of the smallest overall ranking as an "optimistic" estimate of the match ranking and vice versa as a "pessimistic" estimate, and call the median overall ranking a "neutral" estimate.

Table 2-4 Optimistic, neutral, pessimistic estimation of the probability of ranking within the top 10,5,1 in each year

Rank	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
top 1(optimistic)	0%	0%	0%	1%	2%	4%	18%	24%	36%	100%
top 1(neutral)	0%	0%	0%	0%	1%	3%	16%	22%	28%	100%
top 1(pessimistic)	0%	0%	0%	0%	0%	0%	15%	20%	20%	98%
top 5(optimistic)	16%	6%	7%	36%	41%	60%	98%	100%	100%	100%
top 5(neutral)	9%	6%	6%	32%	34%	58%	95%	100%	100%	100%
top 5(pessimistic)	8%	4%	6%	32%	40%	54%	92%	99%	100%	100%
top 10(optimistic)	62%	58%	60%	95%	100%	100%	100%	100%	100%	100%
top 10(neutral)	60%	49%	48%	92%	99%	100%	100%	100%	100%	100%
top 10(pessimistic)	54%	48%	47%	90%	98%	98%	100%	100%	100%	100%

Based on our estimation, in the next 10 years, Rarita has a probability of 9.06% to 13.73% ranking within the top ten members 7 times, 30.47% to 37.47% ranking within the top ten 8 times, 36.27% to 40.63% ranking within the top ten 9 times, 11.85% to 19.03% probability of remaining in the top ten all the time. Also, our prediction shows that Rarita has a very high probability of winning the championship more than once. There is a 40.75% to 43.48% chance that Rarita will win two championships and a 12.33% to 15.84% chance that will three championships in the next ten years.

Here, if we assume "ranking within the top ten members" in the next 5 years more than

three times is a “success”, prediction shows the probability of that fluctuates from 85.59% to 90.13%. And the probability of not meeting the second standard of being “competitive” fluctuates from 0% to 0.87%. **Therefore, the probability range of being competitive is 84.85% to 90.13%.**

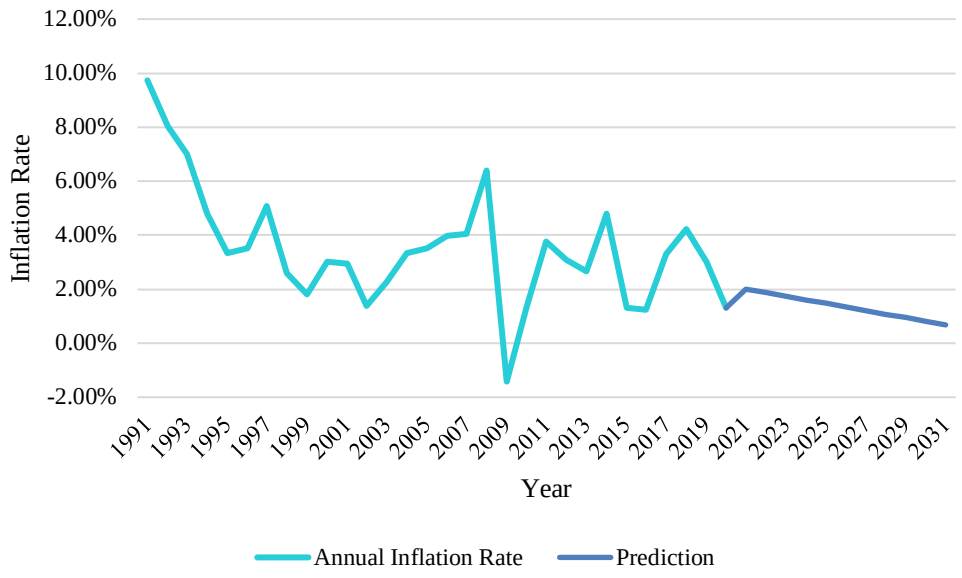
Table 2-5 Probabilities of ranking in different situations

top 10(optimistic)						
Times	0-5	6	7	8	9	10
Probability	0.01%	0.80%	9.06%	30.47%	40.63%	19.03%
top 10(neutral)						
Times	0-5	6	7	8	9	10
Probability	0.00%	0.87%	12.85%	36.43%	37.14%	12.72%
top 10(pessimistic)						
Times	0-5	6	7	8	9	10
Probability	0.00%	0.68%	13.73%	37.47%	36.27%	11.85%
top 1(optimistic)						
Times	0	1	2	3	4	5~10
Probability	0.00%	38.48%	43.48%	15.84%	2.16%	0.03%
top 1(neutral)						
Times	0	1	2	3	4	5~10
Probability	0.07%	45.34%	40.75%	12.33%	1.43%	0.09%
top 1(pessimistic)						
Times	0	1	2	3	4	5~10
probability	0.87%	43.28%	42.04%	12.62%	1.20%	0.00%

2.3 Spending and Direct Revenue Analysis

Salary spending

Salary spending of constructing a National team is calculated based on given lineups



and inflation rate in the next decade. Specifically, we adjust players' salaries to their capabilities and future inflation rate.

Figure 2-3 Prediction of Annual Inflation Rate using the ES method

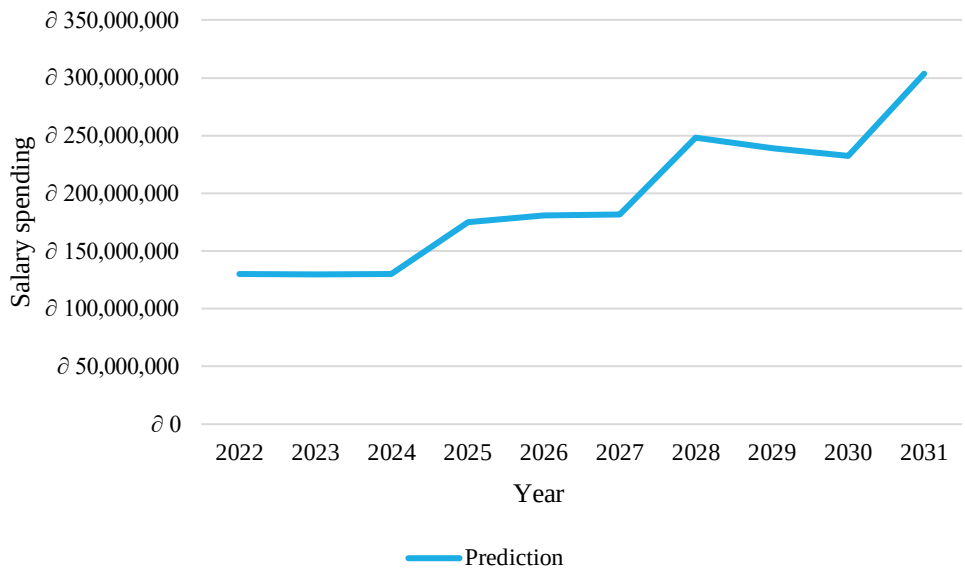


Figure 2-4 Prediction of Salary spending in the next decades

Other expense

We assume the profit margin maintains a constant 17% and obtain the amount based on the revenue.

Direct team revenues

We discover the relationship between players' ratings, followers, attendance and Matchday, Commercial, Broadcast revenue and estimate the future revenue of each category. We exclude the revenue that the original football industry could acquire from our estimation to represent the revenue that a competitive team directly brings.

The following table illustrates the spending of assembling the team and direct revenues in each year.

Table 2-6 the spending of assembling the team and direct revenues in each year

Year	Direct revenue			Spending on Assembling a Team	
	Matchday	Broadcast	Commercial	Salary of National Team	Other Expense
2022	∂ 212	∂ 760	∂ 482	∂ 130	∂ 1,207
2023	∂ 209	∂ 733	∂ 398	∂ 131	∂ 1,112
2024	∂ 216	∂ 697	∂ 349	∂ 132	∂ 1,048
2025	∂ 286	∂ 627	∂ 544	∂ 169	∂ 1,210
2026	∂ 293	∂ 588	∂ 491	∂ 175	∂ 1,138
2027	∂ 319	∂ 538	∂ 509	∂ 180	∂ 1,134
2028	∂ 379	∂ 475	∂ 661	∂ 241	∂ 1,258
2029	∂ 386	∂ 429	∂ 599	∂ 254	∂ 1,174
2030	∂ 436	∂ 368	∂ 702	∂ 248	∂ 1,250
2031	∂ 517	∂ 298	∂ 924	∂ 328	∂ 1,444

3. Economic Impact

To estimate the impacts of our plan on other economic indices, we consider three types of socioeconomic effects: direct, indirect and induced effects. All of these effects are reflected in the GDP, tax revenue, employment rates, savings rate and other economical indices. Each type of effect is briefly discussed below and the interrelationship between them is shown in Figure 3-1. Detailed definitions, analysis methods and forecast results can be found in Appendix B.

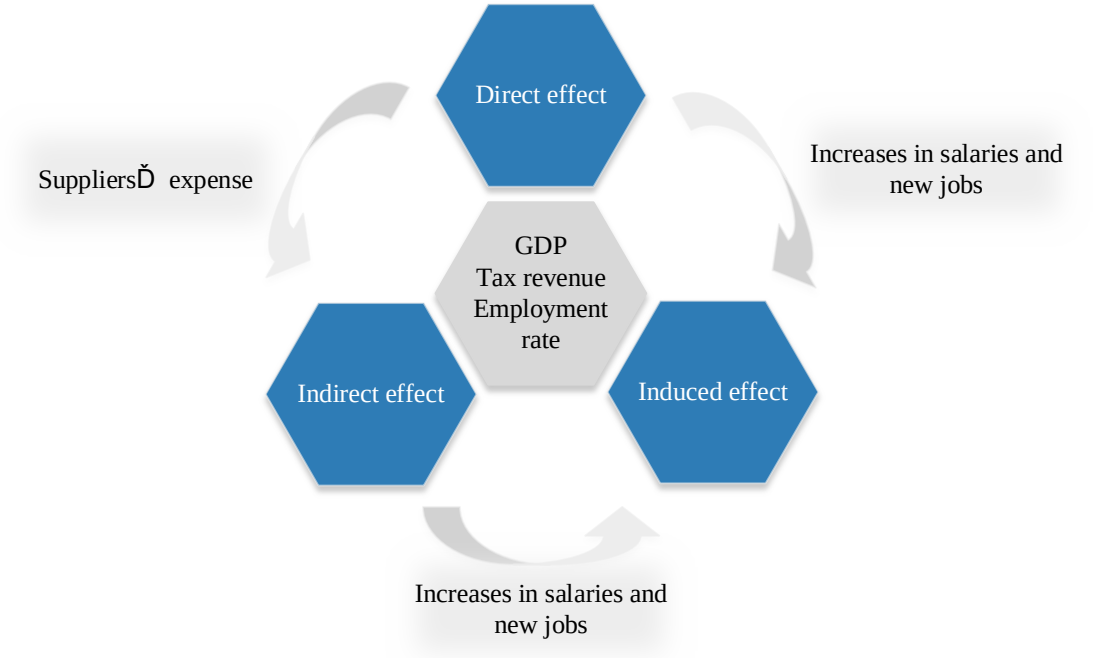


Figure 3-1 Interrelationship between effects

3.1 Direct effects

The total revenue generated by the football industry will be ∂3641M to ∂4942M annually over the next decade, representing 1.049% to 1.142% of GDP. Figure 3-2 shows the revenue by category in the stacked column chart, and the total revenue predicted with the 10th, 50th and 90th percentile of the rank in the line chart.

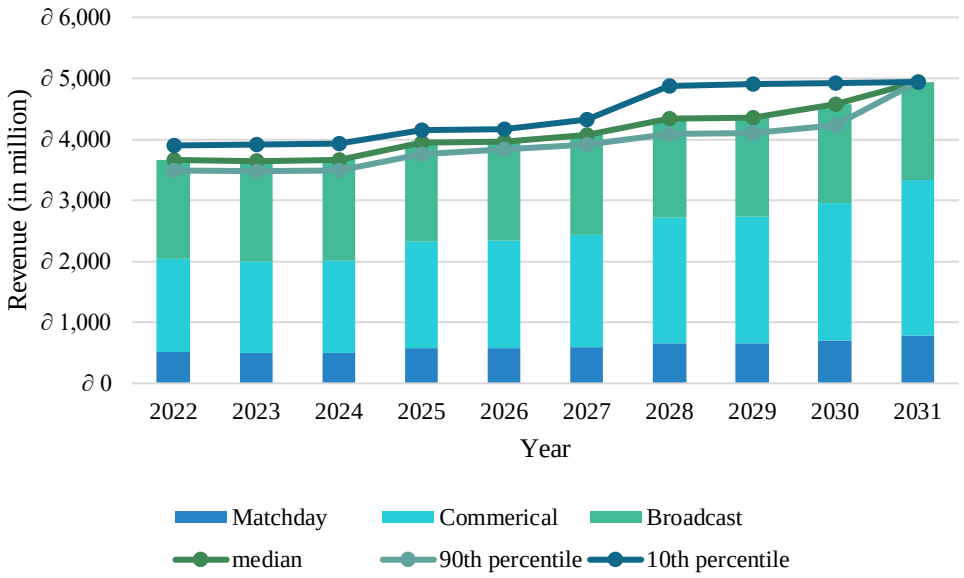


Figure 3-2 Revenue by category and total revenue in 10th,50th and 90th percentile

The proportions of three revenue to the total revenue are shown in Figure 3-3. The proportion of commercial revenue will grow and take over from the broadcast revenues. Commercial operations will gradually play a more important role in developing football's economy than broadcasting. The matchday revenue, however, will be proportionate to the total revenue stably.

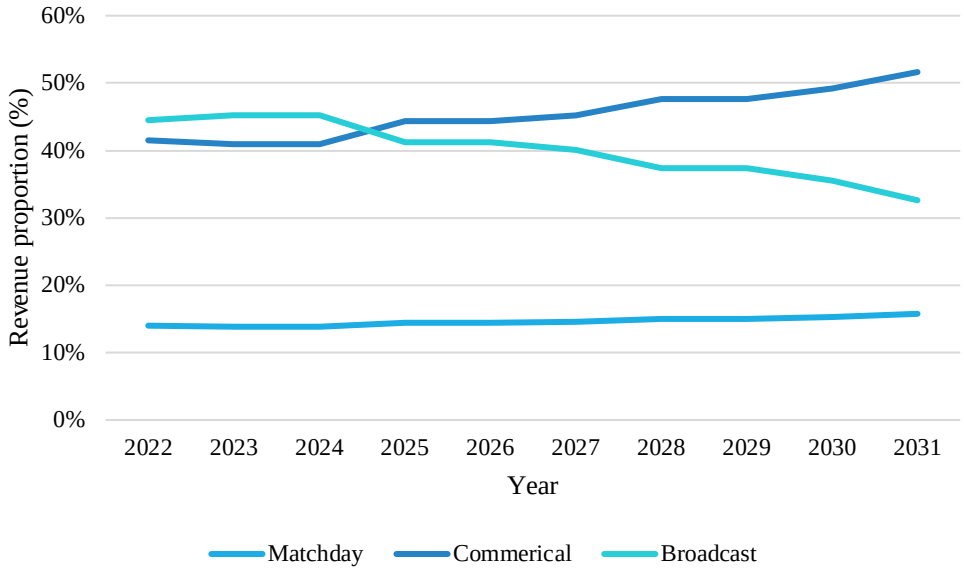


Figure 3-3 Proportion of revenue by category

3.2 Indirect effects and induced effects

Impact on GDP

Considering the multiplier effect, we respectively assume economic multiplier is 2 and 5 and the annual contribution of football industry to GDP will be ∂7283M to ∂9885M and ∂18207M to ∂24712M under different assumptions, equivalent to 2.2% and 5.4% of GDP (see Figure 3-4)

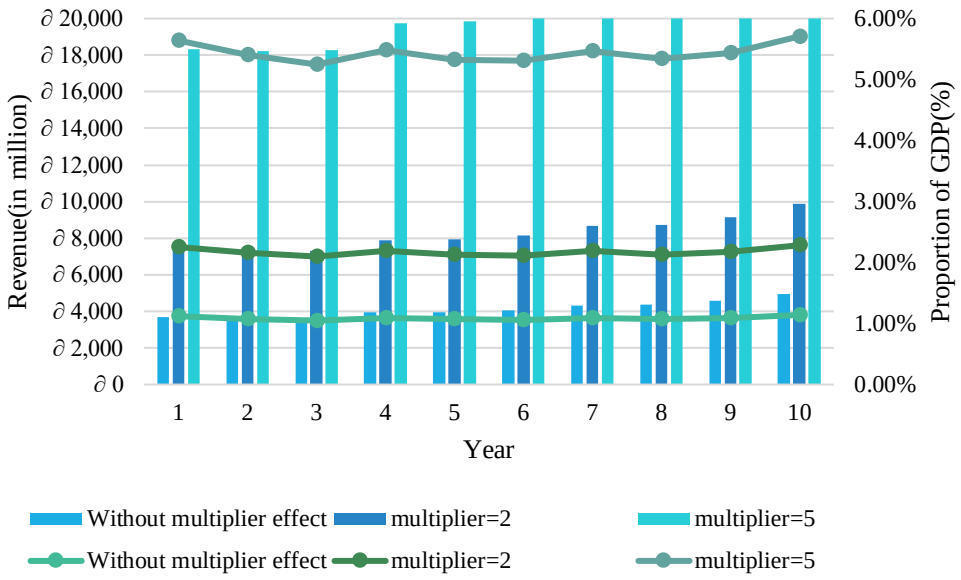


Figure 3-4 Total revenue and proportion of GDP by the multiplier

Impact on tax revenue

Tax rates vary from country to country. Because of lack of data, we assume the Rarita government tax all the revenues with the same tax rate, 30%. Based on this, we predict that it will have a tax revenue collection of per capita of about ∂86-87 in 2022-2024, about ∂93-95 in 2025-2027, ∂100-105 in 2028-2030 and ∂115 in 2031.

Impact on employment rate

Using employment multipliers, we predict the football industry will annually create 19778 to 31159 direct jobs and 38019 to 51213 indirect jobs in the next decade because of the revenue in three aspects (see Figure 3-5 and Figure 3-6). Commercial revenue will create the newest jobs, especially the direct jobs, and broadcast revenue creates little direct but many indirect jobs.

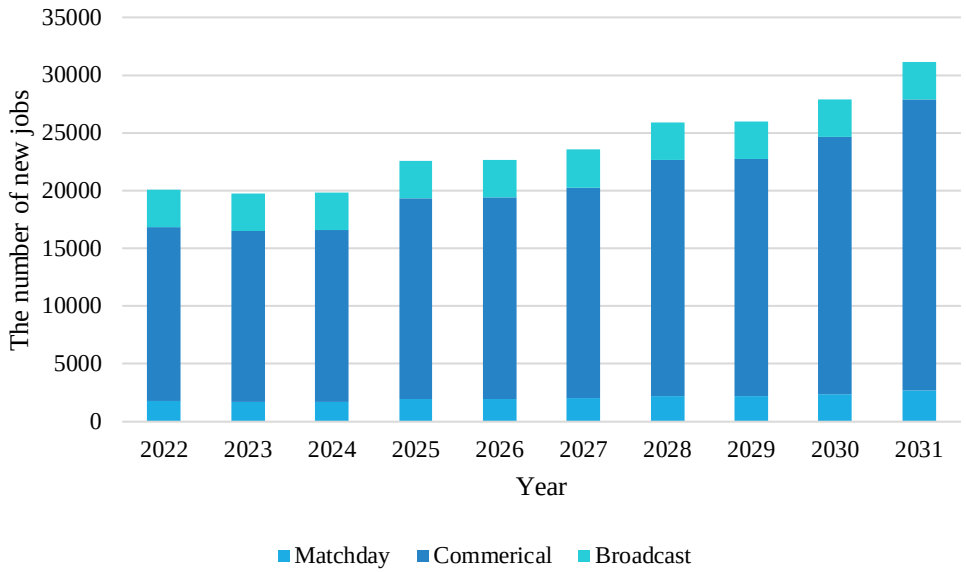


Figure 3-5 Direct jobs by category

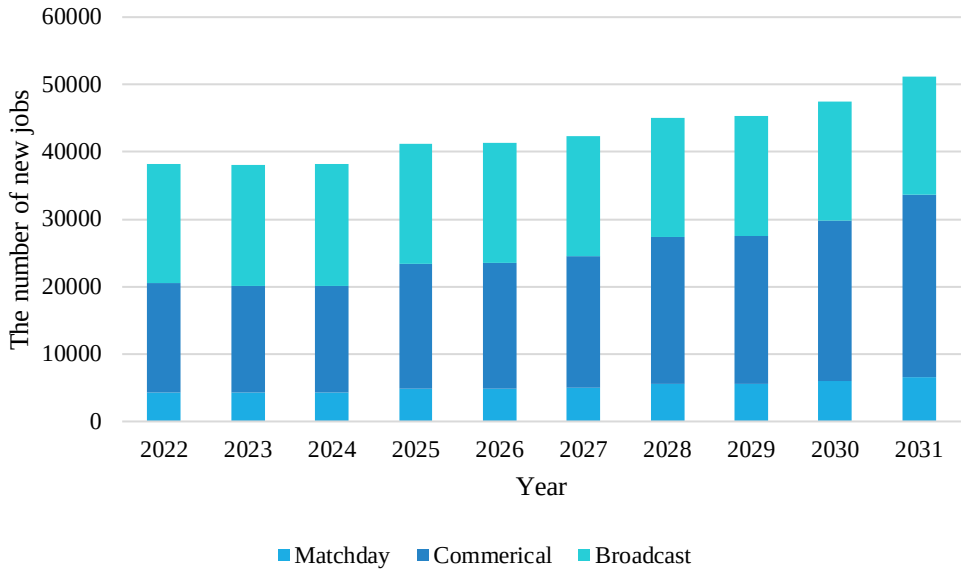


Figure 3-6 Indirect jobs by category

Figure3-7 shows the football industry will create up to 82 thousand new jobs annually, equivalent to a 0.63% new employment rate.

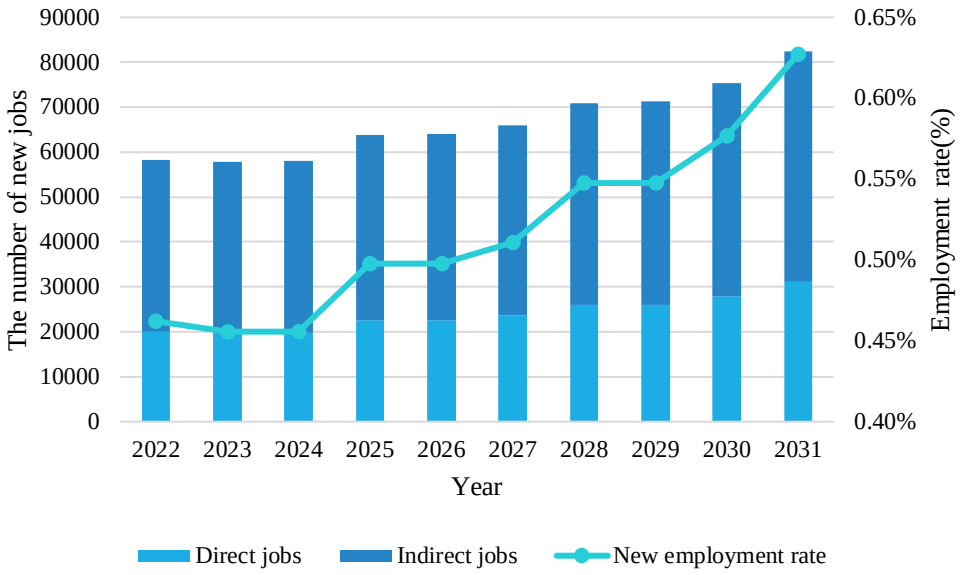


Figure 3-7 Total jobs increase and the new employment rate

3.3 Effects by region

We assume that every region will receive the same amount of per capita total revenue as its share of GDP. So the per capita total revenues by region are shown in Figure 3-8. Individuals in East Rarita will gain the biggest share because of its powerful economic force. But individuals in West Rarita will also get a considerable share because of the large population despite economic weakness. (Regional comparisons of population and GDP are shown in Figure 3-9 and Figure 3-10)

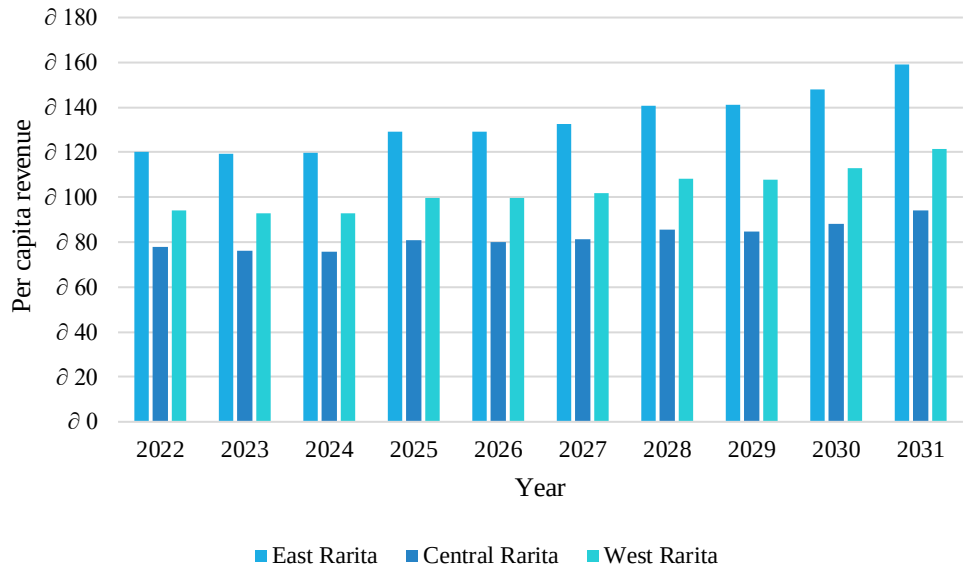


Figure 3-8 Per capita total revenues by region

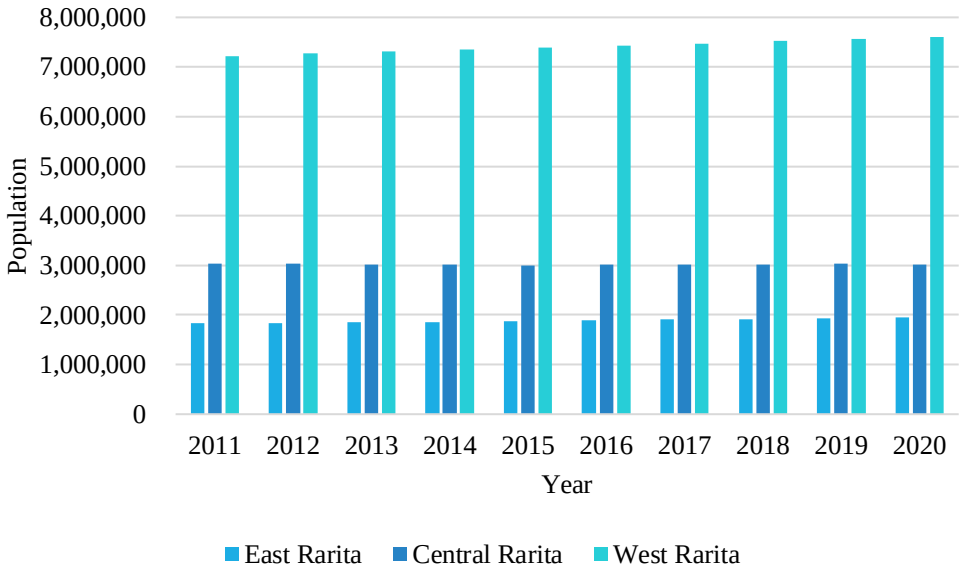


Figure 3-9 Population by region

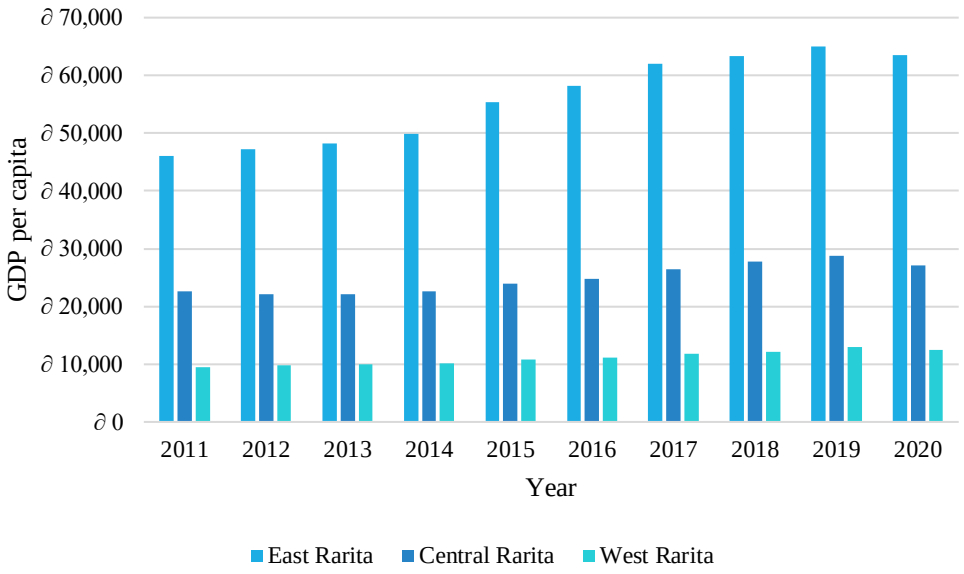


Figure 3-10 GDP per capita by region

4. Implementation Plan

4.1 Team selection

According to our criteria for selection, 56 players from 15 countries, 31 clubs will be selected to participate in FSA on behalf of Rarita's team. The table below is a complete list of information of players.

Table 4-1 Complete information of participating players[4]

Player	Lineup1	Lineup2	Lineup3	Lineup4	Nation	Pos	Born	Squad
D. Makumbi	√	√	√	√	Rarita	FWMF	2001	Black Coyotes
F. Ajio	√	√			Rarita	FW	1991	Wild Hornets
H. Makumbi	√	√			Rarita	FW	1993	Red Anchormen
Z. Zziwa	√				Rarita	FW	1996	Strong Oaks
G. Simango	√				Rarita	FWMF	1992	Mad Cardinals
X. Leroy	√	√			Rarita	MF	1994	Strong Oaks
Q. Morrison	√				Rarita	MF	1987	Serious Buffaloes
F. Chin	√	√	√	√	Rarita	MF	1997	Black Coyotes
O. Wanjala	√	√	√		Rarita	MF	1996	Black Coyotes
L. Leibowitz	√	√	√	√	Rarita	MF	1998	Strong Oaks
H. Amade	√		√		Rarita	MFFW	2000	Wild Hornets
W. Addai	√				Rarita	DF	1988	Mad Cardinals
N. Tamura	√				Rarita	DF	1991	Punctual Fire
F. Namukasa	√				Rarita	DF	1995	Golden Cadets
R. Mensah	√				Rarita	DF	1998	Strong Oaks
J. Jackson	√				Rarita	DF	1993	Golden Cadets
S. Hashemi	√				Rarita	DF	1989	Educated Avengers
E. Nyirenda	√				Rarita	DF	1997	Great Pandas
F. Ithungu	√				Rarita	GK	1992	Educated Avengers
U. Nyeko	√				Rarita	GK	1991	Strong Oaks
S. Nyarko	√				Greri Landmoslands	MF	1997	Wild Hornets
S. Nadunga	√				Iverde	DF	1992	Ultimate Longhorns
T. Nakirijja	√				Nganion	MF	1996	Marvelous Coyotes
I. Tabu		√	√	√	Rarita	FW	2002	Black Coyotes
K. Ramos		√			Rarita	MF	1999	Educated Avengers
M. Kyakimwa		√	√		Rarita	DF	1996	Great Pandas
T. Larsson		√	√	√	Rarita	DF	1999	Black Coyotes
H. Oliveira		√	√	√	Rarita	DF	2002	Wild Hornets
H. Sinaga		√	√		Bernepamar	DF	1996	Marvelous Coyotes
G. Matsika		√	√	√	Deshslands Landdenhai	DF	2000	Flying Bombadiers
X. Muhwezi		√			Greri Landmoslands	MF	1993	Punctual Rustlers
T. Kamugisha		√			Lefghau	GK	1993	Marvelous Coyotes
B. Owor		√	√	√	Mico	MFFW	2000	Mighty Monkeys
E. Naik		√	√	√	Nganion	DF	2001	Marvelous Coyotes
Z. Nakagawa		√	√	√	People's Land of Maneau	MF	1997	Mighty Jays
J. Suryani		√	√		Redohrainbri	FWMF	1999	Black Coyotes
B. Lindberg		√	√		Rosvi	FW	1997	Polar Kangaroos
M. Ayebazibwe		√			Sobianitedrucy	DF	1993	Fighting Clippers
A. Khainza		√	√	√	Sobianitedrucy	GK	1999	Black Coyotes
A. Tindimwebwa			√		Rarita	FWMF	2000	Wild Hornets
F. Akumu			√		Rarita	GK	2000	Red Anchormen
F. Shaikh			√		Dosqaly	FWMF	2000	Weak Blimps
S. Ssenyonga			√	√	Dosqaly	MF	2001	Hideous Pioneers
A. Nakiranda			√		Dosqaly	DF	2000	Serious Thunderbirds
E. Giraud			√		Nganion	DF	1998	Swift Marauders
R. Dahl				√	Byasier Pujan	DF	2002	Blue Jaguars
E. König				√	Dosqaly	FWMF	2003	Unaccountable Foxes
I. Salminen				√	Dosqaly	MF	2002	Overconfident Kangaroos
K. Okwir				√	Dosqaly	DF	1999	Weak Blimps
B. Umaru				√	Esia	FWDF	1998	Serious Cyclones
J. Halvorsen				√	Esia	FWMF	2003	Ultimate Dolphins
I. Nassiwa				√	Esia	GK	2002	Ultimate Longhorns
P. Nahabwe				√	Greri Landmoslands	DF	2000	Somber Stallions
L. Suárez				√	Nganion	FWMF	2002	Plane Janes
K. Yousefi				√	People's Land of Maneau	DF	2000	Sugar Storm
D. Sigauke				√	Sobianitedrucy	MF	1997	Sugar Bengals

[4] Lineup1,2,3,4 indicates the lineups of 2022 to 2024, 2025 to 2027, 2028 to 2030 and 2031

4.2 Income monitor

We will annually spend one-tenth of the ∂995M initial fund on other extraordinary items such as building football facilities like stadiums, cultivating juvenile players and so on. Therefore we will purchase investment products with maturities of 1 to 10 years respectively with ∂99.5M. And all interest on investment and annual net revenue will be reinvested in assets with a one-year maturity[5].

Assuming the gross profit margin of total revenue is the average of historical data,17%, we can predict the annual net revenue. Then we can predict the total net income which sum of the net revenue, the investment income and the gain by lending higher ranking players to other countries. Under different rental situations, the accumulative net income will be ∂6050M and ∂6093M in 2031.

Table 4-2:the accumulative net income of each year

Year	min	max
2022	∂ 598	∂ 651
2023	∂ 1,190	∂ 1,249
2024	∂ 1,787	∂ 1,846
2025	∂ 2,398	∂ 2,455
2026	∂ 3,004	∂ 3,062
2027	∂ 3,622	∂ 3,676
2028	∂ 4,223	∂ 4,274
2029	∂ 4,812	∂ 4,860
2030	∂ 5,440	∂ 5,488
2031	∂ 6,050	∂ 6,093

[5] Detailed information is in economic impact.xlsx, sheets 'income'

5. Assumptions

Assumption 1: We assume the capabilities of players change with their ages

Based on the given information about current players for 2020 and 2021, we can calculate ratings for 2022. According to the conclusion from "When Do Soccer Players Peak? A Note", the average professional soccer player peaks between the ages of 25 and 27. Therefore, we believe that it's possible to forecast the future performance of players by adjusting their ratings considering their ages.

$$K = \begin{cases} 1 + e^{\frac{age}{500}} & age < 30 \\ 1 - e^{-\frac{age}{500}} & 30 \leq age < 35 \\ 1 - e^{-\frac{age}{500}} & age \geq 35 \end{cases}$$

$$\boldsymbol{Rating\ in\ i\ year = K * Rating\ in\ (i-1)\ year \quad i = 2023 \ldots 2031}$$

Assumption 2: We assume if the national team is not constructed, the revenue of the football industry in Rarita grows at an average growth rate.

In this report, we divide the total revenue into the nation's league revenue and the direct revenue generated from forming a national team. To analyze the latter part, we assume the nation's league revenue grows at an average growth rate based on the data in the "revenue" sheet from 2016 to 2020.

Assumption 3: We assume every team adopts a 4-3-3 formation[6] and every player can play in a game.

For the convenience of simulation, we simplify the change of formation in real games and assume every player is healthy in the year.

Assumption 4: We assume the reinvestment rate is equal to the risk-free spot rate.

It is used in predicting the interest earned by investing the initial fund and net revenue.

Assumption 5: We assume that all expenditures and revenues will incur at the end of the year.

Assumption 6: We use the median of future rank for the prediction of income unless indicated.

[6] This formation consists of four FWs, four MFs, three DFs, one GK

6. Risk and Risk Mitigation Considerations

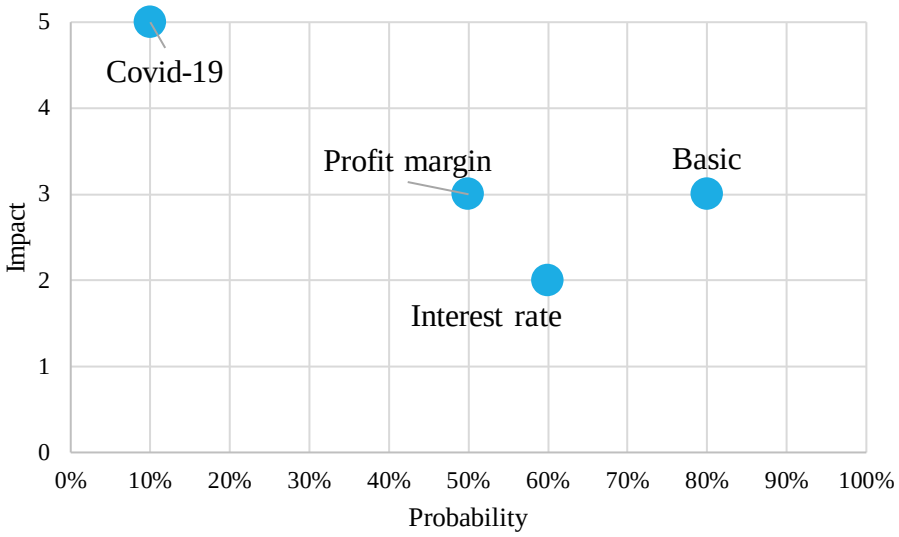


Figure 6-1 Risk matrix[7]

6.1 Basic risk

Recruitment:

The basic risk of our report is the uncertainty of recruiting the goal players. The team will underperform its estimated performance if the recruitment fails, which directly leads to a decline in rank and indirectly influence the revenue.

The following table shows an example of the decline of followers, average attendance, revenue and economic impact if we fail to hire the top 5 players in 2031.

Table 6-1 Decline of each index

	Rank	Followers	Attendances	Revenues	Economic Impact (multiplier=2)
Decline	2.2	49692129	1828	∂ 44,192,692	∂ 88,385,384

Mitigation:

1. Raise the price of the offer above his market value if we believe in the potential of our goal players.
2. Prepay the deposit and stipulate penalty provisions in the contract to compensate

[7] 1 = Negligible, 2 = Minor, 3 = Moderate, 4 = Major, 5 = Catastrophic

for our economic loss.

Loan transfer:

We assume the number of players lending to other countries follows a Poisson distribution with a mean of 70% of players lending to other countries. If the actual number of lending is prominently fewer than our expectation, it will directly affect the revenue. Here we use Expected Shortfalls[8] to measure the expected loss of revenue:

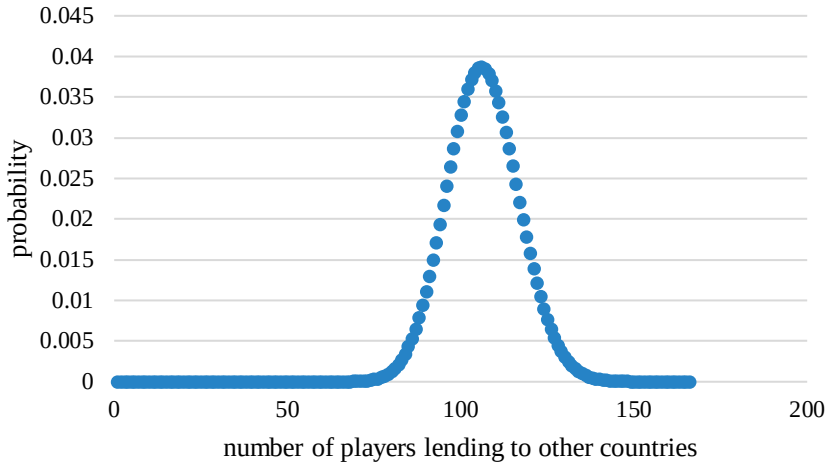


Figure 6-2 The probability distribution of lending

Table 6-2 The expected shortfalls(in million) of each year

	2022	2023	2024	2025	2026
ES[S;0.05]	∂ 0.49	∂ 0.49	∂ 0.48	∂ 0.63	∂ 0.60
ES[S;0.1]	∂ 1.80	∂ 1.81	∂ 1.79	∂ 0.55	∂ 0.53
	2027	**2028**	**2029**	**2030**	**2031**
ES[S;0.05]	∂ 0.57	∂ 0.24	∂ 0.23	∂ 0.21	∂ 0.34
ES[S;0.1]	∂ 0.50	∂ 1.40	∂ 1.30	∂ 1.19	∂ 1.38

Mitigation:

1. Allocate 1% of revenue to improve the youth system in Rarita, aiming to cultivate more competitive players.

[8] Our definition of ES is $ES[S;p] = E[(\text{VaR}[S;p] - S)_+]$(a bit different from the original one but are of similar meaning in statistics)

6.2 Economic risk

Gross profit margin risk

If the gross profit margin is lower than expected, the accumulative net income in 2031 may be negative. Table 8 shows the boundary value of gross profit margin with it not less than zero.

Table 6-3 Boundary gross profit margin with net income equals 0

	median	90th percentile	10th percentile
Min	2.622%	2.744%	2.452%
Max	2.519%	2.635%	2.356%

Mitigation

1. Upgrade the industrial structure to find a new way to increase profit.

Interest rate risk

Using the most pessimistic assumption that the interest rate is zero, we can predict the accumulative net income will be ∂5797M and ∂5841M in 2031, which are about ∂200M less than that under normal circumstances

Table 6-4 accumulative net income in 2031 (million Doubloons)

	median	90th percentile	10th percentile
Min	5,797	5,489	6,280
Max	5,841	5,532	6,323

Mitigation

1. Build a better portfolio to beat the market.
2. Broaden the investigating channels such as investing in overseas financial markets or the real economy.
3. Buy derivatives like interest rate swaps to transfer the risk

Covid-19 Risk

Covid-19 has a financial impact on the total revenues of football clubs. Matchday revenue is significantly impacted by Covid-19 as stadia is closed to fans. Besides, the broadcast revenue may also be impacted due to the suspension. From the report released by Deloitte, Premier League clubs witness a decline in 12% of Matchday revenue and 23% of broadcast revenue in the 2019/2020 season. The worsening of the pandemic

will seriously affect the financial condition of Rarita's football industry.

Mitigation:

1. Purchase event cancellation insurance to cover the loss of revenue derived from cancellation and interruption.
2. Allocate more funding from official associations or non-governmental organizations in advance.

7. Data and Data Limitations

7.1 Data Limitations

- Original data includes many missing and invalid data. We have to use interpolation methods like KNN interpolation to approximate the real value. The incompleteness of our source data may lead to the deviation of our estimation of the players' ratings.
- There are some anomalies in some players' indexes, which may result in a large gap between players' ratings without standardization.
- We are only provided five years of revenue and expense data. A larger size of data sample may improve the accuracy of our regression equation, thus elevating the accuracy of our prediction on revenue and expense.
- We are unaware of in which year the data of average league attendance is acquired. We assume it's acquired in 2021.

7.2 Data Sources

We list them in Reference.

Appendix

Appendix A

A.1 Data preprocessing and the calculation of rating[9]

***Step* 1**:Subset invalid numbers like negative "Gls" or "Shots on target percentage" that exceeds 100%. True them into NAN.
***Step* 2**:Abandon the index with more than 50% of data is NAN such as "Blocks ShSv", "Performance PK", "Performance PKatt".
***Step* 3**:For players playing the role of "FW", we define "Shooting" as the main capability and the others as the subsidiary capability. Similarly, we define "Passing" as the main capability for "MF" and "Defense" for "DF". We process data of each position respectively, subsetting indexes of main capability with less than 30% of missing data. As for the subsidiary capability, we adopt K- Nearest Neighbor method to interpolate the missing data.
***Step* 4**:Referring to the statistics provided by "Premier League Player Stats"[10], we develop our rating system, choosing specific indexes in each field to evaluate the performance of a player.

Table A-1 Accumulative net income in 2031 (million Doubloons)

Capability	First-level index	Second-level index	Weight
shooting	Finishing	Modified Gls	0.6
	attacking	Modified Standard G/SoT	0.3
	reaction	Standard Sh	0.1
Pass	assist	modified Ast	0.45
	Progressive Pass	Prog	0.125
		PPA	0.125
	Long Pass	Long Cmp%	0.1
	Medium Pass	Medium Cmp%	0.1
	short Pass	short Cmp%	0.1
Defense	Block	Blocks Blocks	0.083
		Blocks Sh	0.083
		Blocks Pass	0.083
	Interception	Pressures Att/Mid/Def 3rd	0.125
		Tkl+Int	0.125
	Tackle	Tackles TkIW	0.075
		Vs Dribbles Tkl%	0.075
	Pressures	Pressure%	0.15
	Error	Err	0.1
	Clear	Clearance	0.1
GK	reflex	performance GA90	0.2

[9] Detailed information is in "normalized but not standardized ratings of players.xlsx" and "player's information(rating,salary).xlsx"
[10] 2021/22 Premier League Player Stats & Season Archives

		Performance CS%	0.2
	Diving	Performance Save%	0.3
	Outcome	W%	0.21
		D%	0.09

***Step* 5**: Now is time to approximate the missing data of the main capability. The following ways are adopted to address the problem.

Table A-2 Accumulative net income in 2031 (million Doubloons)

Missing data	Approximation
Gls	Expected xG
Ast	xA
Standard G/sh	Gls/Standard Sh
Standard SoT%	Standard Sh/Standard SoT
Standard G/SoT	Standard G/Sh / Standard SoT%

***Step* 6**: To eliminate the influence of outliers and differences in dimension, we normalize each index and calculate initial ratings for each player. Then we standardize the ratings into a range from 50 to 100 (called z-rating)for each position.

$$z - \text{rating} = \frac{\text{rating}_i - \text{rating}_{\min}}{\text{rating}_{\max} - \text{rating}_{\min}} \times 50 + 50$$

Python code

```
import pandas as pd
import matplotlib.pyplot as plt
import pylab as pl
data=df
#Count the number of missing values
missing=data.isnull().sum().reset_index().rename(columns={0:'missNum'})
# Calculate the scale of missing values
missing['missRate']=missing['missNum']/data.shape[0]
# Displayed in order of deletion rate
miss_analy=missing[missing.missRate>0].sort_values(by='missRate',ascending=False)
# miss_analy stores a data frame for each variable missing case
fig = plt.figure(figsize=(18,6))
plt.bar(np.arange(miss_analy.shape[0]), list(miss_analy.missRate.values), align = 'center'
    ,color=['red','green','yellow','steelblue'])
plt.title('Histogram of missing value of variables')
plt.xlabel('variables names')
plt.ylabel('missing rate')
plt.xticks(np.arange(miss_analy.shape[0]),list(miss_analy['index']))
pl.xticks(rotation=90)
for x,y in enumerate(list(miss_analy.missRate.values)):
    plt.text(x,y+0.12,'{:.0%}'.format(y),ha='center',rotation=90)
```

```
plt.ylim([0,1.0])
plt.show()
```

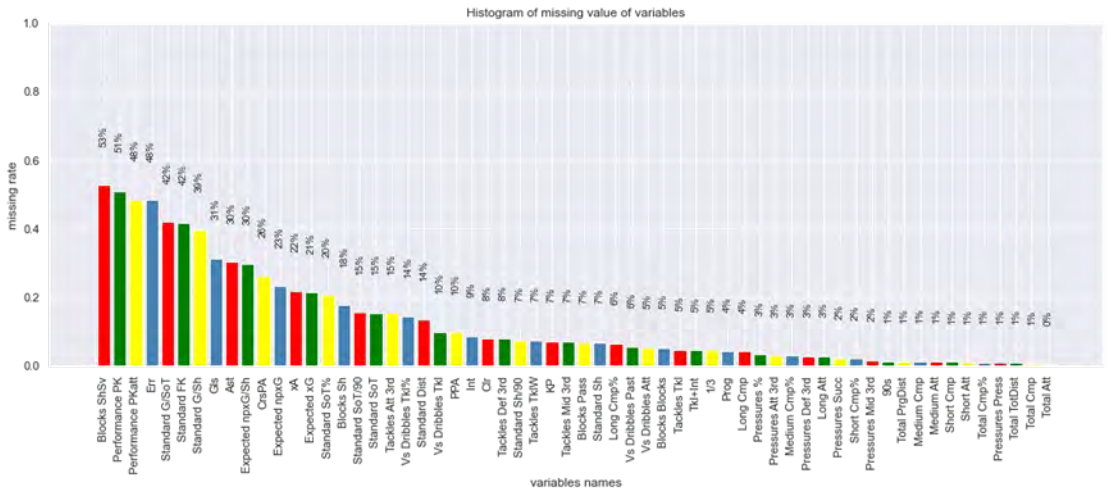


Figure A-1 the percent of missing values of “Shooting”, “Passing” and “Defense”

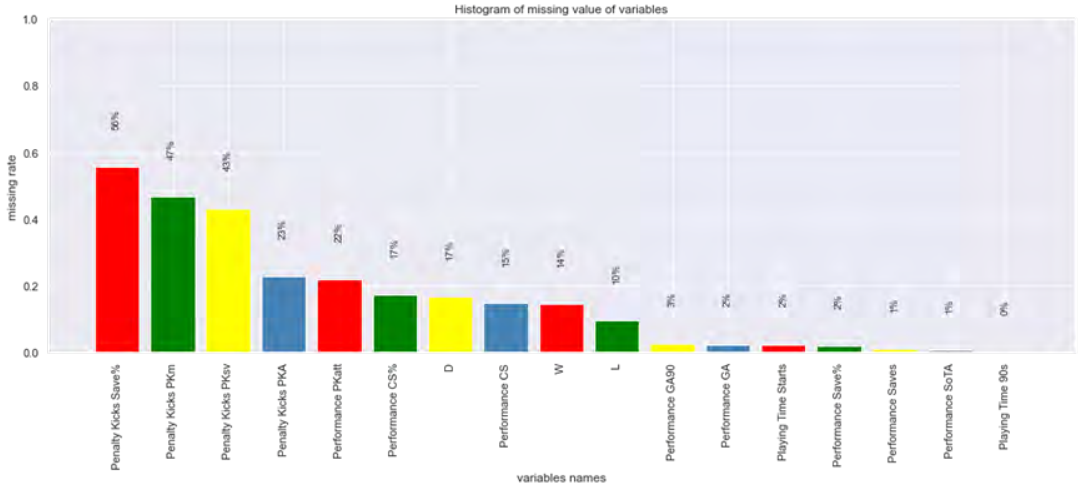


Figure A-2 the percent of missing values of “Goalkeeping”

A.2 Criteria for Defining Win or Lose: Under the System of Elo-rating

In our system, we assume each football player is considered individually and should be assigned a rating, which is common in many sports games. Here, we refer to the Elo algorithm. The following variables are introduced to illustrate our algorithm:

- A_i: A player of Team A
- R_{A_i}: Rating of player A_i
- R_A: The rating of team A, equal to $\sum_i R_{A_i}$
- ${R_A}^C$: The rating of team A in a real game, follows $N\left(R_A, \frac{R_A}{10}\right)$

- E_A: Expectation value of team A for a given match——indicates the chances of success for team A

We obtain the rating of team A as the average performance during the whole year, denoted as R_A. As the performance of a team in a single game can be influenced by many factors such as weather, the mental state of players, we assume the rating follows a normal distribution, with the mean of R_A, and the standard deviation of $R_A/10$, which indicates the uncertainty of the real game.

In the end, we define E_A in a quasi-logistic form as

$$E_A = \frac{1}{1 + e^{-\left(R_A{}^C - R_B{}^C\right)}}$$

If $R_A{}^C > R_B{}^C$, then $E_A > 0.5$, indicating R_A as the winner, vice versa.

A.3 Monte-Carlo Method to simulate the FSA Competition[11]

The Monte-Carlo simulation is a statics-based formula that converts the uncertainties of betting events from input variables into probability distributions, which helps forecast the potential outcomes and is widely used in Sports Betting.

In this part, we will introduce the idea of simulating the FSA competition year-round and apply the statistical model to help quantify the probability ranges of being competitive successfully.

Firstly, we present our round-robin simulation. Using the Elo algorithm, we simulate the result (win or lose) of each game and assign scores to the winner for *num*(num-1)* times (*num* represents the number of teams). After the circulation, we rank every team based on their total scores.

[11] The result of simulation is in "probability range of competitive.xlsx"

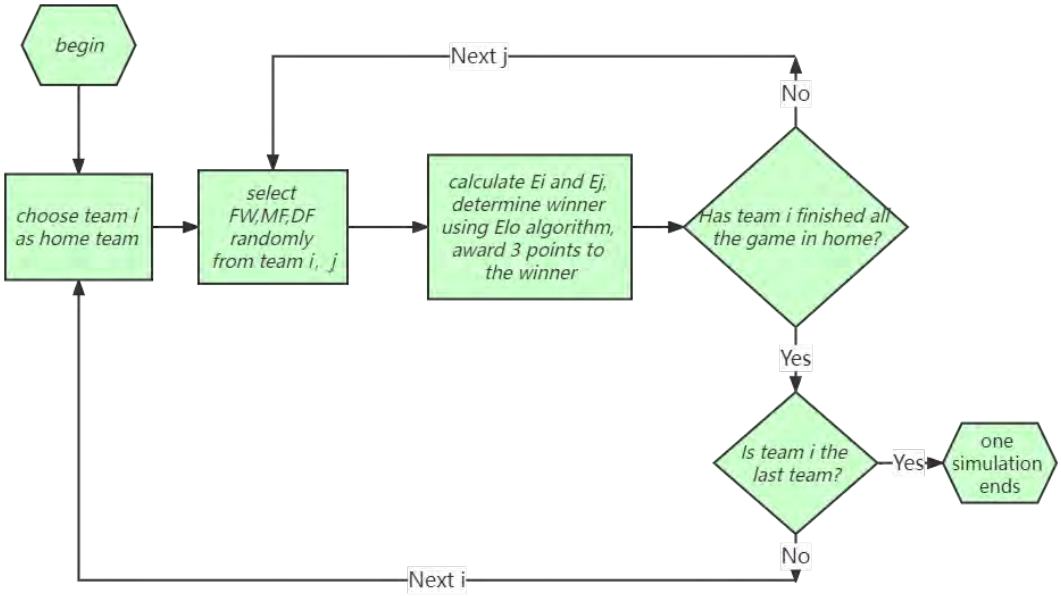


Figure A-3 The flow chart of a round of the game

Next, to decrease the deviation of a single simulation, we repeat the round-robin simulation multiple times (like 100 times) and record the rank of Rarita in each simulation. The following histogram shows an example of the distribution of Rarita's rank in 2022:

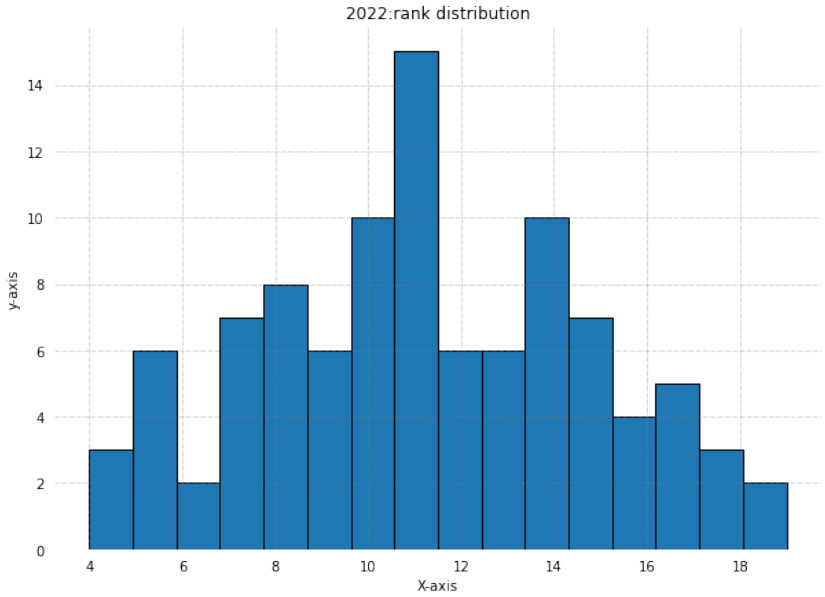


Figure A-4 The distribution of Rarita's rank in 2022

In the end, to estimate the probability ranges of the "success" of being competitive, we repeat the above simulation for 50 iterations. Therefore, we loop three loops in total together in our program. The following histogram illustrates an example of the distribution of the probability of "NOT being the top 10 members in FSA" in 2023:

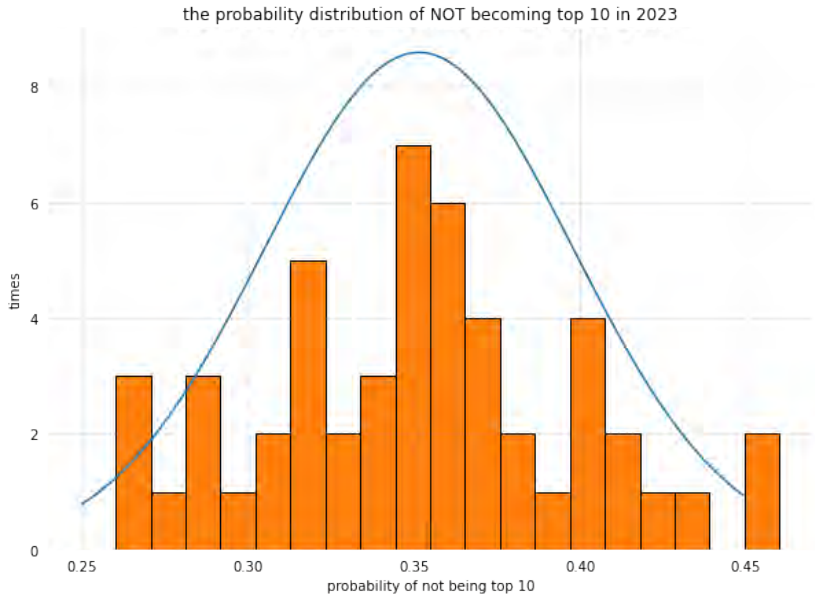


Figure A-5 The distribution of the probability of "NOT being the top 10 members in FSA" in 2023

Python code

```
def logistic(x):
    return 1 / (1 + np.exp(-x))

# Defines a function that takes random numbers from a normal distribution
def get_normal_random_number(loc, scale):
    number = np.random.normal(loc=loc, scale=scale)
    return number

#Store specific rank in each round and each iteration
result = np.zeros((50, 50), dtype=int)
# Store the probability of ranking the top 1 in each iteration
prob1=np.zeros(50)
# Store the probability of ranking the top 2-5 in each iteration
prob2_5=np.zeros(50)
# Store the probability of ranking the top 6-10 in each iteration
prob6_10=np.zeros(50)
# Store the probability of ranking the top 10+ in each iteration
prob10_=np.zeros(50)

d=np.zeros(50)
FW=np.zeros(len(Nation))
MF=np.zeros(len(Nation))
DF=np.zeros(len(Nation))
GK=np.zeros(len(Nation))
total_rank=np.zeros(23)
for circle in range(50):
        for k in range(50):
```

```
        team=np.zeros(23)
        for i in range(23):
            rating_i=rating(Nation[i],df1)
             performance_i=get_normal_random_number(rating_i,rating_i/10)
                 for j in range(i+1,23):
                      rating_j=rating(Nation[j],df1)

                       performance_j=get_normal_random_number(rating_j,rating_j/
                       10)
                      if (logistic(performance_i-performance_j)>0.5):
                          team[i]=team[i]+3
                          else:
                          team[j]=team[j]+3

        index = np.argsort(-team) # 排序后的索引（负号为降序排列）
             rank = np.argsort(index)+1 # 名次
             d[k]=rank[index]

    result[circle]=d
    prob10_[circle]=len(d[d>10])/len(d)
    prob6_10[circle]=len(d[(d>5)&(d<=10)])/len(d)
    prob2_5[circle]=len(d[(d>1)&(d<=5)])/len(d)
    prob1[circle]=len(d[d==1])/len(d)
```

Appendix B

B.1 Definitions

Revenue

Matchday revenue is the portion of total revenue attributed to match day - generated as a result of staging matches at stadiums and largely derived from ticket sales.
Broadcast revenue is the portion of total revenue attributed to broadcasting - media broadcasting revenue received due to participation in domestic leagues, domestic cups and, where relevant for some clubs, international competitions.
Commercial revenue is the portion of total revenue attributed to commercial - generated from sponsorship, merchandising and other commercial operations.

Direct effects

Direct effects are the set of expenditures made directly in the activities of building the nation's football team. The direct effects are analyzed by the activities in the process of building the national football team as follows:

- ✧ Building stadiums and gymnasiums promotes the development of the construction industry. The local government can make long-term profits on the rental of stadiums and gymnasiums.
- ✧ Developing supporting industries, including sports clothing and sports equipment, can promote the development of the manufacturing industry. The preparation of building the national team also boosts other supporting industries like sports

insurance.

- ✧ Training sports staff, including football talents, football referees, athletes and relevant administrative personnel, can not only stimulate employment, but also increase fans by cultivating football stars, so that enterprises in the football industry can form brand effects and obtain economic benefits.
- ✧ Holding football league matches is the most obvious source of direct effects. On the one hand, people watch the game on site. Their consumption has an economic impact on all industries in the place where the game is held, mainly including the impact on the sports industry and other industries. The economic impact on the sports industry is mainly reflected in the local ticket revenue. The impact on other industries includes tourism, transportation, accommodation, catering (especially beer) industry. On the other hand, no matter whether the fans go to the local game or not, their acts like watching the games, purchasing football lotteries and magazines can impact industries including the football lottery industry, sports souvenir sales industry, advertising industry, football newspaper miscellaneous industry, and the sale of broadcasting rights on TV and network platforms.

Indirect effects

Indirect effects are the expenses taking place in the supply chain whose income stems from the initial industries expenditures discussed in the previous part. And also these effects include the further transmission impact of the indirectly affected industry on its upstream and downstream industries. For instance, the development of the construction industry, which affects the upstream steel and chemical industry, and therefore the coal and power industries; the development of garment manufacturing industry affects the chemical fiber manufacturing industry and textile industry. The multiplier can be used to analyze the total impact.

Induced effects

The induced effects are stemming from household spending after the removal of taxes and savings. It is generated by the spending of the employees within the industries affected directly or indirectly by our plan. Individuals tend to spend more as the salaries and employment rate increase because of the development of every affected industry. This impact is the same as the indirect impact and can also be analyzed by the multiplier.

Multiplier

- ✧ **Economic multiplier**

If we assume that the economic multiplier is 2, it means that for every Doubloon spent by the football industry, additional spending of $\partial 1$ is generated across Rarita's economy and the total spending will be $\partial 2$. Then we can predict the total revenue will be twice as large as the revenue without considering the multiplier effects, which is also the result that only considers the direct effect.

Here we use the assumption that the economic multiplier is 2 or 5. The assumption that it is 2 is according to ACIL Allen's report "The Economic and Social Benefits of Club Based Football in Western Australia", Report to the West Australian Football Commission, October 2018, pii. And the assumption is that it is according to PWC's

report "economic, fiscal and social impact of professional football in Spain December 2018". These two reports are both about the football industry's impact on the real world.

✧ **Employment multiplier**

If we assume the employment multiplier of direct jobs is 3, it means 3 jobs will be created directly in the industry if the final demand of this industry increases by 1 million Doubloon.

Referring to Josh Bivens's report "Updated employment multipliers for the U.S. economy" on January 23, 2019, we choose three industry multipliers to forecast the number of jobs created by the whole revenue from these three aspects.

For simplicity, we assume the exchange rate is \$1 to a Doubloon (∂). because currently, the exchange is \$1.1055 to a Euro (€) which is quite similar to the exchange between Doubloon and Euro.

Table 1 shows the different multipliers in the three industries. The *supplier jobs* include materials and capital services supplier jobs and the *induced jobs* include jobs supported by respending of income from direct jobs and supplier jobs, as well as public-sector jobs supported by tax revenue.

We only use the direct and total indirect employment multipliers to predict the jobs created.

Table B-1 Employment multipliers per ∂1 million in final demand

Industry (Group)	Revenue	Direct jobs	Supplier jobs	Induced jobs	Total indirect jobs
Spectator sports*	Matchday	3.43	4.55	3.93	8.47
Retail trade**	Commercial	9.9	4.6	6.1	10.6
Information***	broadcast	2.0	4.5	6.4	10.9

* *Spectator sports* industry belongs to the industry group of *Arts, entertainment, and recreation.*

***Retail trade* industry group includes the industry of *food and beverage stores, general merchandise stores and other retail.*

**** Information* industry group includes the industry of *radio and television broadcasting, wired and wireless telecommunications carriers, satellite, telecommunications resellers, and all other telecommunications.*

Gross profit margin

Gross Profit Margin is the percentage of Gross Profit and sales revenue (or operating revenue), where Gross Profit is the difference between revenue and operating costs corresponding to revenue.

$$Gross\ Profit\ Margin = \frac{Gross\ Profit}{Operating\ Income} \times 100\%$$

B.2 Analysis methods

Regression

In the process of regression, we find the relationship between the rank of the team and the total number of followers could be modeled well using logarithmic regression which is given by the formula:

$$Follower = -42.722 \ln(Rank) + 158.148 \quad (1)$$

where *Follower* is the total number of Facebook, Instagram, Twitter, Youtube and Tiktok followers (in millions), and *Rank* is the tournament place. It is assumed that this correlation is due to people's preference for quality football teams.

Similarly, we also find there are linear regression correlations between the number of followers and the matchday revenue as well as the commercial revenue, which are given as follows:

$$Matchday = 0.191 Follower + 29.1 \quad (2)$$

$$Commercial = 0.75 Follower + 75.726 \quad (3)$$

where *Matchday* is the per capita matchday revenue (∂) and the *Commercial* is the per capita commercial revenue (∂). These two revenue is positively correlated to the number of followers is presumably because followers tend to spend more money on tickets, souvenir and other football products than other people.

There is no direct relationship between the number of followers and the broadcast revenue, but we find a clear power relationship between the number of followers and the national average attendance at league games which is given by the formula:

$$\text{Attendance} = 40308.75 \times \text{Follower}^{0.081} \quad (4)$$

where *Attendance* is the average attendance at league games. Sametime, we find that there is a negative logarithmic regression relationship between the average attendance at league games and the broadcast revenue as follows:

$$\text{Broadcast} = -84.0398 * \ln(\text{Attendance}) + 1048.3782 \quad (5)$$

where *Broadcast* is the per capita broadcast revenue (∂). It is assumed that with more followers who are passionate about football, a larger proportion of people will choose to watch the football games on site, so the attendance increases and the broadcast revenue decreases. It is also reflected in the negative correlation between matchday revenue and the broadcast revenue, for watching games on-site and off-site are substitutes.

The test results of the above regressions are as follows:

(1) Follower-Rank

$$Follower = -42.722 \ln(Rank) + 158.148$$

Model Summary			
R	R Square	Adjusted R Square	Std. The error of the Estimate
0.544	0.296	0.245	53.329

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.

Regression	16710.559	1	16710.559	5.876	0.029
Residual	39815.046	14	2843.932		
Total	56525.604	15			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
ln(Rank)	-5.781	2.385	-0.544	-2.424	0.029
(Constant)	127.702	26.288		4.858	0

(2) Attendance-Follower

$$\text{Attendance} = 40308.75 \times \text{Follower}^{0.081}$$

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.975	0.95	0.947	0.269

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	19.32	1	19.32	267.811	0
Residual	1.01	14	0.072		
Total	20.33	15			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
ln(Rank)	-0.919	0.056	-0.975	-16.365	0
(Constant)	40308.754	9043.915		4.457	0.001

(3) Per Capita Matchday-Follower

$$Matchday = 0.191 Follower + 29.1$$

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.793	0.629	0.602	11.105

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	2925.694	1	2925.694	23.722	0
Residual	1726.645	14	123.332		
Total	4652.339	15			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

ln(Rank)	0.191	0.039	0.793	4.871	0
(Constant)	29.1	4.434		6.564	0

(4) Per Capita Commercial-Follower

$$Commercial = 0.75Follower + 75.726$$

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.795	0.631	0.605	36.429

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	31815.982	1	31815.982	23.975	0
Residual	18578.635	14	1327.045		
Total	50394.616	15			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
ln(Rank)	0.75	0.153	0.795	4.896	0
(Constant)	75.726	14.398		5.26	0

(5) Per Capita Broadcast-Follower

$$\text{Broadcast} = -84.0398 * \ln(\text{Attendance}) + 1048.3782$$

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.5	0.25	0.196	41.889

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	8183.879	1	8183.879	4.664	0.049
Residual	24565.911	14	1754.708		
Total	32749.789	15			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
ln(Rank)	-84.04	38.914	-0.5	-2.16	0.049
(Constant)	1048.378	424.752		2.468	0.027

Exponential smoothing method

Exponential smoothing method is used to predict GDP, population and reinvestment interest rates with different maturity periods

B.3 Detailed results

Forecast interest rate

Table B-2 Forecast interest rate (%)

Term / Year	1	2	3	4	5	6	7	8	9	10
2022	0.20	0.22	0.53	0.72	1.15	1.73	2.19	2.18	2.21	2.21
2023	0.26	0.25	0.53	0.67	1.07	1.61	2.02	1.98	1.98	1.96
2024	0.32	0.28	0.52	0.63	0.99	1.49	1.86	1.78	1.75	1.70
2025	0.38	0.31	0.52	0.59	0.91	1.37	1.70	1.58	1.53	1.45
2026	0.44	0.34	0.51	0.55	0.83	1.25	1.53	1.39	1.30	1.20
2027	0.50	0.37	0.51	0.51	0.75	1.13	1.37	1.19	1.07	0.94
2028	0.56	0.40	0.50	0.47	0.66	1.00	1.21	0.99	0.84	0.69
2029	0.62	0.43	0.50	0.42	0.58	0.88	1.04	0.79	0.61	0.44
2030	0.68	0.46	0.49	0.38	0.50	0.76	0.88	0.59	0.38	0.19
2031	0.74	0.49	0.49	0.34	0.42	0.64	0.72	0.40	0.15	-0.07

Prediction results

The predicted results based on the above regression are shown below.

(1) Predicted changes in the number of followers for 2022-2031

Table B-3 Predicted changes in the number of followers

Year	Median	90th Percentile	10th Percentile
2022	59.77695966	42.45467931	81.60045196
2023	55.70511816	39.69746461	81.60045196
2024	55.70511816	39.69746461	81.60045196
2025	81.60045196	64.27817161	98.9227323
2026	81.60045196	69.31009846	98.9227323
2027	89.3895935	75.01482661	111.2130858
2028	111.2130858	89.3895935	158.148
2029	111.2130858	89.3895935	158.148
2030	128.5353662	98.9227323	158.148
2031	158.148	158.148	158.148

(2) Predicted changes in the number of attendance for 2022-2031

Table B-4 Predicted changes in the number of attendance

Year	Median	90th Percentile	10th Percentile
2022	56143.38198	54608.63253	57576.65474
2023	55823.47062	54312.41511	57576.65474
2024	55823.47062	54312.41511	57576.65474
2025	57576.65474	56474.5105	58481.47463
2026	57576.65474	56820.34265	58481.47463
2027	58003.41644	57185.54264	59038.8593
2028	59038.8593	58003.41644	60746.81194
2029	59038.8593	58003.41644	60746.81194
2030	59735.17831	58481.47463	60746.81194
2031	60746.81194	60746.81194	60746.81194

(3) Predicted changes in Per Capita Matchday for 2022-2031

Table B-5 Predicted changes in Per Capita Matchday

Year	Median	90th Percentile	10th Percentile
2022	∂ 41	∂ 37	∂ 45
2023	∂ 40	∂ 37	∂ 45
2024	∂ 40	∂ 37	∂ 45
2025	∂ 45	∂ 41	∂ 48
2026	∂ 45	∂ 42	∂ 48
2027	∂ 46	∂ 43	∂ 50
2028	∂ 50	∂ 46	∂ 59
2029	∂ 50	∂ 46	∂ 59
2030	∂ 54	∂ 48	∂ 59
2031	∂ 59	∂ 59	∂ 59

(4) Predicted changes in Per Capita Commercial for 2022-2031

Table B-6 Predicted changes in Per Capita Commercial

Year	Median	90th Percentile	10th Percentile
2022	∂ 121	∂ 108	∂ 137

2023	∂ 118	∂ 105	∂ 137
2024	∂ 118	∂ 105	∂ 137
2025	∂ 137	∂ 124	∂ 150
2026	∂ 137	∂ 128	∂ 150
2027	∂ 143	∂ 132	∂ 159
2028	∂ 159	∂ 143	∂ 194
2029	∂ 159	∂ 143	∂ 194
2030	∂ 172	∂ 150	∂ 194
2031	∂ 194	∂ 194	∂ 194

(5) Predicted changes in Per Capita Broadcast for 2022-2031

Table B-7 Predicted changes in Per Capita Broadcast

Year	Median	90th Percentile	10th Percentile
2022	∂ 129	∂ 132	∂ 127
2023	∂ 130	∂ 132	∂ 127
2024	∂ 130	∂ 132	∂ 127
2025	∂ 127	∂ 129	∂ 126
2026	∂ 127	∂ 128	∂ 126
2027	∂ 127	∂ 128	∂ 125
2028	∂ 125	∂ 127	∂ 123
2029	∂ 125	∂ 127	∂ 123
2030	∂ 124	∂ 126	∂ 123
2031	∂ 123	∂ 123	∂ 123

(6) Predicted changes in cumulative net income for 2022-2031

Based on an analysis of historical data, the report assumes a net income to revenue ratio of 17% .

Based on the project fund utilization plan and annual revenue and expenditure forecast, we get the cumulative net income from 2022 to 2031.

$$Net\ Income_t = Matchday + Commercial + Broadcast - Staff\ Costs - Other\ Expenses + Net\ income\ from\ player\ loan + (1 + i) \times Net\ Income_{t-1} + Interest\ on\ initial\ capital$$

Minimum cumulative net income from 2022 to 2031 in 1000 simulations

Table B-8 Minimum cumulative net income

Year	Median	90th Percentile	10th Percentile
2022	∂ 71,997,812	∂ 67,392,884	∂ 78,068,323
2023	∂ 141,180,442	∂ 132,338,958	∂ 154,475,626
2024	∂ 210,848,764	∂ 197,735,703	∂ 231,427,293
2025	∂ 249,359,844	∂ 231,293,869	∂ 275,024,528
2026	∂ 276,440,940	∂ 254,787,576	∂ 307,248,486
2027	∂ 297,294,308	∂ 271,376,104	∂ 334,675,796
2028	∂ 257,947,590	∂ 225,436,422	∂ 309,676,696
2029	∂ 197,445,059	∂ 158,256,561	∂ 263,694,419
2030	∂ 138,462,754	∂ 90,102,545	∂ 214,194,643
2031	∂ 0	-∂ 48,718,180	∂ 76,292,472

Maximum cumulative net income from 2022 to 2031 in 1000 simulations

Table B-9 Maximum cumulative net income

Year	Median	90th Percentile	10th Percentile
2022	∂ 112,541,494	∂ 107,936,566	∂ 118,612,006
2023	∂ 227,608,248	∂ 218,766,764	∂ 240,903,432
2024	∂ 343,291,779	∂ 330,178,719	∂ 363,870,309
2025	∂ 426,391,209	∂ 408,325,234	∂ 452,055,894
2026	∂ 501,189,991	∂ 479,536,626	∂ 531,997,536
2027	∂ 566,204,816	∂ 540,286,613	∂ 603,586,304
2028	∂ 570,618,646	∂ 538,107,478	∂ 622,347,752
2029	∂ 553,698,416	∂ 514,509,918	∂ 619,947,776
2030	∂ 540,403,615	∂ 492,043,407	∂ 616,135,505
2031	∂ 446,187,106	∂ 397,468,926	∂ 522,479,578

Direct effects

The GDP per capita used in the report is predicted by utilizing exponential smoothing method with time-series data from 2011 to 2020. The prediction results are as follows.

(1) The GDP of West Rarita

Table B-10 The GDP of West Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit

2022	∂ 13,702	∂ 13,099	∂ 14,304
2023	∂ 14,101	∂ 13,494	∂ 14,709
2024	∂ 14,501	∂ 13,888	∂ 15,114
2025	∂ 14,901	∂ 14,283	∂ 15,518
2026	∂ 15,300	∂ 14,678	∂ 15,923
2027	∂ 15,700	∂ 15,073	∂ 16,328
2028	∂ 16,100	∂ 15,467	∂ 16,732
2029	∂ 16,500	∂ 15,862	∂ 17,137
2030	∂ 16,899	∂ 16,257	∂ 17,542
2031	∂ 17,299	∂ 16,651	∂ 17,947

(2) The GDP of East Rarita

Table B-11 The GDP of East Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit
2022	∂ 68,738	∂ 63,845	∂ 73,631
2023	∂ 71,140	∂ 65,250	∂ 77,030
2024	∂ 73,542	∂ 66,799	∂ 80,284
2025	∂ 75,943	∂ 68,443	∂ 83,444
2026	∂ 78,345	∂ 70,155	∂ 86,536
2027	∂ 80,747	∂ 71,919	∂ 89,575
2028	∂ 83,149	∂ 73,725	∂ 92,572
2029	∂ 85,551	∂ 75,566	∂ 95,535
2030	∂ 87,952	∂ 77,435	∂ 98,470
2031	∂ 90,354	∂ 79,329	∂ 101,379

(3) The GDP of Central Rarita

Table B-12 The GDP of General Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit
2022	∂ 28,864	∂ 26,222	∂ 31,507
2023	∂ 29,632	∂ 26,451	∂ 32,813
2024	∂ 30,400	∂ 26,758	∂ 34,041
2025	∂ 31,167	∂ 27,116	∂ 35,218
2026	∂ 31,935	∂ 27,512	∂ 36,359
2027	∂ 32,703	∂ 27,935	∂ 37,471

2028	∂ 33,471	∂ 28,381	∂ 38,560
2029	∂ 34,239	∂ 28,846	∂ 39,631
2030	∂ 35,006	∂ 29,326	∂ 40,686
2031	∂ 35,774	∂ 29,820	∂ 41,728

(4) The GDP of Rarita

Table B-13 The GDP of Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit
2022	∂ 25,640	∂ 23,782	∂ 27,497
2023	∂ 26,438	∂ 24,202	∂ 28,674
2024	∂ 27,237	∂ 24,677	∂ 29,796
2025	∂ 28,036	∂ 25,188	∂ 30,883
2026	∂ 28,834	∂ 25,725	∂ 31,943
2027	∂ 29,633	∂ 26,282	∂ 32,984
2028	∂ 30,432	∂ 26,855	∂ 34,009
2029	∂ 31,230	∂ 27,440	∂ 35,021
2030	∂ 32,029	∂ 28,037	∂ 36,021
2031	∂ 32,828	∂ 28,643	∂ 37,013

The population used in the report is predicted by utilizing the exponential smoothing method with time-series data from 2011 to 2020. The prediction results are as follows.

(1) The Population of West Rarita

Table B-14 The Population of West Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit
2022	7,691,960	7,687,139	7,696,781
2023	7,734,429	7,729,466	7,739,392
2024	7,776,898	7,771,796	7,782,000
2025	7,819,366	7,814,128	7,824,605
2026	7,861,835	7,856,463	7,867,207
2027	7,904,304	7,898,800	7,909,808
2028	7,946,773	7,941,139	7,952,406
2029	7,989,241	7,983,480	7,995,003
2030	8,031,710	8,025,823	8,037,598

2031	8,074,179	8,068,167	8,080,191

(2) The Population of East Rarita

Table B-15 The Population of East Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit
2022	1,958,601	1,943,868	1,973,335
2023	1,966,286	1,942,076	1,990,495
2024	1,973,970	1,938,891	2,009,049
2025	1,981,654	1,934,466	2,028,842
2026	1,989,338	1,928,915	2,049,762
2027	1,997,022	1,922,326	2,071,719
2028	2,004,707	1,914,769	2,094,645
2029	2,012,391	1,906,301	2,118,480
2030	2,020,075	1,896,972	2,143,178
2031	2,027,759	1,886,822	2,168,697

(3) The Population of Central Rarita

Table B-16 The Population of Central Rarita

Year	prediction	Confidence lower limit	Confidence upper limit
2022	3,022,320	2,991,786	3,052,854
2023	3,022,342	2,985,586	3,059,098
2024	3,022,364	2,980,286	3,064,443
2025	3,022,387	2,975,577	3,069,196
2026	3,022,409	2,971,295	3,073,522
2027	3,022,431	2,967,341	3,077,521
2028	3,022,453	2,963,646	3,081,260
2029	3,022,475	2,960,165	3,084,785
2030	3,022,498	2,956,864	3,088,131
2031	3,022,520	2,953,717	3,091,323

(4) The Population of Rarita

Table B-17 The Population of Rarita

Year	Prediction	Confidence lower limit	Confidence upper limit

2022	12684471.12	12640239.71	12728702.53
2023	12740363.88	12687119.51	12793608.25
2024	12796256.64	12735302.09	12857211.19
2025	12852149.4	12784341.56	12919957.24
2026	12908042.16	12833999.59	12982084.73
2027	12963934.92	12884131.05	13043738.78
2028	13019827.68	12934639.83	13105015.52
2029	13075720.44	12985458.37	13165982.51
2030	13131613.2	13036537.04	13226689.35
2031	13187505.96	13087838.14	13287173.77

Indirect and induced effects (with multipliers)

(1) Impact on GDP

Table B-18 Impact on GDP

Year	Without Multiplier Effect		Multiplier=2		Multiplier=5	
	MCB Revenue	the Percentage of GDP	MCB Revenue	the Percentage of GDP	MCB Revenue	the Percentage of GDP
2022	∂3,650	1.12%	∂7,301	2.24%	∂18,252	5.61%
2023	∂3,625	1.08%	∂7,251	2.15%	∂18,127	5.38%
2024	∂3,641	1.04%	∂7,283	2.09%	∂18,207	5.22%
2025	∂3,935	1.09%	∂7,869	2.18%	∂19,674	5.46%
2026	∂3,952	1.06%	∂7,904	2.12%	∂19,760	5.31%
2027	∂4,055	1.06%	∂8,111	2.11%	∂20,277	5.28%
2028	∂4,319	1.09%	∂8,638	2.18%	∂21,595	5.45%
2029	∂4,338	1.06%	∂8,675	2.12%	∂21,689	5.31%
2030	∂4,556	1.08%	∂9,112	2.17%	∂22,779	5.42%
2031	∂4,921	1.14%	∂9,843	2.27%	∂24,606	5.68%

(2) Impact on employment rate

Table B-19 Impact on employment rate

Year	Direct jobs	Indirect jobs	Total Jobs	New employment rate
2022	20000.56054	38097.99814	58098.6	0.46%
2023	19691.24713	37851.26486	57542.5	0.46%
2024	19778.39852	38018.79058	57797.2	0.46%
2025	22465.09601	40981.98908	63447.1	0.50%
2026	22563.65177	41161.77958	63725.4	0.50%

2027	23455.13444	42212.43248	65667.6	0.51%
2028	25794.91115	44882.02059	70676.9	0.55%
2029	25906.60498	45076.363	70983.0	0.55%
2030	27814.97651	47288.71209	75103.7	0.58%
2031	31026.15422	50995.27136	82021.4	0.63%

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