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Section 1. Marketing

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MARKETING INTELLIGENCE AS AN IMPORTANT ASPECT TO STUDY COMPETITIVE ENVIRONMENT

Abstract. The article explores the competitive landscape and notes that timely and accurate information is vital to decision-making. The authors note that the goal of marketing intelligence is to improve the strategic decision-making process, track and evaluate the actions of competitors. The authors believe that it widely used this data collection method in retail systems to, directly and indirectly, collect information about competitors.

Keywords: Marketing intelligence, competitive environment, data collection.

Introduction. Well functioned marketing intelligence system is vital for every company, it helps implementing effective marketing campaigns, formulating strategies and creating action plans to provide decent competition to market players. Strategy can't be defined without proper calculations and planning.

In today's environment, accurate, relevant, and on-time information is essential to make the right decisions. To manage effective marketing information and fresh, updated data are essential tools that the company must translate into marketing action. The fundamental requirement is the market research that business facilities should conduct to determine market opportunities. The reason is to get feedback on the current situation about the opportunities that determine the company's drive and success. Market-

ing Intelligence is an essential component of the corporate culture of modern business success, without it any competition-related activity is impossible.

Marketing Intelligence asks for systematic collection and analysis of publicly available information about competitors and their achievements in a given market segment. Dividing customers into strategic groups, opens up unique opportunities for businesses in a competitive business environment. For each group are defined: marketing goals, products, service, market share, growth trends and etc. [1].

Managers often use the intranet to verify supplies in the network. The reason may be the depletion of stocks of specific goods. In order not to irritate the customer, the manager can tell the customer which branch to apply for the desired product. The store

may also request to get mentioned product from the nearest branch. Chain stores often use this method to sell stock balances during promotions.

The Internet is a common way nowadays to get information about competitors. In this process are studied the website of the company, social media, blogs, etc. As researchers point out, analyzing customer comments and considering their experiences in the future will receive more and more attention and have the greatest impact on their purchasing decision.

The marketing officer of LLC “Nikora”, a large supermarket chain in the Georgian retail market, says that “Nikora” constantly monitors sales data, the customer’s attitude and trust towards the brand, and their involvement in the campaigns offered by the company. LLC “Nikora” branches also use intranet sources effectively during promotions in order to help each other in sales and customer satisfaction. All the above is monitored with the help of modern computer technologies and intranet, which provides sales statistics. At last, strategic decisions are made by top management after the Marketing manager will report the data. Once information is collected from all possible sources and sorted by value, it can be used by management to make strategic marketing decisions.

While most of the sources used to obtain information about competitors are legal, the morality of some sources is still under question. Obviously, companies should take advantage of the competitors’ data but still need to keep an eye on it, however, everything should be under ethical norms. Let’s consider a specific business activity to see a better picture of reality. For example, by managing supermarket chain stores, the business owner should consider the following challenges that a particular market may face while operating. First of all, the management constantly has to control both his own and competitor’s product assortment and prices in the areas where the company’s trading branches are located. Also, must be aware of the peculiarities of competitors’ business: whether they have introduced

new goods or services, what type of promotions they have, whether they have presented innovations in the customer relationship management system, etc. [2].

Threats that supermarket might face are:

- Direct competitors;
- Indirect competitors;
- Suppliers, distributors;
- Contractors;
- Employees;
- Government structures;
- Clients; as well as a pickpocket on store territory causing the company to suffer, and so on.

The main challenge still comes from direct competitors. Their specially trained staff frequently visit a neighborhood stores, to better explore various aspects of their trading business: range, prices, quality, terms of services, methods of attracting and retaining customers, etc. If necessary, competitors can use the so-called “mystery shopping” technique to monitor the skills of staff and the quality of customer service, as well as interview them to clarify information. At this time, not only the existing shortcomings can be identified, but also the opportunities to satisfy the interests that will give the competitor significant advantages.

Every business object has common and inherent challenges. Common are, for example, threats from competitors: the nuances of business intelligence, as well as from counterparties and criminals, and so on. As been already mentioned above, the main threat still comes from competitors. Their intelligence activities should be answered by the management of the firm with active counter-intelligence technologies, which means:

- Obstructing the monitoring of the firm from outside, as well as the collection and processing of current information about the strengths and weaknesses of the firm;
- Hide the weaknesses and risks of the firm. Disguise real intentions, preparatory and implementing actions;
- Disclosure of “sources”, as well as employees of the company, who show inadequate reli-

ability in the process of storage and processing of commercial information.

These technologies reduce challenges and prevent the opponent from managing effectively a competitive strategy. Often researchers make the mistake of not being able to read the material about the stages of a competitor's development. This study gives company an idea of the corporate culture of the facility and its problem-solving approaches. However, important information needs to be verified from additional sources as well. Since no company publishes a negative about themselves, they mostly try to embellish the reality. There is nothing wrong with presenting yourself in a profitable way, just as an analyst should not overlook this circumstance.

The advantages of a competitor's product, both real and exaggerated, are reflected in its advertising clips or booklets. Knowledge of the shortcomings of their goods or services helps us to correctly define our own marketing policy. It is much more profitable to avoid direct confrontation with the opponent, to draw the customer's attention to their own advantages and not to the common features with a competitor's product. Having an information about the weaknesses of the opponent's goods will allow companies to "seduce" the audience that is dissatisfied with their product/service.

In retail business, many things are introduced by observation and imitation of each other. For example, for a supermarket as a model for organizing trade, it is necessary to attribute the so-called "Grocery cart" to deliver purchased products to the cash register and then (if necessary) to the car. It has appeared on market from the 1940s, when one of the women placed a shopping cart and moved the purchased products through a stroller. Since then, the news was picked up by neighboring markets and imitated each other. Most of the supermarkets today use similar carts (already in different sizes and designs) to make the shopping process more convenient for consumers.

The common goal for all business sectors is to increase sales and revenue. As a result, it is important

to know the competitors market share. To get this information, companies need to know the capacity of a given segment, the volume of competitor sales and the number of customers. Crucial to success is both retaining existing customers as well as searching for new ones and expanding the market segment. For marketing strategy to be effective, it is necessary to distinguish between customer attraction and retention strategies. As a rule, 80% of the funds are spent on the intelligence organization, and 20% on the realization of ideas. The outcome is that insufficiently processed information is provided to the company's management. Funds should be distributed almost in reverse, with 30% spent on intelligence organization and 70% on analysis and implementation of results in practice [3].

One of the prerequisites for the company's success is positive reviews from users on social media. Important information is provided by customer feedback, reporting of the company's goods (services) and positive feedback from customers indirectly allowing us to compare companies and their goods. However, corporate wars are becoming more and more important today.

The challenge is that the image created in a social network can differ significantly from reality. There are cases where the company is threatened by former employees who are dissatisfied with the dismissal and express antipathy towards management. They can bring to the surface the scandal and weaknesses of the former employer. Offended by management, they criticized the company's products and talked about the company's weaknesses. Therefore, the company's communication service should constantly monitor the opinions expressed by users on all the news voiced by the company: posts, videos, statuses, etc. And make a targeted operative response to the interested audience.

Consider the practical use of marketing intelligence with the following specific example. Let's say we produced semi-finished meat products like dumplings, cutlets, etc. It is natural to start an activity by gathering information about a business, the

surroundings around, that operate in this field. The principal objects of interest are always competitors. It is necessary to find out how the market segment is distributed among them. Then we need to look at customers, suppliers, potential partners, counterparties, and so on.

Collecting the data starts from open sources. However, because of the specifics of the business, it may be necessary to use hidden sources as well. Unfortunately, there is no agency in our country, Georgia, that has comprehensive information on the sectoral markets and trends in specific businesses operating there. We can get the information:

1. By direct and indirect methods. However, for the market, there is a selling and delivery price. If the first is open information, the second is closed;

2. The indirect method is a method of calculating the rate associated with it. If we are interested in the cost of making these semi-finished products, we will need to use indirect methods. In particular, consideration of constituent ingredients and energy carriers, as well as utility and transport costs, etc. which involves carrying out certain works.

3. In terms of ethics, there are seemingly fewer ethical methods that do not violate legal norms. The less known a competitor is the less information about it in open source. As a result, it is often necessary to get data directly from a competitor.

4. Clearly unethical methods that do not seem to violate legal norms For Example getting information through covert observations, under the pretext of offering raw material, etc.

5. Unethical actions. These actions include illegal invasion into the company using special equipment. Copy data from information systems using audio and video surveillance technology. Abuse of official authority also includes serious crimes: blackmail, threats of violence, bribery, use of necessary connections in the state, law enforcement, and criminal structures.

In order to use marketing intelligence methods effectively, needs to be found highly qualified specialists and create a team that will be distinguished by data: analytical ability, flexible and non-standard thinking, sociability, resilience, and ability to hide emotions, intuition if artistry is needed, etc.

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PREDICTING APP RATINGS WITH LINEAR REGRESSION

Abstract. App ratings are one of the most important criteria when it comes to app development and app marketing, as they are indicators of whether an app will provide any benefit to the user. Therefore, it is very crucial to find out what factors are the most important if an app wants to get high ratings. In this project, I used a dataset that contained information regarding apps in the Google Play Store. I constructed a multiple linear regression model that can predict app rating scores according to the basic data information of the apps. I will first introduce the basic concepts and methodology details of the multiple regression. Then, I will construct a data analysis and data model based off the dataset I used. Finally, I will use Python to conduct the model and provide insight for the target companies and developers.

Keywords: predicting app ratings, machine learning, multiple linear regression, least squares regression, data cleaning.

Background and Introduction

For this project, I wanted to identify and examine the patterns and factors that go into the rating score of apps on the app store. I want to be able to determine why some apps receive better ratings than other apps, and I want to discuss the implementations of this. The main target is to find the relationship between the app rating scores and the factors, with linear regression models as the main analysis tool. Moreover, I will provide insights and results interpretation according to the model outcomes, verifying the efficiency and robustness of the model construction. For example, I could be looking at the effects of the number of installs of an app or the size of an app.

Methodology Overview

Linear Regression Basis [1]:

I am concerned with whether the relationship pattern between two values of variables can be described as a straight line, which is the simplest and most used form.

$$Y = a + bX$$

Where Y is the dependent variable, measured in units of the dependent variable, X is the independent

variable, measured in units of the independent variable, and a and b are constants defining the nature of the relationship between the variables X and Y .

- The “ a ” or Y -intercept (aka Y -int) is the value of Y when $X = 0$.
- The “ b ” is the slope of the line and is known as the regression coefficient and is the change in Y associated with a one-unit change in X .

The greater the slope or regression coefficient, the more influence the independent variable has on the dependent variable, and the more change in Y associated with a change in X .

The regression coefficient is typically more important than the intercept from a policy researcher perspective as we are usually interested in the effect of one variable on another.

Coming back to the equation, I also have a term to capture the error in our estimating equation, denoted ϵ or e . Also known as the residual, it reflects the unexplained variation in Y , and its magnitude reflects the goodness of fit of the regression line. The smaller the error, the closer the points are to

our line. So, our general equation describing a line is: $Y = a + bX + e$

Regression Analysis:

Simple regression is a procedure to find specific values for the slope and the intercept.

If the line that is drawn to describe the data is has a positive slope, the data suggests a positive relationship. If the line has a negative slope, the data suggests a negative relationship. If the line is horizontal/if the slope is zero, there is no relationship in the data.

In drawing a linear regression line, one wants to minimize the distance between the points and the line. Distance is then measured vertically from an observed point to our estimated line. Since I cannot draw a line that minimizes the distance between all points and the line at the same time, I needed to find a way to average the distances to get a best-fitting line. In the most common form of regression analysis, the technique is to find the sum of the squared values of the vertical distance [2]:

$$\sum(Y_i - \hat{Y}_i)^2$$

That form of regression is called Ordinary Least Squares, or Least Squares, and it has two key properties:

The sum of all actual values minus expected values equals zero

The sum of all (actual – expected) squared is the minimum value possible.

In equation form:

1. $\sum(Y_i - \hat{Y}_i) = 0$
2. $\sum(Y_i - \hat{Y}_i)^2 = \text{minimum}$

Data

Data Source [3]:

I am using an excel sheet with information regarding apps. It includes the app names (“App” column), the category of the apps (“Category” column), the rating scores of the apps (“Rating” column), the number of reviews the apps have (“Reviews” column), the size of the apps (“Size” column), the approximate number of installs of the apps (“Installs” column), whether the app is free or paid (“Type” column), the price if it is paid (“Price” column), the content rating (“Content Rating” column), the genre (“Genres” column), the apps’ current version (“Current Ver” column), and the apps’ android version (“Android Ver” column).

Table 1. – First Preview of the Raw Dataset

37	How to draw ladybug and Cat Noir	ART_AND_DESIGN	3.8	564 9.2M	100,000+	Free	0 Everyone Art & Design	2.1	4.1 and up					
38	UNICORN - Color By Number & Pixel Art Coloring	ART_AND_DESIGN	4.7	8145 24M	500,000+	Free	0 Everyone Art & Design/Creativity	1.0.9	4.4 and up					
39	Floor Plan Creator	ART_AND_DESIGN	4.1	36639	Varies with device	5,000,000+	Free	0 Everyone Art & Design	Varies with device	2.3.3 and up				
40	PIP Camera - PIP Collage Maker	ART_AND_DESIGN	4.7	158 11M	10,000+	Free	0 Everyone Art & Design		1.3	4.0.3 and up				
41	How To Color Disney Princess - Coloring Pages	ART_AND_DESIGN	4	591 9.4M	500,000+	Free	0 Everyone Art & Design			1.4.0 and up				
42	Drawing Clothes Fashion Ideas	ART_AND_DESIGN	4.2	117 15M	10,000+	Free	0 Everyone Art & Design	2.0.1		4.0.3 and up				
43	Sad Poetry Photo Frames 2018	ART_AND_DESIGN	4.5	176 10M	100,000+	Free	0 Everyone Art & Design			1.4.0.3 and up				
44	Textgram - write on photos	ART_AND_DESIGN	4.4	295221	Varies with device	10,000,000+	Free	0 Everyone Art & Design		Varies with device				
45	Paint Splash!	ART_AND_DESIGN	3.8	2206 1.2M	100,000+	Free	0 Everyone Art & Design/Creativity		1.16	4.1 and up				
46	Possible Sticks and Similar DIY Craft Ideas	ART_AND_DESIGN	4.2	26 12M	10,000+	Free	0 Everyone Art & Design		1.0.0	4.1 and up				
47	Canva: Poster, banner, card maker & graphic design	ART_AND_DESIGN	4.7	174531 24M	10,000,000+	Free	0 Everyone Art & Design	1.6.1		4.1 and up				
48	Install Images with music to make video without Net - 2018	ART_AND_DESIGN	4.6	1070 25M	100,000+	Free	0 Everyone Art & Design			1.6	4.1 and up			
49	Little Teddy Bear Colouring Book Game	ART_AND_DESIGN	4.2	85 8.0M	100,000+	Free	0 Everyone Art & Design	2.0.0		4.1 and up				
50	How To Draw Food	ART_AND_DESIGN	4.3	945 7.9M	100,000+	Free	0 Everyone Art & Design			1.2.3 and up				
51	Monster Truck Stunt 3D 2019	AUTO_AND_VEHICLES	4.2	367 25M	100,000+	Free	0 Everyone Auto & Vehicles			1.4.0.3 and up				
52	Real Tractor Farming	AUTO_AND_VEHICLES	4	1598 55M	1,000,000+	Free	0 Everyone Auto & Vehicles			11	4.1 and up			
53	Ultimate F1 Racing Championship	AUTO_AND_VEHICLES	3.8	204 57M	100,000+	Free	0 Everyone Auto & Vehicles				3.4.1 and up			
54	Used Cars and Trucks for Sale	AUTO_AND_VEHICLES	4.6	17057	Varies with device	1,000,000+	Free	0 Everyone Auto & Vehicles		Varies with device				
55	American Muscle Car Race	AUTO_AND_VEHICLES	3.9	129 35M	100,000+	Free	0 Everyone Auto & Vehicles				3.4.1 and up			
56	Offroad Off Road Tanker Driver Transport Truck 2018	AUTO_AND_VEHICLES	4.3	542 33M	100,000+	Free	0 Everyone Auto & Vehicles				4.4.1 and up			
57	Tickets SDA 2018 and Exam from the State Traffic Safety Inspectorate with Drom.ru	AUTO_AND_VEHICLES	4.5	10479 33M	100,000+	Free	0 Everyone Auto & Vehicles	1.7.1			4.0 and up			
58	Gas Prices (Germany only)	AUTO_AND_VEHICLES	4.4	805 5.6M	50,000+	Free	0 Everyone Auto & Vehicles	2.5.1			4.4 and up			
59	Extreme Rally Championship	AUTO_AND_VEHICLES	4.2	129 54M	100,000+	Free	0 Everyone Auto & Vehicles				3.4.1 and up			
60	Restart Navigator	AUTO_AND_VEHICLES	4	1403 201K	100,000+	Free	0 Everyone Auto & Vehicles	1.0.1			2.2 and up			
61	REG - Check the regnumber, find information about Swedish vehicles	AUTO_AND_VEHICLES	3.9	3971 3.6M	100,000+	Free	0 Everyone Auto & Vehicles				2.493	4.4 and up		
62	CityBus Lviv	AUTO_AND_VEHICLES	4.6	534 5.7M	10,000+	Free	0 Everyone Auto & Vehicles	1.9.1				4.0.3 and up		
63	CDL Practice Test 2018 Edition	AUTO_AND_VEHICLES	4.9	7734 17M	100,000+	Free	0 Everyone Auto & Vehicles					1.7	4.2 and up	
64	eZTC (ETC balance inquiry, meter trial, real-time traffic)	AUTO_AND_VEHICLES	4.3	18946 8.6M	1,000,000+	Free	0 Everyone Auto & Vehicles	2.20	Build 02			4.1 and up		
65	Free VIN Report for Used Cars	AUTO_AND_VEHICLES	4.6	2411 2.4M	100,000+	Free	0 Everyone Auto & Vehicles					1.37	4.0 and up	
66	DMV Permit Practice Test 2018 Edition	AUTO_AND_VEHICLES	4.9	6090 27M	100,000+	Free	0 Everyone Auto & Vehicles					1.7	4.2 and up	
67	Check Vehicle Tax	AUTO_AND_VEHICLES	3.9	295 2.7M	10,000+	Free	0 Everyone Auto & Vehicles	6.2.1					4.4 and up	
68	Used Cars Mexico	AUTO_AND_VEHICLES	4	190 2.5M	50,000+	Free	0 Everyone Auto & Vehicles						1.2.3 and up	
69	Ulysses Speedometer	AUTO_AND_VEHICLES	4.3	40211	Varies with device	5,000,000+	Free	0 Everyone Auto & Vehicles				Varies with device		
70	REPUVE	AUTO_AND_VEHICLES	3.9	356	Varies with device	100,000+	Free	0 Everyone Auto & Vehicles				Varies with device		
71	Used cars for sale - Trovit	AUTO_AND_VEHICLES	4.2	32930 7.0M	5,000,000+	Free	0 Everyone Auto & Vehicles	4.47.3					4.0.3 and up	
72	Fees of the State Traffic Safety Inspectorate are official: inspection, payment of fines	AUTO_AND_VEHICLES	4.8	116946 35M	5,000,000+	Free	0 Everyone Auto & Vehicles	1.9.7					4.0.3 and up	
73	5K Enca Direct Malli - Used Cars Search	AUTO_AND_VEHICLES	3.6	1379 16M	500,000+	Free	0 Everyone Auto & Vehicles	2.2.21					4.2 and up	
74	Android Auto - Maps, Media, Messaging & Voice	AUTO_AND_VEHICLES	4.2	271920 16M	10,000,000+	Free	0 Teen Auto & Vehicles						Varies with device	5.0 and up

Table 2. – Second Preview of the Raw Dataset

4246	Zombie Catchers	GAME	4.7	989158	75M	10,000,000+	Free	0	Everyone	Action	1.0.27	4.1 and up	
4247	FollowMeter for Instagram	SOCIAL	4.4	90082	8.8M	1,000,000+	Free	0	Everyone	Social	2.44	4.1 and up	
4248	I LOVE PASTA	FAMILY	4	83875	43M	1,000,000+	Free	0	Everyone	Simulation	1.6.1	2.3.3 and up	
4249	Talking Tom Cat	FAMILY	4.3	1838090	Varies with device	100,000,000+	Free	0	Everyone	Casual	Varies with device	4.1 and up	
4250	Fidget Spinner	GAME	4.2	307398	9.9M	10,000,000+	Free	0	Everyone	Arcade	1.12.5.1	2.1 and up	
4251	Jetpack Joyride	GAME	4.4	4637439	96M	100,000,000+	Free	0	Everyone	Arcade	1.10.12	4.1 and up	
4252	J Touch	TOOLS	4.6	2176	953k	100,000+	Free	0	Everyone	Tools	1.5.1-GP	4.1 and up	
4253	J-Nevel Club	FAMILY	3.3	162	9.0M	10,000+	Free	0	Teen	Entertainment		1.2	4.1 and up
4254	Anger of stick 5 : zombie	GAME	4.5	547644	23M	50,000,000+	Free	0	Teen	Action	1.1.5	2.3 and up	
4255	J - Style Pro	HEALTH_AND_FITNESS	2.3	74	2.6M	10,000+	Free	0	Everyone	Health & Fitness		1.1	4.3 and up
4256	Cook Baked Lasagna	FAMILY	4.3	56259	23M	10,000,000+	Free	0	Everyone	Casual		4.0	and up
4257	Tom's Love Letters	FAMILY	4.1	705805	35M	50,000,000+	Free	0	Everyone	Entertainment	2.3.1.8	4.1 and up	

Table 3. – Third Preview of the Raw Dataset

572	BiggerCity: Chat for gay bears, chubs & chasers	DATING	4.1	923	44M	100,000+	Free	0	Mature 17	Dating	3.4.1.1	4.1 and up
573	Moco+ - Chat, Meet People	DATING	4.2	1546	Varies with device	10,000+	Paid	\$3.99	Mature 17	Dating	2.6.139	4.1 and up
574	SilverSingles: The 50+ Dating App	DATING	3.3	149	16M	10,000+	Free	0	Mature 17	Dating	4.8.5	4.0.3 and up

All of the data is put into the variable “data,” which uses pandas to read and obtain all the information from the dataset. This variable is fundamental to the function of the code. I say this because this variable “data” is used differently for each column in the dataset to meet the needs of that specific column.

For example, I used the data variable to create different variables only applicable to certain columns, or I used the data variable to apply functions only applicable to certain columns. This allowed me to focus on the columns individually when cleaning the data.

Data Cleaning:

Table 4. – Preview of the Cleaned Dataset

	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver	CategoryCleaned	GenresCleaned
2	ART_AND_DESIGN	4.7	87510	6908.8	50000000	0	0.0	0	Art & Design	August 1, 2018	1.2.4	4.0.3 and up	0	0
3	ART_AND_DESIGN	4.5	215644	25600	50000000	0	0.0	1	Art & Design	June 8, 2018	Varies with device	4.2 and up	0	0
4	ART_AND_DESIGN	4.3	567	2867.2	100000	0	0.0	0	Art & Design Creativity	June 20, 2018	1.1	4.4 and up	0	1
5	ART_AND_DESIGN	4.4	167	5734.4	50000	0	0.0	0	Art & Design	March 26, 2017	1.0	2.3 and up	0	0
6	ART_AND_DESIGN	3.8	178	19456	50000	0	0.0	0	Art & Design	April 26, 2018	1.1	4.0.3 and up	0	0

In general, when examining data, one should make sure that there are readable numerical values within each column. In order to create a multiple linear regression model, data cleaning needs to be done first. Therefore, to begin, I turned the different category types within the category columns into their respective numbers. For example, in the “Category” column of my dataset (shown in figure 1), which contained the categories the apps were in, “ART_AND_DESIGN” was assigned to 0, “AUTO_AND_VEHICLES” was assigned to 1, and so on. I did this by creating a dict which mapped the original column into a new column with the new assigned values. This was useful as it tied a specific number to each app instead of a string. Now, if any app was tied to the number 0, the program would know that they were in the “ART_AND_DESIGN” category. Figure 4 demonstrates the original column mapped into the new column

“Category Cleaned.” The new column is used for the eventual regression model, and the old one is ignored.

Next, the same concept applies to size. The size either had an “M” or a “k” in it (shown in figures 2), which meant megabyte or kilobyte, respectively. In order to make this readable to my program, I wanted to remove these letters and translate them into solid numbers in order to create a more uniform column. In this case, I converted each into solid numbers representative of how many kilobytes the app took up. So, I wrote a function that removed the letter “M” and then multiplied the number by 1024, since 1M is equal to 1024k. Then, for those with k, I just removed the letter “k” and returned the number. Then, I mapped the column and applied the function to it. In (Figure 4), it portrays the size as being readable floats.

Then, for the Installs column, the values were formatted such as the raw number with a plus sign at the

end of it (shown in figures 1 and 2), so for example, “50,000+.” Therefore, I wanted to remove the “+” and then convert the remaining values into floats so that it would be readable. I stripped the “+” off of each value then converted it into float using `astype`. However, there was a problem. I was unable to convert the entire column into float because one of the boxes in the columns had an alien value. So, I found the location, and dropped the alien value so that the system would allow me to convert the column into floats. Again, in (Figure 4), one can see the cleaned column.

After, for the “Type” column, there were two values—“Free” or “Paid” (shown in figures 1 and 2). To convert these into readable values, I turned them into binary-0 and 1. I wrote a function which returned 0 if the value was “Free” and returned 1 if the value was “Paid.” Then, I mapped the column into a new column and applied the written function. The cleaned dataset in Figure 4 shows the new mapped values.

Nearing the end, I used the same concept as I used for the category column for the content rating column. The content rating column contained “Everyone,” “Everyone 10+,” “Teen,” and “Mature 17+.” I used a dict and applied respective values (numbers) to each different value in content rating, so that the values could be readable by the program. In the small preview shown in (Figure 4), the respective numerical values are shown in the Content Rating column instead of the string values.

I then had to clean up the “Genres” column too, which, although quite similar to the “Category” column, was not identical. Even so, the same concept of data cleaning stands for the “Genres” column. To clean this column, I created a separate dict which mapped numerical values in place of the original string values in the column. As you can see in (Figure 4), the “Genres Cleaned” column is showing, which shows numerical values. This is just a map of the original “Genres” column, so when building the regression model, similar to as stated previously regarding the “Category” column, I just use the “Genres Cleaned” column instead of the “Genres” column.

Finally, I had to clean the price column and drop any unneeded columns. Regarding the price column, for the Free values, the price was already equal to 0 (shown in figure 3). I wrote a function that ignored the value of 0 and removed the \$ sign from the ones that did cost money. I then dropped the “Current Ver” and “Android Ver” columns, as they did not help much in my model.

Results Insights

Linear Regression:

In order to put this code to use, I used linear regression at the end. By using linear regression, I created linear models that demonstrate relationships between different variables of the data [5]. By compiling many different points based off of the data set, and by drawing a line that draws relationships, I was able to visualize any patterns within the data set. Doing this allowed me to diagnose the factors that go into the overall review of an app.

Correlation:

The colors seen in (Figure 5) are an indication of the magnitude of correlation. The darker (or bluer) the color is, the higher the correlation is, and the lighter (or redder) the color is, the lower the correlation is. When first looking at this heat map, the eye gravitates towards the bottom right and the center, which are marked by the variables “Category Cleaned” and “Genres Cleaned” and “Type” and “Price” respectively. This means that those variables are correlated to each other. Looking at the rest of the heat map, you are able to tell which variables are correlated and which are not. For example, “Content Rating” and “Category Cleaned” would have a low correlation.

Regression Coefficients Validation:

When finding the coefficients of the regression, I found there to be extremely low coefficients. This seems reasonable as the rate of change of the regression graph was not very high, meaning that the low values of the coefficients are plausible [6].

Residuals Analysis:

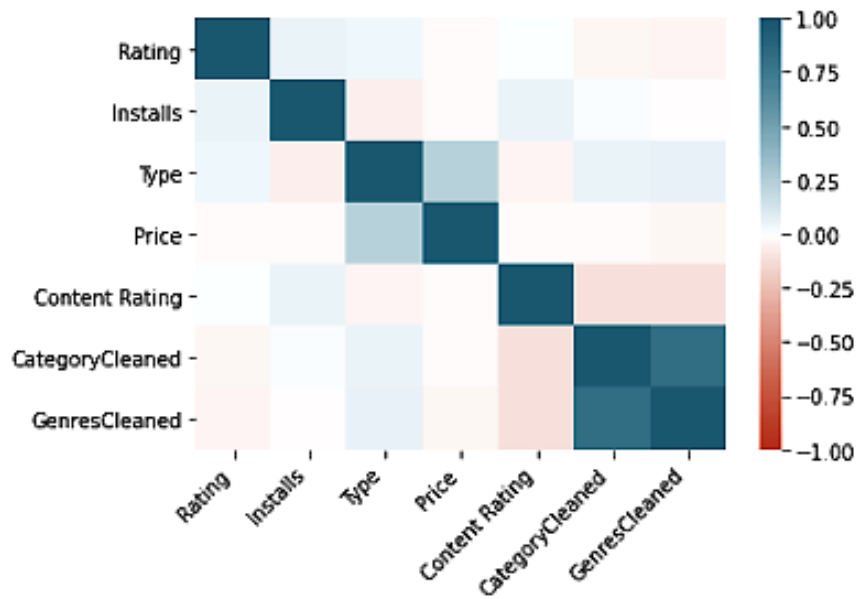
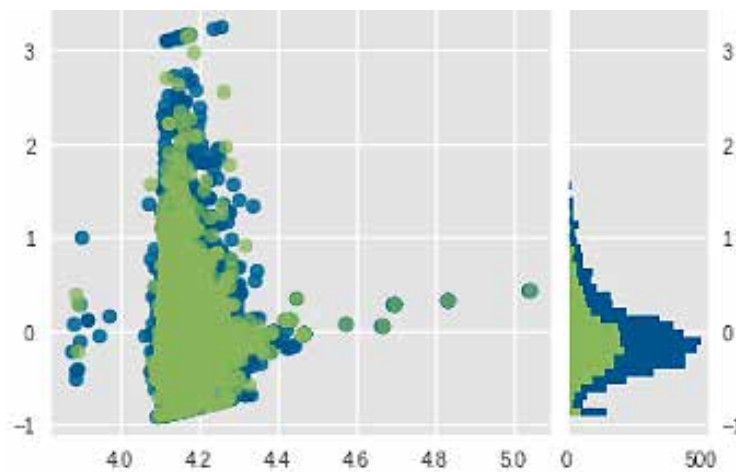


Figure 5. Correlation Heat Map



$R^2: 0.010048884330930763$

Figure 6. Residuals Plot

Here, I have the residuals plot, as well as my calculated R^2 value. The R^2 value is, in short, a statistic that gives basic information regarding the accuracy, or robustness, of a model. For the R^2 value, one is usually looking for a higher value than the one I calculated: a R^2 value of 1 is the most optimal. However, there are reasons for the low R^2 value. First off, the data points are very distributed. They do not concentrate on one area – it is more like they are concentrated in many areas (shown in figure 6). This will affect the R^2 value. Second, there are differences in the magnitude of the variables used. For example, the column

of reviews may only be in the thousands, whereas the column of installs may be well into the millions. With such a huge difference in value, it is hard to calculate an accurate R^2 value that adequately fits the graph. Therefore, although the raw calculations for the R^2 value were done, it is not exactly applicable in this situation, due to external factors.

Business Insight/Developer Perspective:

So, our results are linear models that have “Actual Ratings” on the y-axis and “Predicted Ratings” on the x-axis. The models are representative of predictions of app ratings made based on the data provided

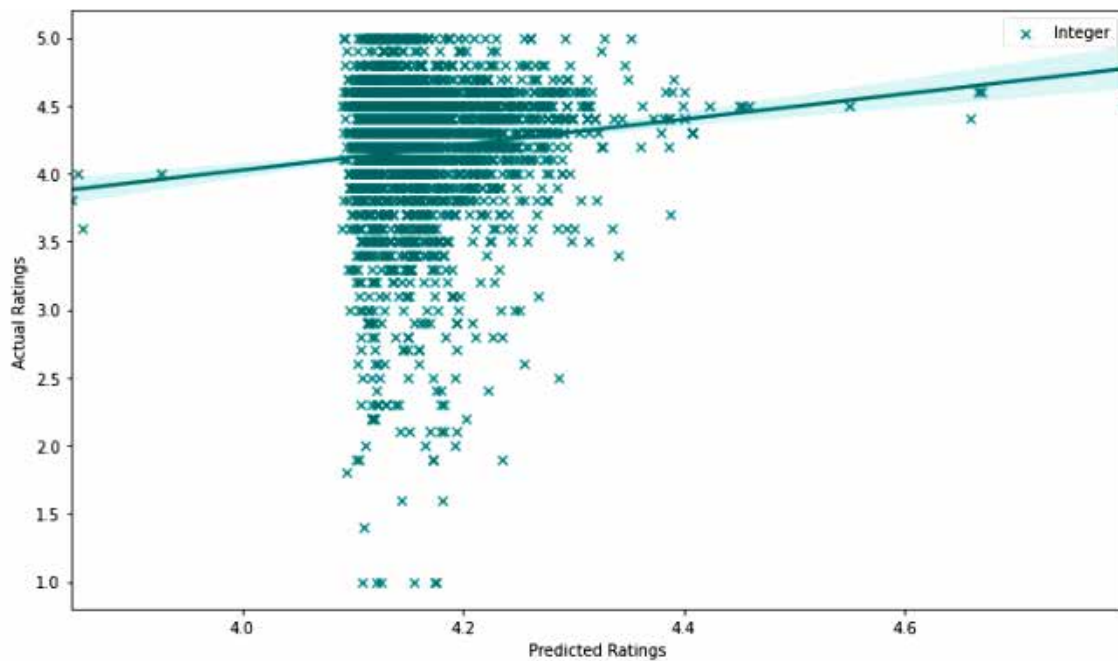


Figure 7. Linear Model Excluding Genres Column

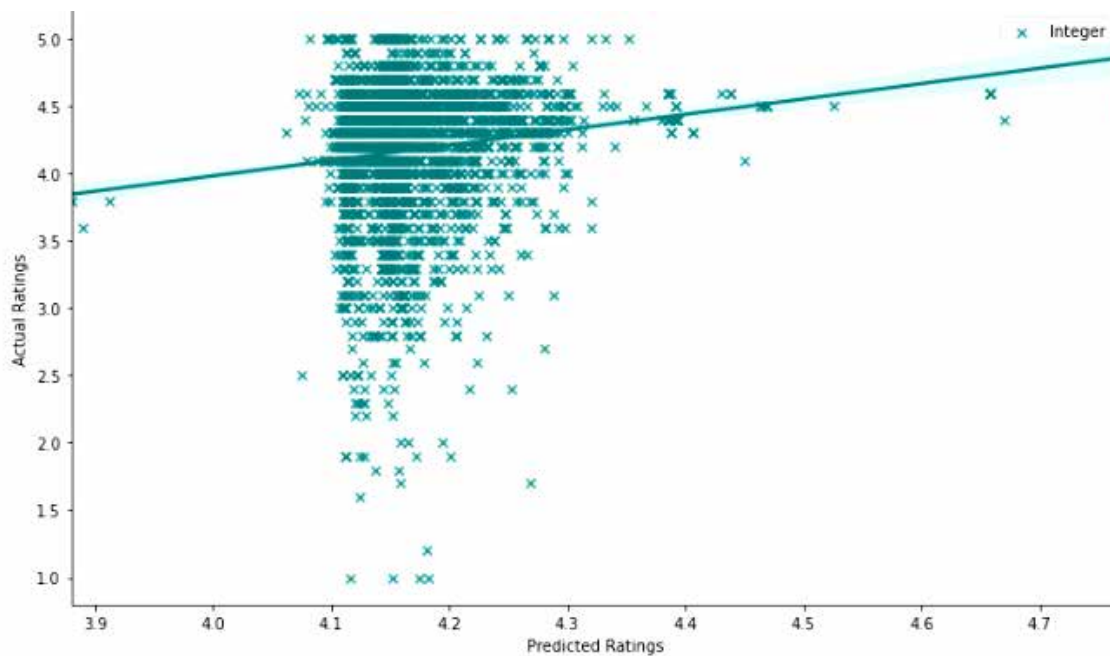


Figure 8. Linear Model Including Genres Column

The graphs in Figures 7 and 8 are quite similar of course – one column of genres is not going to make a big difference. There is just a small deviation in standard deviation and average value, with the standard deviation being 0.0569 and 0.064 and the average value being 4.191 and 4.200 respectively for Excluding Genres and Including Genres. The linear model

without genre column had a lower average value and a lower standard deviation as well, meaning the values varied from the average value less than the linear model with the genres column. Including the genres column tended to create the less accurate model [6].

This model is able to create a prediction value of a rating, and then graph it against the actual rating.

As seen from the graph, it is not terrible. Most of the data points are clustered near the center line, which tends to be the most accurate part.

Businesses will be able to use this to create a competitive advantage when releasing apps. Knowing they have a program that can predict the ratings of an app given certain variables, they can create apps that are more centered around the variables that seem to pull the highest predicted rating. For example, variables such as size, price, and the number of installs can all be affected due to this model and give businesses some assistance when creating apps and planning for the future of those apps.

Model Improvement

I found that the R^2 value was not very ideal in terms of a good prediction criteria. According to the linear regression model itself, one can improve the model accuracy by standardizing the features, so that all the features can be put into the model with same magnitude. This would also help with dealing with the extremely large values, or conversely, extremely low values.

Another aspect that could help me improve in this project would be increasing the model complexity. Instead of linear model, I can try a non-linear mode, such as non-parametric regression or, even more advanced, machine learning models like a tree model or a neural network. I could also have introduced more complex variables. This would give a sense of specificity and zone into the apps more.

Conclusion

Ultimately, in this paper I was able to reach my goal. I was not only able to clean and scan data, but I was also able to apply it to a linear regression model, which then has applications to the real world. I was able to learn many things and experiment with many things, and research a conclusion that could be useful to businesses who are involved with app development and marketing. Among the many variables that made up the data set I used, such as “App,” “Category,” “Rating,” “Reviews,” and “Size,” I figured that some were more influential than others. This was supported by my correlation heat graph. For example, looking at the “Type” and “Price” columns, which are symbolic of whether an app costs money or not, you are able to tell that they are very influential variables. Also looking at “Content Rating” and “Installs,” there is a decent correlation. When looking at these variables in a logical perspective, it makes logical sense that these variables would be more influential – people want to get bang for their buck, don’t they? So, after completing this project, my suggestions for companies and developers who would want to improve their ratings would be to focus on reasonable and balanced prices on apps (if not free) and try to maximize the number of installs. The more installs an app has, the more accurate the ratings get, as it starts to average out. With a greater number of installs comes a greater number of reviews. Deviations are less frequent and therefore an app will have more accurate ratings.

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Section 2. Mathematical and instrumental methods of economics

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MEDIA TREND ANALYSIS

Abstract. With the advent of information era, media has become more and more important in our daily life. In this project, with the statistics of a commercial TV show as an example, I statistically analyzed the potential driving forces behind the decline of the TV show viewership. Specifically, I first examined the linear relationship between potential variables and the TV show viewership, based upon which, I come up with some statistical factor to make TV show viewership prediction. After an examination and some analysis on the regression result, I conclude that the presence of a specific character and the presence of some competing shows don't have significant effects on the decline of the TV viewership. I also conclude that the budget of the show has positive but minor effect on the boost of the viewership. Those findings are also consistent with my background research.

Keywords: Linear regression, media data, TV show conversions.

1. Motivation

With the advent of information era, media has become more and more important in our daily life. Recent studies have found that adult spent 2 hours on average on social medias, among which, Facebook and Youtube have become the major part of the adult time allocation. In China, recent development of short video platform such as Tiktok and Bilibili have been very successful in capturing teenagers' attentions. From both company profit and efficient information prospective, understanding what are the important factors behind the soaring media participation has become more and more important. In this project, I use the viewership of a digital company as a quantification of the media participation. As the viewership fluctuate according to the other statistics, I analyze the relevant driving forces behind the media participation.

2. Relevant Digital Company Data

An India media company launched a TV show in 2017. The show has been very popular and commercially successfully at the beginning but then the viewership experiences a decrease as it approaches the ends. The companies have released some statistics that are very useful for my studies. Here I briefly summarize the statistics below:

- Date: Date of the statistics;
- Views of the show: The viewership of the show;
- Visitors: The number of visitors to the platform, who doesn't necessarily watch a show;
- Views of the platform: the number of times videos on the platform got played;
- Ad impression: number of ads' impressions, which represent the budget of the show;

- Cricket match India: whether or not the popular cricket match is played on that day;
- Character A: whether or not a famous character is present in the show.

3. Background Research and Data Visualization

In this section, I summarize the background research I conducted about the Media influence and propose a few conjectures with data visualization to support my preliminary conclusion.

3.1 Leisure Time Hypothesis

My first hypothesis is that the time of day a program is broadcast has important impact on the popularity of the media show. Because adult viewers usually watch programs after work, when they get home from work, and in the evening; children watch TV around the time of day, after dinner or before bed. Seniors are more likely to watch the news in the morning. So it is very important for a TV

show to have a good time slot. If it airs at midnight, early in the morning, or during most people’s working hours, TV views will suffer in some amount, no matter what the program’s appealing subject matter is. The reason is only few people will watch a program during non-regular entertainment hours just because it is very appealing and hot. For example, China Central Television (here in after referred to as CCTV) usually broadcasts the morning news at 6:00 a.m. sharp to provide fresh information for early commuters; at 12:00 p.m., broadcasting the news for 30 minutes for those who have free time during lunch break; and finally at 7:00 p.m. broadcasting the news bulletin. These three programs have been the same schedule of CCTV for many years. Based upon this conjecture, I plotted the TV show number according to the different weekday in (Figure 1).

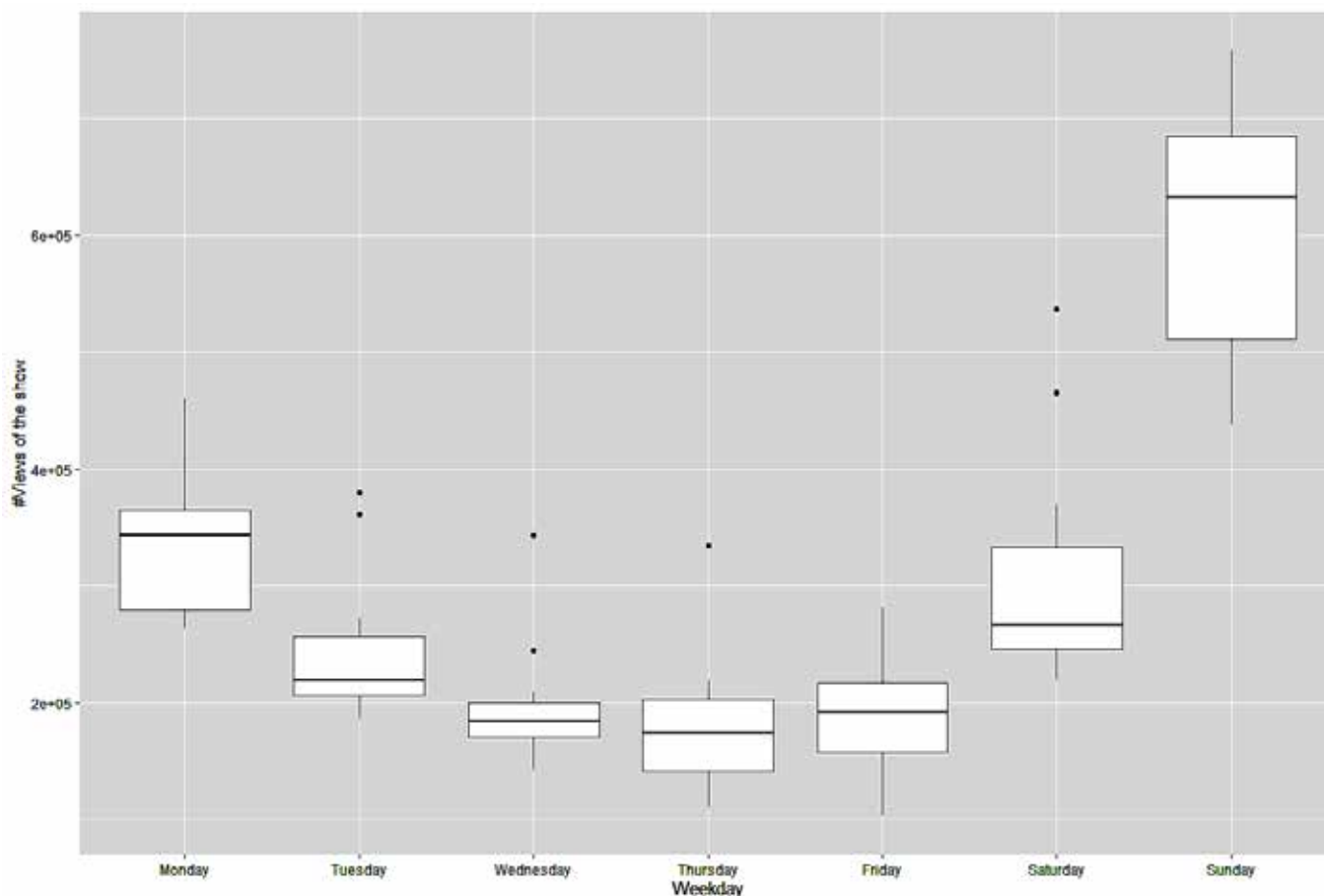


Figure 1. Weekday effect

As it is suggested by Figure 1, one important pattern I observe is the weekend effect. The number of people watching the show tends to be much higher over the weekend and much slower during the weekdays.

3.2 Star Effect Hypothesis

Another factor that could be influential to the views of the show — superstar. This term was first described in a study titled “Quitters Never Win: The (Adverse) Incentive Effects of Competing with Superstars” by Jennifer Brown. In the NBA, for

example, games with superstars not only generate higher TV views, but also higher game attendance. This increases the revenue of both the superstar’s team and the opposing team. Another example of the influence of celebrities on their fans is a TV show starring a popular celebrity, which gets significantly more views during the time period it is on that network. I thus also plot the effect of presence of some celebrity in (Figure 2), which seems to be consistent with my background research.

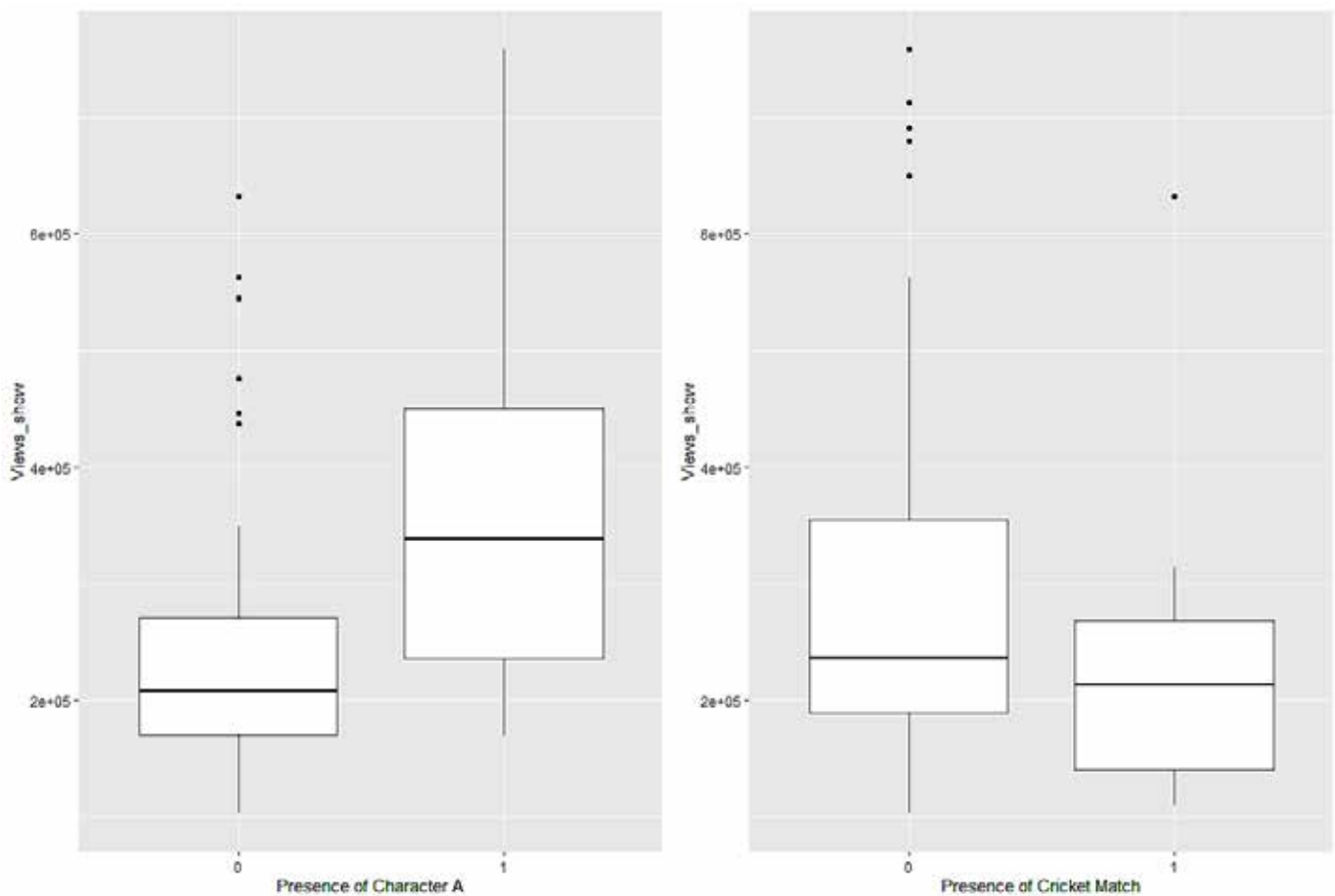


Figure 2. Presence of Character A/ Presence of Cricket Match

3.3 Audience within the Program

The third speculation about the factors affecting the ratings is the subject matter and audience of the program. The formula for calculating ratings is

$$\text{Ratings} = \frac{\text{number of people watching the program in the region}}{\text{total number of people in the region}}$$

So for each TV station, they cannot simply broadcast popular or fixed programs, they need to meet the needs of different people for different topics on TV. For example, older people may prefer military dramas, younger people prefer news, American dramas, movies, and romance dramas, while children prefer cartoons. So a popular program subject matter and

novel production methods in meeting a wider audience group at the same time drive the views of show. One of the representator of the number of people in the region could be the number of visitors to the

companies platform and (Figure 3) seems to confirm their linear relationship since the #Views of the show is positively correlated with respect to the number of vistors and number of views in the platform.

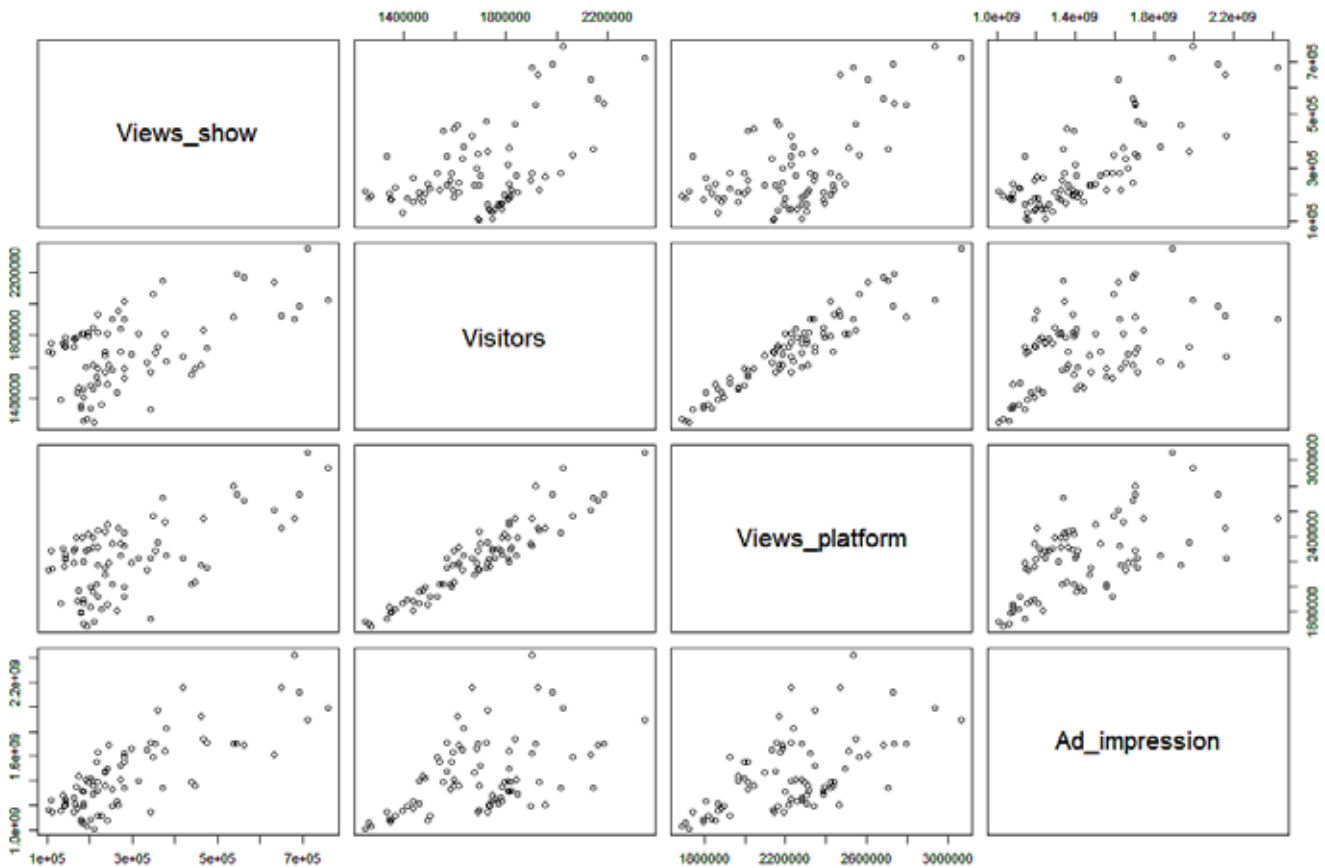


Figure 3. Exploration of Linear Relationship

4. Model

4.1 Model setup

As it is confirmed in section 3, the data demonstrate great linearity, which falls perfectly under the linear regression setup:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \epsilon$$

where:

- Y – is the viewership
- X_1, X_2, \dots, X_p are different variables relevant to the viewership
- $\epsilon \sim N(0, \sigma^2)$ is the residual, which follow a normal distribution

The model is thus assuming that one unit change of certain variable X_p will change β_p unit of Y .

4.2 Model solution

The model is defined by the pairs of the coefficients and is found by minimizing the squared error distance between the observation Y and model fit \hat{Y} . Specifically, we hope to find $\{(\beta_0^*, \beta_1^*, \dots, \beta_p^*)\}$ that minimizes the distance from n data points

$$L\{(\beta_0^*, \beta_1^*, \dots, \beta_p^*)\} = \sum_{i=1}^n (Y_i - \beta_0 - \beta_1 X_{i1} - \beta_2 X_{i2} - \dots - \beta_p X_{ip})^2$$

Using calculus (when a function reaches the minimum at a point, its derivative equals 0 at this point), we could solve $\{(\beta_0^*, \beta_1^*, \dots, \beta_p^*)\}$ by solving the following equations:

$$\frac{dL(\dots)}{d\beta_0} = 0, \frac{dL(\dots)}{d\beta_1} = 0, \dots, \frac{dL(\dots)}{d\beta_p} = 0$$

For example, if we only have one variable for prediction, the solutions $\{(\beta_0^*, \beta_1^*)\}$ are:

$$\beta_1^* = \frac{\sum_{i=1}^n X_i Y_i - n \bar{X} \bar{Y}}{\sum_{i=1}^n X_i^2 - n \bar{X}^2}$$

$$\beta_0^* = \bar{Y} - \beta_1^* \cdot \bar{X}$$

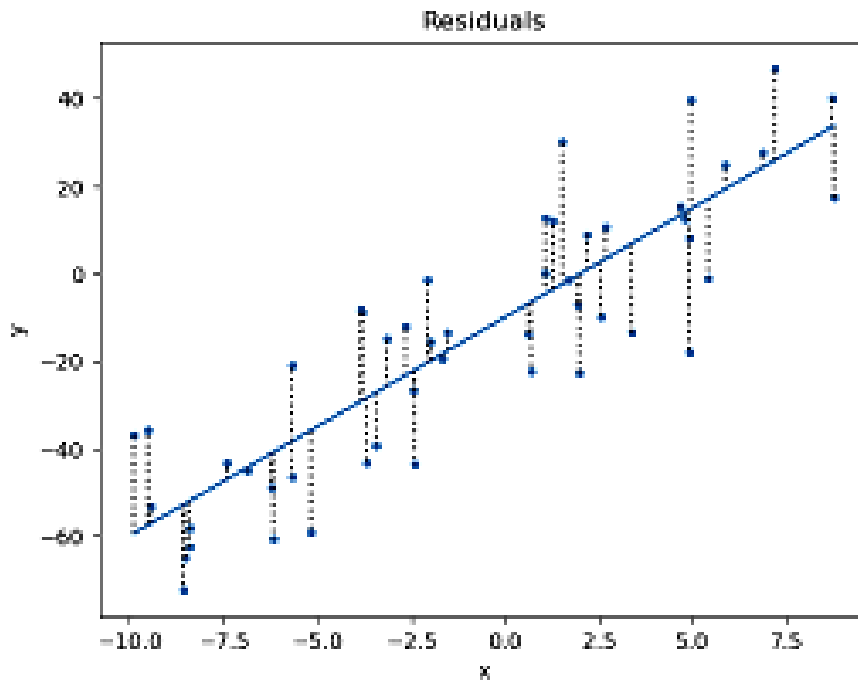


Figure 4.

For a multivariate regression, I used R to solve for the solutions.

4.3 Model interpretation

Now I attach the output of the R regression for

model interpretation, the corresponding variable with “*” indicates significant influence on the viewership prediction:

```

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -3.570e+05  8.373e+04 -4.264  5.93e-05 ***
Visitors     -2.593e-01  1.400e-01 -1.852  0.06811 .
Views_platform  3.329e-01  1.189e-01  2.801  0.00652 **
Ad_impression  2.189e-04  5.310e-05  4.122  9.81e-05 ***
cricket_match_india  3.427e+03  3.025e+04  0.113  0.91011
Character_A   -2.646e+04  3.097e+04 -0.854  0.39577
isweekend     1.508e+05  2.577e+04  5.852  1.28e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 75520 on 73 degrees of freedom
Multiple R-squared:  0.7804,    Adjusted R-squared:  0.7624
F-statistic: 43.25 on 6 and 73 DF,  p-value: < 2.2e-16
    
```

From the fitted model, we could conclude that the presence of Character A and the presence of a cricket

match don't have significant effects on the viewership. The model confirms the weekend effect and has

demonstrated minor but strong dependence on the Ad impression variable. This is in general consist with my background research that the commercial budget of the show typically has positive but limited effects on its popularity. Compared to the number of visitors, the number of views in the platform is more significant since the people who visit the platform don't necessarily get converted into the real user of the platform, which suggests potential improvement on capturing the visitor's attentions to the platform. Quantitatively, we have the presence of weekend date increase the show viewership 150,000 on average, ten thousands units change of the of the Ad impression will boost the viewership by 2 units, and that about 30% of the views occurred on the platform is converted into the viewership of this specific show.

5. Result Analysis-Normality Check

The exist of the linear regression model solution doesn't necessarily require any statistical assumption, but in order to validate the statistical conclusion in section 4, we need to put extra efforts on the normality examination. Specifically, in section 4, we assumed the residual follows a normal distribution $\epsilon \sim N(0, \sigma^2)$, without which the statistical conclusion (significance of the slope) doesn't hold. To conduct the examination, I here first estimate the σ^2 with the residual $\hat{\sigma}^2 = \frac{\sum_{i=1}^n (Y_i - \hat{Y}_i)^2}{n - \rho}$ where ρ is the number of parameters included in the linear regression model. Then with the estimated $\hat{\sigma}^2$, I simulate the normal distribution with $N(0, \hat{\sigma}^2)$ and overlay it with the density plot of the residual $Y_i - \hat{Y}_i$ to compare how similar they are:

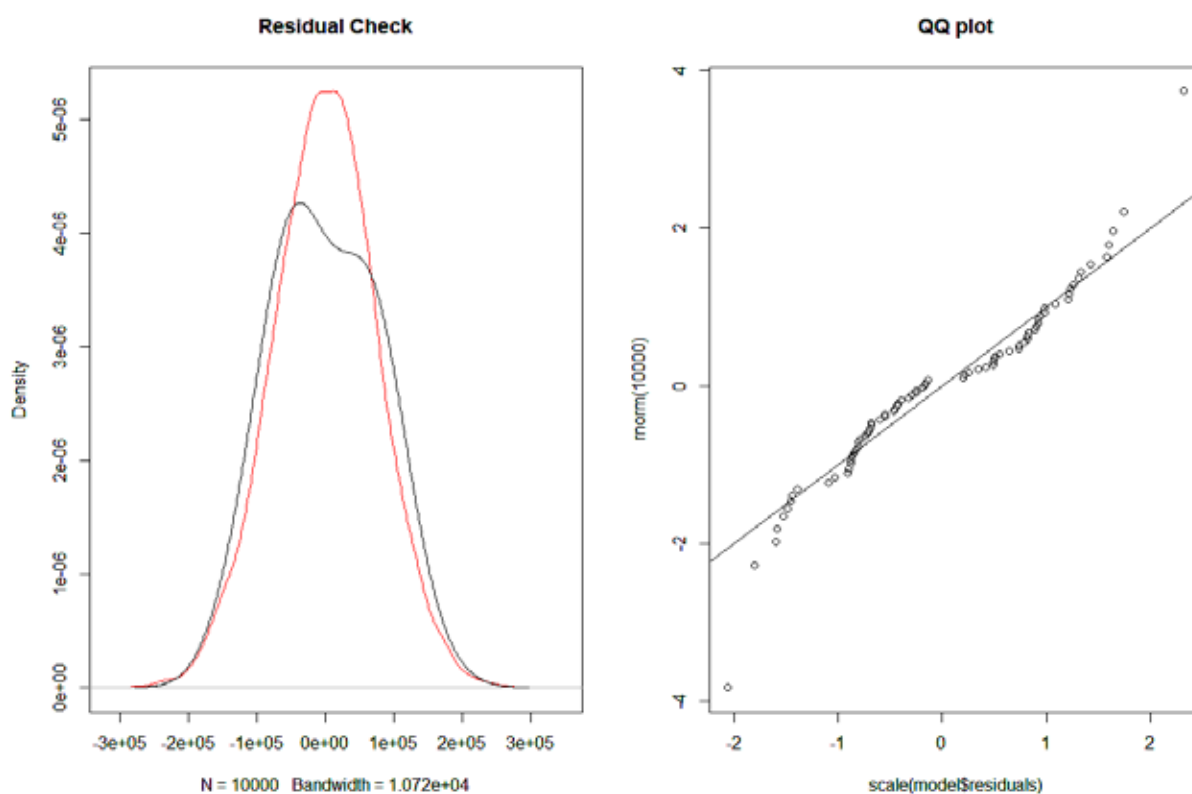


Figure 4. Presence of Character A/ Presence of Cricket Match

The result indicates great normality and thus conclude the linear regression with its correct assumption.

6. Conclusion

In this project, I employed linear regression to analyze the commercial statistics of a TV show. The result

of the model confirms the weekend effect and quantitatively measured the conversion rate of the platform viewership to the viewership of the show. The model also eliminates some plausible influencer such as the presence of a famous character A and the presence of a

popular local match. It also provided important guidance on the viewership improvement by quantifying and comparing the effect of number of visitors and

effect of number of views in the platform. The examination of the normality assumption also suggests great normality and thus validate the model conclusion.

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Section 3. Innovation management

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THE MODELING OF INVESTMENT PROCESS

Abstract. The problem of the pricing of European type option is investigated for the financial (B, S)-market in terms of the well-known Cox-Ross-Rubinstein model. A general payoff function depending on the entire realization of stock prices is considered. The form of a fair price of an option is found for one class of nonself-financed strategies. A minimal hedge and the investor's capital process are constructed. The obtained results make it possible to construct a complex of programs for numerical examples.

Keywords: Financial market, bond, stock, European option, hedge, fair price, Maple, Computer modeling.

We consider the financial-market consisting only of two assets: a bank account (bonds) and stocks (shares). According to the well-known Cox-Ross-Rubinstein discrete model, the time-dependent behavior (evolution) of the variables and is defined by the recurrent equations;

$$B_n = (1+r)B_{n-1}, B_0 > 0 \quad (1)$$

$$S_n = (1+\rho_n)S_{n-1}, S_0 > 0 \quad (2)$$

It is assumed that the family $\{\mathbb{P}\}$ of probability measures P is defined on the measurable space $(\Omega, \mathcal{F}, \mathcal{F}_n), n = 0, 1, \dots, N$, by filtration.

In equalities (1), (2), $r > 0$ is an interest rate, and ρ_n for any probability measure $P \in \mathbb{P}$ is a sequence of independent, identically distributed random variables taking only two values a and b ; also, $P(\rho_n = b) = p, P(\rho_n = a) = 1 - p$ and

$$-1 < a < r < b \quad (3)$$

It can be verified that if r exceeds b , then one can be advised to deposit money at the bank account (to invest money in bonds), but if r is less than a , then it is better for one to purchase shares.

In model (1),(2) it is assumed that B_n is the risk-free asset (the interest rate r is a constant), and S_n is the risky asset because the stock price is a random variable.

2. Let us now assume that there is some investor who has the initial capital

$X_0 = x > 0$ and wants to raise this capital in the future by using the capability of the (B, S)-market. In that case, we deal with the so-called investment problem.

The investor can deposit his capital at the bank account and then, according to (1), at some moment of time N this capital will be equal to

$$X_N = X_0(1+r)^N.$$

So, if the investor wants to get the capital f_N at some moment of time N in the future, then it is obvious that his initial capital $X_0 = x$ must be equal to

$$x = (1+r)^{-N} f_N.$$

On the other hand, the investor might want to invest his capital $X_0 = x$ in stocks. Then from (2) it readily follows that for the investor to get the capital f_N at a moment of time N in the future, his initial capital $X_0 = x$ can be defined by the equality

$$x = [1 + (bp + aq)]^{-N} f_N.$$

However, the investor also has the third choice: to deposit some part of his initial capital $X_0 = x$ at the bank account and to invest the rest of the capital in stocks. As a rule, the investor prefers to do so.

Let the price of one bond B_0 and the price of one stock S_0 at the initial moment of time $n=0$ be equal to zero ($n=0$). Suppose that at the moment of time $n=0$ the investor purchased β_0 quantity of bonds and γ_0 quantity of stocks. Note that β_0 and γ_0 may be a partial and a negative value. For example, $\beta_0 = -0,1$ means taking a loan equal to $0,1\beta_0$, while $\gamma_0 = 0,5$ means purchasing half a stock. Therefore the investor's initial capital can be written in form

$$X_0 = X_0^\pi = \beta_0 B_0 + \gamma_0 S_0, \quad (4)$$

Where $\pi = \pi_0 = (\beta_0, \gamma_0)$ is said to form the investor's portfolio or strategy at the moment of time $n=0$.

Let us now assume that there is a sequence of Φ_{n-1} -measurable functions $g = (g_n)$, $n=0,1,\dots$, $g_0 = 0$. Suppose that before the arrival of the moment of time $n=1$, the investor transformed his portfolio $\pi_0 = (\beta_0, \gamma_0)$ to the new portfolio $\pi_1 = (\beta_1, \gamma_1)$ in a manner such that the equality

$$X_0^\pi = \beta_0 B_0 + \gamma_0 S_0 + g_1, \quad (5)$$

is satisfied. Thus if $g \geq 0$, then the initial capital X_0^π diminishes by the value g_1 ; if $g_1 \leq 0$, then X_0^π increases by the value g_1 .

After the arrival of the moment of time $n=1$, the investor will have the capital

$$X_1^\pi = \beta_1 B_1 + \gamma_1 S_1, \quad (6)$$

Where B_1 and S_1 are the new prices of one bond and one stock, respectively, at the moment of time $N=1$.

From (6) and (5) we obtain

$$\Delta X_1^\pi = \beta_1 \Delta B_1 + \gamma_1 \Delta S_1 - g_1, \quad (7)$$

Where $\Delta X_1^\pi = X_1^\pi - X_0^\pi$, $\Delta B_1 = B_1 - B_0$, $\Delta S_1 = S_1 - S_0$.

Analogously, for any moments of time $n-1$ and n we have

$$X_{n-1}^\pi = \beta_{n-1} B_{n-1} + \gamma_{n-1} S_{n-1}, \quad (8)$$

$$X_{n-1}^\pi = \beta_n B_{n-1} + \gamma_n S_{n-1} + g_n, \quad (9)$$

$$X_n^\pi = \beta_n B_n + \gamma_n S_n + g_n, \quad (10)$$

$$X_n^\pi = \beta_n \Delta B_n + \gamma_n \Delta S_n - g_n, \quad (11)$$

Where

$$\Delta X_n^\pi = X_n^\pi - X_{n-1}^\pi, \Delta B_n = B_n - B_{n-1}, \Delta S_n = S_n - S_{n-1}.$$

If the strategy π is constructed with the values of g_n taken into account, then it is called nonself-financed. When $g_n = 0$, the strategy π is called self-financed.

Let us write the conditions for the strategy to be nonself-financed and self-financed. For this, we subtract equality (8) from equality (10) to have

$$\Delta S_n^\pi = \beta_n \Delta B_n + \gamma_n \Delta S_n + \Delta \beta_n B_{n-1} + \Delta \gamma_n S_{n-1} \quad (12)$$

By comparing equalities (11) and (12) we obtain the condition for the strategy

$\pi_n = (\beta_n, \gamma_n)$, $n = 0, 1, \dots, N$, to be nonself-financed:

$$\Delta\beta_n B_{n-1} + \Delta\gamma_n S_{n-1} + g_n = 0. \quad (13)$$

When $g_n \equiv 0$, from (13) we the condition for the strategy to be self-financed:

$$\Delta\beta_n B_{n-1} + \Delta\gamma_n S_{n-1} = 0. \quad (14)$$

3. The strategy $\pi = \pi_n = (\beta_n, \gamma_n)$ is called a (x, f, N) – hedge if

$$\begin{aligned} X_0^\pi &= X_0 = x, \\ X_N^\pi &\geq f_N, \end{aligned}$$

Where $f = f_N$ is some payoff function.

If we have the equality $X_N^\pi = f_N$, then π is called a minimal hedge.

For $X_0 = x > 0$ and $f = f_N$ we denote by (x, f, N) the set of all (x, f, N) – hedges.

Now let us define a standard European call option. This is a derivative (secondary) security with the payoff function

$$f = f_N = (S_N - K)^+ = \max(S_N - K, 0). \quad (15)$$

The owner of this option enjoys the right to buy a stock at a price K at a certain moment of time N . If $S_N > K$, then the owner of the option will buy a stock at a price K , sell it at once at a price S_N and have a gain $f_N = S_N - K$.

His gain will actually be equal to

$$f_N = S_N - K - C_N,$$

where C_N is the so-called fair (rational) price of a standard European call option. If $S_N > K$, then the owner of the option will not carry out the operation with his option and his loss will be equal to C_N .

The problem of the investor (option seller) consists in the following: using the fair price of the option

$$C_N = \inf \{x > 0 : \Pi(x, f, N) \neq \emptyset\}$$

it is required to construct a minimal hedge $\pi_n^* = (\beta_n^*, \gamma_n^*)$. In other words, the investor's capital must be equal to f_N at a moment of time N .

The basic problems of the pricing of a European option can be formulated as follows:

- 1) defining a fair price C_N ;
- 2) constructing a minimal hedge $\pi_n^* = (\beta_n^*, \gamma_n^*)$;
- 3) constructing the investor's capital process X_n^π for the strategy π_n^* .

4. Let us consider financial (B, S) -market (1),(2) and nonself-financed strategies π_n . Assume that $f = f_N = f_N(S_0, S_1, \dots, S_N)$ and the sequence of ϕ_{n-1} – measurable functions $g = (g_n)$ defined by the equality

$$g_n = c_1 \beta_n B_{n-1} + c_2 \gamma_n S_{n-1} \quad (16)$$

is given, where the constants c_1 and c_2 are such that $0 < c_1 < 1, 0 < c_2 < 1$.

Theorem 1. Let on the (B, S) -market (1),(2) the strategy π be a (x, f, N) -hedge. Then

$$x \geq E^* \left[\left(\frac{1+c_1}{1+r} \right)^N f_N \right]. \quad (17)$$

If in addition to this the (x, f, N) -hedge π is minimal, then

$$x = E^* \left[\left(\frac{1+c_1}{1+r} \right)^N f_N \right]. \quad (18)$$

Theorem 2. Let the initial capital $x > 0$ and the payoff function $f_N = f_N(S_0, S_1, \dots, S_N)$ be such that condition (18) fulfilled. Then in the class (x, f, N) there exists a minimal (x, f, N) – hedge π^* .

Theorem 3. Assume that the financial market (1), (2) is considered and the sequence of ϕ_{n-1} – measurable functions $g = (g_n)$ is given by means of (16). Then

1) the fair price C_N of a European type option with the execution at the moment of time N and payoff function $f_N = f_N(S_0, S_1, \dots, S_N)$ is defined by the formula

$$C_N = E^* \left[\left(\frac{1+c_1}{1+r} \right)^N f_N \right]. \quad (19)$$

where E^* is the averaging with respect to a measure $P^* \in \Pi$ such that $P^*(\rho_n = b) = p^*, P^*(\rho_n = a) = 1 - p^*, 0 < p^* < 1$,

$$p^* = \frac{r - c_1(1+a) + c_2(1+r) - a}{(b-a)(1+c_1)}; \quad (20)$$

2) there exists a minimal (x, f, N) – hedge $\pi^* = (\pi_n^*) = (\beta_n^*, \gamma_n^*)$, $n = 0, 1, \dots, N$, whose ϕ_{n-1} – measurable components are defined by the formulas

$$\beta_n^* = \frac{X_{n-1}^* - \gamma_n^* S_{n-1} (1 + c_2)}{B_{n-1} (1 + c_1)}, \quad (21)$$

$$\gamma_n^* = \frac{\alpha_n^* B_n}{B_{n-1} (1 + c_1)}, \quad (22)$$

Where $\alpha_k^* = \alpha_k^*(\rho_1, \rho_2, \dots, \rho_{k-1})$, $k \geq 2$, $\alpha_1^* = \text{const}$, are the definite ϕ_{n-1} -measurable functions; the capital $X^\pi = (X_n^\pi)$, $n = 0, 1, \dots, N$, corresponding to the hedge $\pi^* = (\pi_n^*)$ is given by the formula

$$X_n^{\pi^*} = E^* \left[\left(\frac{1 + c_1}{1 + r} \right)^N f_N | \phi_n \right], \quad (23)$$

Remark 1. A strategy π is called an arbitrage one if the capital $X^\pi = (X_n^\pi)$, $n = 0, 1, \dots, N$, corresponding to this strategy is such that

$X_0^\pi = x \leq 0$; $X_N^\pi(\omega) \geq 0$ for all $\omega \in \Omega$; $X_N^\pi > 0$ for some $\omega \in \Omega$.

For the considered model (1),(2) of the financial (B, S) — market, using the conditions of Theorem 3, for any strategy $\pi = \pi_n = (\beta_n, \gamma_n)$ we have $E^* M_n^\pi = M_0^\pi$. Therefore a strategy π is a priori a non-arbitrage one.

Remark 2. At each moment of time n , $n = 0, 1, \dots, -1$, a minimal strategy

$$\pi_{n+1}^* = (\beta_{n+1}^*, \gamma_{n+1}^*) \text{ is defined by the equalities}$$

$$\beta_{n+1}^* = \frac{(1+b)f((1+a)S_n) - (1+a)f((1+b)S_n)}{(1+r)(b-a)B_n}, \quad (24)$$

$$\gamma_{n+1}^* = \frac{f((1+a)S_n) - f((1+b)S_n)}{(b-a)S_n}. \quad (25)$$

Corollary 1. The capital of the minimal strategy constructed by (24), (25) is defined by the equality

$$X_n^{\pi^*} = \frac{1+c_1}{1+r} \left[p^* f((1+b)S_n) + (1-p^*) f((1+a)S_n) \right], \quad (26)$$

where p^* is defined by equality (20).

Corollary 2. The following recurrent equalities are valid:

$$C_{N-k,j} = \frac{1+c_1}{1+r} \left[p^* C_{N-k+1,j+1} + (1-p^*) C_{N-k+1,j} \right], \quad (27)$$

where $k = 1, 2, \dots, N$, $j = 0, 1, \dots, N-k$, the value p^* is defined by equality (20).

Corollary 3. An European standard call option fair price is defined by the equalities

$$C_n = S_0 \sum_{k=k_0}^N C_N^k (p^*)^k (1-p^*)^{N-k} \left(\frac{(1+c_1)(1+a)}{1+r} \right)^N \left(\frac{1+b}{1+a} \right)^k - K \left(\frac{1+c_1}{1+r} \right)^N \cdot \sum_{k=k_0}^N C_N^k (p^*)^k (1-p^*)^{N-k} \quad (28)$$

The calculations given in the article can be performed on the program Maple, for example calculate the value given in formula (28). This program will look like Maple:

```
restart
k0 := 2 : N := 10 : s := 0 : s0 := 1.5 : K := 1.2 :
pzv := 0.5 : cl := 2.1 : a := 0.2 : b := 3.2 : r := 4.2 :
uclav := ( (1+cl) * (1+a) / (1+r) )^N :
uclr := ( (1+cl) / (1+r) ) :
mn := 0 : gn := 0 :
for k from k0 to N
do
bi := binomial(N, k) :
mn := mn + bi * pzv^k * (1 - pzv)^(N - k) * uclav * ( (1+b) / (1+a) )^k :
gn := gn + bi * pzv^k * (1 - pzv)^(N - k) :
od :
cn := s0 * mn - K * uclr * gn :
print ("Cn=" || cn);
"Cn = 14607.89293"
```

where k_0 is the smallest integer number for which the inequality

$$S_0 (1+a)^N \left(\frac{1+b}{1+a} \right)^{k_0} > K$$

holds and p^* is defined by equality (20).

5. Let us consider binormal trees using the formulas obtained above and to solve the one-step $N = 1$, $n = 0, 1$, and two-step $N = 2$, $n = 0, 1, 2$ problems. We introduce the notation:

$$S_1 = S_{1,j} = S_0 (1+b)^j (1+a)^{1-j}, \quad f_1 = f_{1,j} = f(S_{1,j}), \quad j = 0, 1$$

$$S_2 = S_{2,j} = S_0 (1+b)^j (1+a)^{2-j}, \quad f_2 = f_{2,j} = f(S_{2,j}), \quad j = 0, 1, 2$$

It is assumed that

$$B_0 = 20, r = \frac{1}{5}, k = 100, S_0 = 100,$$

$$\rho_n = b = \frac{3}{5}, \text{ or } \rho_n = b = -\frac{2}{5}, n = 0, 1, 2.$$

Example 1. $N = 1, n = 0, 1; c_1 = \frac{1}{40}, c_2 = \frac{1}{50}$. We have

$$C_2 = \frac{609}{20}, \beta_1^* = -\frac{3}{2}, \gamma_1^* = \frac{3}{5}, g_1 = \frac{9}{20}, X_0^{\pi^*} = C_1.$$

1) If $S_1 = S_{1,1} = 160$, then $X_1^{\pi^*} = f(S_1) = 60$.

2) If $S_1 = S_{1,0} = 60$, then $X_1^{\pi^*} = f(S_1) = 0$.

In the Article examines the pricing of European-type options for the financial (B, S) -market in the framework of the well-known Cox-Ross-Rubinstein model. The general payoff function is considered, which depends on the full realization of stock prices. The option fair price form was found for one class of non-self-financed strategies. Minimum hedge and investor capital outflow built. The results obtained to construct a complex of programs using numerical examples. The findings of the study are of great importance during crisis situations during the COVID-19 pandemic.

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Section 4. Economic theory

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FLEXIBLE WORKING: PRESENTATION OF THE INTERRELATIONSHIPS AND DEPENDENCIES

Abstract. The research field of the article relates to the diachronic aspect of the development of the world of work. Within the scope of this article, the problem of systematic flexibility development by combining requirements and resources in the modern world of work is explored, in which the existing potentials of the present specifics are examined in more detail.

Keywords: flexibility, the world of work, work organization, the employer, the employee.

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FLEXIBILISIERUNG DER ARBEITSWELT: DARLEGUNG DER ZUSAMMENHÄNGE UND ABHÄNGIGKEITEN

Anmerkung. Das Forschungsfeld des Artikels bezieht sich auf den diachronischen Aspekt der Entwicklung der Arbeitswelt. Im Rahmen dieses Artikels wird die Problematik der systematischen Flexibilitätsentwicklung durch ein Vereinen von Anforderungen und Ressourcen in der modernen Arbeitswelt erforscht, in dem die bestehenden Potenziale der vorliegenden Spezifik näher beleuchtet werden.

Schlüsselwörter: die Flexibilität, die Arbeitswelt, die Arbeitsorganisation, der Arbeitgeber, der Arbeitnehmer.

Das Thema der vorliegenden Forschung gewinnt immer wieder an Bedeutung sowie Aktualität, weil die Frage der Flexibilisierung der Arbeitswelt als strategischer Herausforderung bei der Senkung von Störfaktoren immer noch problematisch ist und multifaktoriell betrachtet werden kann. Das Forschungsfeld des Artikels bezieht sich auf den diachronischen Aspekt der Entwicklung der Arbeitswelt. Das Ziel der vorliegenden Forschung besteht in der Feststellung der Zusammenhänge und Abhängigkeiten im Kontext der bestehenden Arbeitsbedingungen auf dem Arbeitsmarkt.

„Irgendwie scheint es paradox, dass Unternehmen, die in technischer Hinsicht schon auf dem Stand des 21. Jahrhunderts sind, in ihrer Firmensstruktur Prinzipien des frühen 20. Jahrhunderts aufweisen und ihre Mitarbeiter mit Methoden des 19. Jahrhunderts zur Arbeit motivieren“ [15, 87–88]. Dabei geht es weniger um die Rundumerneuerung, sondern um eine Renaissance von in Vergessenheit geratenen Werten und Strukturen. Demokratisierung, Digitalisierung, Arbeitswelt 3.0 sind die großen Themen, mit denen sich aktuell jedes Unternehmen auseinandersetzen muss. Jedes Unternehmen sollte sich die Frage stellen, inwieweit sich die Anforderungen an Führung gewandelt haben und wie der Spagat zwischen Führungskraft, Fachkraft und Gründern (Mitgesellschaftern, Partnern, ehemaligen Freunden) zu schaffen ist. Das herrschende Paradigma der Arbeitswelt des 20. Jahrhunderts, der Taylorismus, zeichnete sich durch zahlreiche Dysfunktionen, die letztendlich zu den gesundheitlichen Problemen der Arbeitskräfte, dem Mangel an Arbeiter für bestimmte Qualifikationen, den Problemen mit der Arbeitsdisziplin und zu hoher Fluktuation führten. Kritisiert wird der Taylorismus wegen des ihm zugrundeliegenden mechanistischen Menschenbild, das den Menschen als ein Rädchen im Getriebe ansieht. Obwohl der Taylorismus heutzutage nicht mehr als das herrschende Paradigma gilt und immer mehr nach neuen Arbeitsformen- bzw. modellen gesucht wird, nutzen noch viele Unternehmen die Me-

thoden und Prinzipien des Taylorismus. Abgelehnt wird aber von den meisten Unternehmen – deren Managementphilosophien auf tayloristischen Ideen beruhen – das Prinzip der strikten Trennung von Kopf- und Handarbeit. Die Mitarbeiter können somit nicht ihre eigenen Ideen zur Optimierung und Verbesserung des Arbeitsprozesses einbringen bzw. umzusetzen [8, 17].

Die „alten“ Führungsmuster und Modelle der Arbeitsorganisation werden durch starre Hierarchien, Problemlösung bzw. Aufgabenerfüllung nach Vorschrift, wenige Handlungs- und Entscheidungsspielräume für Mitarbeiter, autoritäre Führungsstile, einem Mangel an Mitbeteiligung der Mitarbeiter geprägt. Die alten Arbeits- und Führungsmodelle bieten wenige Chancen für die Entfaltung des Potenzials der Mitarbeiter, damit sie neue kreative Ideen bzw. Know-how einbringen können. Außerdem verursachen solche Modelle mittel- und langfristig die Senkung der Motivation der Mitarbeiter und letztendlich deren Leistungsstärke. Dies führt allmählich auch zu einer Senkung der Leistungsstärke des Unternehmens. Technologischer Wandel, Transformation zur Informations- bzw. Wissensgesellschaft, soziale Veränderungen wie demographischer Wandel, Individualisierung und Wertewandel verursachen die Veränderung der Arbeitswelt. Die Arbeitswelt erlebt infolge des demografischen Wandels einen Mangel an Arbeitskräften bestimmter Qualifikation. Die Transformation zur Informations- bzw. Wissensgesellschaft bedeutet, dass die Arbeitswelt immer mehr einen Bedarf an Mitarbeitern hat, die eigens Know-how einbringen könnten. Die Unternehmen, die sich erfolgreich und nachhaltig entwickeln möchten, führen einen Kampf um talentierte Arbeitskräfte, insbesondere um innovationsstarke Arbeitskräfte. Die Individualisierung führt dazu, dass die Konsumenten immer mehr nicht Standardprodukte brauchen, sondern nach Exklusivität bzw. individualisierte Waren und Dienstleistungen streben. Die Mitarbeiter, die nach dem mechanischen Vorbild arbeiten bzw. Dienst nach Vorschrift machen, können kaum die Kreativität einbringen, um den Be-

dürfnissen und Wünschen der Kunden gerecht zu werden. Die Unternehmen suchen immer mehr nach kreativen Arbeitnehmern und versuchen zugleich neue Arbeitsmodelle einzusetzen, damit die Mitarbeiter ihr Potenzial entfalten könnten. Die herkömmlichen Arbeitsmodelle, die im 20. Jahrhundert eingesetzt wurden, entsprechen nicht mehr der neuen Wirklichkeit und können nicht zum Erfolg führen [9, 32].

Die sozialen und gesellschaftlichen Veränderungen führen zu einer wesentlichen Transformation der Anforderungen an Arbeitgeber. Während im 20. Jahrhundert der sichere Arbeitsplatz und Gehalt die wichtigste Rolle spielten, sind heutzutage gute Arbeitsbedingungen von größter Bedeutung. Gute Arbeitsbedingungen schließen vor allem eine positive Arbeitsatmosphäre und Teamarbeit, Möglichkeiten zur Selbstverwirklichung, individuelle Gestaltung des Arbeitsumfeldes und flexible Gestaltung der Arbeitszeiten bzw. Work-Life-Balance ein. Von Bedeutung sind die Mitarbeiter-Führungskraft-Beziehung und Mitbestimmung. Hohes Gehalt, gutes Image des Unternehmens, Coaching-Angebote, innovative Arbeits-Tools und gute Positionsausstattung gehören auch zu den wichtigen Faktoren, von denen sich junge Bewerber leiten lassen. Die Demokratisierung und Erweiterung der Mitspracherechte bedeuten, dass die Mitarbeiter auch am Arbeitsplatz eine höhere Mitbeteiligung fordern. Sie suchen nach Arbeitgebern, die ihnen Möglichkeiten bieten, sich an den Entscheidungsprozessen zu beteiligen, insbesondere, was die Arbeitsgestaltung betrifft. Die Arbeitnehmer brauchen mehr Handlungsspielräume, sie lassen sich immer weniger leiten, ohne Berücksichtigung ihrer Meinung. Sie möchten auch gemeinsam mit dem Arbeitgeber entscheiden, wie, wo und wann sie handeln. Die Arbeitnehmer suchen dementsprechend nach flexiblen Arbeitgebern, die flexible Arbeitszeiten und Arbeitsformen zulassen. Der technologische Wandel erlaubt in der Regel mindestens einen Teil der Aufgaben von zu Hause aus zu erfüllen. Somit sind die Arbeitgeber, die auch Home Office anbieten, von vielen Arbeitnehmern bevorzugt [5, 96].

Die Individualisierung führt dazu, dass auch die Arbeitnehmer nach solchen Unternehmen suchen, deren Angebote einzigartig sind. Von Bedeutung ist für viele Arbeitnehmer die einzigartige Unternehmenskultur bzw. -philosophie. Eines der Managementkonzepte, die den neuen Anforderungen der Arbeitswelt in großem Maße entspricht, ist das Employee-Empowerment. Es stellt ein Managementkonzept dar, dessen Grundidee in der Ermächtigung der Mitarbeiter zu dem eigenständigen Handeln, dem Übernehmen von Verantwortung und der Mitbeteiligung besteht. Es wird davon ausgegangen, dass jedem Mitarbeiter freie Handlungsspielräume angeboten werden sollten, damit er besser seine Aufgaben erfüllen kann. Die Aufgabe der Führungskräfte besteht dabei unter anderem darin, die Mitarbeiter zum eigenständigen Handeln zu befähigen, ihnen zu vermitteln, dass sie selbst viele Aufgaben erfüllen bzw. viele Probleme lösen können, während sie sich von eigenen Erfahrungen, Kenntnissen und Kreativität leiten lassen. Die Führungskräfte sollten den Mitarbeitern vermitteln, dass sie in der Lösungskraft und Kreativität der Mitarbeiter vertrauen. Es wird weiterhin davon ausgegangen, dass die Mitarbeiter auch mehr Verantwortung für eigene Entscheidungen und Handlungen tragen sollten. Dementsprechend sollten die Führungskräfte auch das Verantwortungsbewusstsein der Mitarbeiter fördern. Hinzu kommt auch, dass die Mitarbeiter inspiriert werden sollten, sich auch an der Lösungsfindung gemeinsamer unternehmerischer Probleme zu beteiligen, eigene Ideen und Lösungsansätze zu entwickeln und diese einzubringen. Dabei kann es beispielweise um die Verbesserung der Arbeitsgestaltung bzw. Arbeitsorganisation oder um die Verbesserung des Produktes gehen [2, 11].

Es gilt, dass die Hauptziele des Empowerments die Innovationkraft und Leistungsstärke des Unternehmens sowie „menschliche“ Arbeitsgestaltung sind. Die Arbeitsgestaltung nach dem mechanischen Vorbild ist nicht „menschlich“, sie macht aus den Mitarbeitern Maschinen, die über keine Freiheit verfügt. Dem Empowerment-Konzept wird ein humanistisches

Menschenbild zugrunde gelegt. Das humanistische Menschenbild vermittelt, dass alle Menschen zum erfolgreichen eigenständigen Handeln befähigt sind, einige nur unterstützt werden sollten. Im Rahmen des Empowerment-Konzepts wird an das Potenzial jedes Mitarbeiters geglaubt, das durch größere Handlungsspielräume entfaltet und entwickelt werden kann. Das Employee-Empowerment kann nur dann erfolgreich umgesetzt werden, wenn wichtige Voraussetzungen und Vorbedingungen realisiert werden. Dazu gehören vor allem die Aktivierung der Ressourcen der Mitarbeiter. Um eigenständig erfolgreich zu handeln, sollten die Mitarbeiter über bestimmte Kenntnisse, Fähigkeiten und Kompetenzen verfügen. Dementsprechend stellt die Vermittlung neuer Kenntnissen durch Schulungen bzw. neuer Kompetenzen durch Coaching und Trainings eine der wichtigen Aufgaben dar. Dabei wird davon ausgegangen, dass jeder Mensch über bestimmte Ressourcen wie bspw. Problemlösungsfähigkeit und Kreativität verfügt und sie nur aktiviert werden müssen. Einer der Wege der Ressourcenaktivierung ist in dieser Hinsicht das Systemische Coaching. Sein Prinzip liegt darin, dass dem Mitarbeiter nicht geholfen werden muss, sondern er unterstützt werden sollte. Das heißt, statt die Probleme der Mitarbeiter zu lösen, sollten die Führungskräfte die Mitarbeiter bei der Lösungsfindung unterstützen. Eine weitere Vorbedingung ist die Bereitschaft der Mitarbeiter, eigenständig zu handeln und Verantwortung zu übernehmen. Wie erwähnt, können diese Fähigkeiten vermittelt werden, es spielt aber der Wunsch bzw. die Einstellung der Mitarbeiter auch eine wesentliche Rolle [3, 120].

Eine weitere Bedingung ist die Bereitstellung von Informationen und Entscheidungsgrundlagen für die Mitarbeiter. Damit die Mitarbeiter eigenständig erfolgreich handeln können, sollten sie gut informiert sein. Sie sollten eine klare Vorstellung über die gesamte Strategie des Unternehmens, seine kurz-, mittel- und langfristige Ziele und Werte, seine Kultur und Philosophie etc. haben. Die Mitarbeiter sollten auch verstehen, warum die eine oder andere Entscheidung getroffen wird und wonach dabei gestrebt wird. Eine wichtige Bedin-

gung stellt auch die Integration flacher Hierarchien in die Struktur des Unternehmens dar. Flache Hierarchien bedeuten Teams aus gleichgestellten Mitarbeitern, die bestimmte Probleme lösen, wobei die Aufgaben nach Kompetenzen jedes Mitarbeiters vergeben werden. Diese Teams sollten autonom und selbst gesteuert werden, indem jeder Beteiligte über bestimmte Handlungs- und Entscheidungsfreiheit bei der Erfüllung seiner Aufgabe verfügt. Die Entscheidungen, die alle Beteiligten betreffen, werden gemeinsam getroffen. Bei der Umsetzung des Empowerment-Modells sind folgende wichtige Elemente zu nennen: Bestimmung der Unternehmensstruktur mit flachen Hierarchien, richtige Personalauswahl, inspirierend, identifizierend und geistig wirkende Veraltens- und Handlungsweisen der Führungskraft, individuelle Herangehensweise, Aktivierung der Intelligenz und Lösungsbeteiligung der Mitarbeiter [4, 11].

Das Empowerment-Modell bietet den Unternehmen die Chance, durch die Erhöhung der Leistungsstärke, Motivation und Kreativität der Mitarbeiter die Leistungsstärke und Innovationskraft des Unternehmens zu erhöhen. Es wird davon ausgegangen, dass die Mitarbeiter, die mehr Handlungsspielräume haben und mehr Verantwortung tragen, höher motiviert sind, leistungsstärker und kreativer handeln. Motivierend sollte sich auch die Vermittlung des Vertrauens in die Lösungs- und Innovationskraft der Mitarbeiter auswirken. Von Bedeutung ist dabei die konstruktive Fehlerkultur im Unternehmen. Die Führungskräfte und Mitarbeiter sollten die Fehler als Anlass zum Lernen und nicht zur strengen Bestrafung wahrnehmen. In den Unternehmen, wo jeder Fehler streng bestraft ist, kann das Empowerment-Modell nicht eingesetzt werden. Die Führungskräfte sollten also eine bestimmte Fehlerloyalität aufweisen und die Mitarbeiter unterstützen, damit sie diese als Anlass zum Lernen nehmen [1, 117].

Eine weitere Chance ist es, durch Kombination hierarchischer Strukturen mit autonomen selbst-gesteuerten Teams flexibler und schneller auf den Markt zu reagieren. Die Teams können schneller die

Veränderungen auf dem Markt erfassen, als dies in starren hierarchischen Strukturen der Fall ist. Hinzu kommt, dass die starren hierarchischen Strukturen durch Trägheit geprägt werden, und langsam die notwendige Reaktion ausarbeiten können, beispielweise durch Bürokratie, während die Teams schneller und flexibler handeln können. Da das Empowerment auf die Erhöhung der Motivation und des Selbstvertrauens abzielt, wird angenommen, dass die Mitarbeiter in den auf dem Empowerment-Konzept beruhenden Unternehmen langfristig bleiben möchten. Durch Mitarbeiterbindung kann die Fluktuation vermieden werden. Auch die Attraktivität des Unternehmens für potentielle Bewerber kann bspw. durch die positive Mundpropaganda gesteigert werden. Das Empowerment kann auch mittel- und langfristig die Personalkosten senken sowie Profit durch Kundentreue und Kundengewinnung ermöglichen. Es gibt aber auch Grenzen der Umsetzung des Empowerment-Modells. Vor allem sind das die organisatorischen Grenzen. Es handelt sich dabei u.a. um die Unternehmen, deren Technologie des Produktionsprozesses an sich wenig Raum für die Entwicklung autonomer selbstgesteuerter Teams gibt. Hinzu kommt auch, dass nicht viele Tätigkeitsfelder von den autonomen Teams übernommen werden können [6, 8–9].

Ein weiteres modernes Konzept der Personalführung ist das Konzept des Talentmanagements. Das Talentmanagement kann auch als ein ganzheitlicher, zyklischer Prozess dargestellt werden, der auf die Sicherstellung des Bedarfs an den über bestimmte Fähigkeiten und Talente verfügenden Mitarbeitern abzielt. Eine der Hauptideen des Talentmanagements besteht in der Förderung der Entwicklung und der Entfaltung des Potentials der Mitarbeiter. In diesem Prozess kann man eine Reihe von wichtigen eng miteinander verbundenen Elementen hervorheben. Erstens sind das die Strategie und Planung. Ein weiteres Element stellt die Suche nach den Talenten bzw. die Rekrutierung der Bewerber und die Einstellung der gesuchten Arbeitnehmer. Des Weiteren spielen eine große Rolle Performance Management, Weiterbildung und Ent-

wicklung der Mitarbeiter. Das Talentmanagement zielt dabei u.a. auf die Erhöhung der Motivation der Mitarbeiter ab. Noch eine wichtige Komponente stellt die Entwicklung eines angemessenen Motivationssystems dar, einschließlich Belohnungen. Hinzu kommen die Entdeckung der entwicklungsfähigen Mitarbeiter und deren Förderung, Leadership Entwicklung. Insgesamt können zwei wichtigste Lösungsinstrumente hervorgehoben werden: Employer Branding und Mitarbeiterbindung [7, 100–102].

Employer Branding umfasst die systemischen Aktionen der Personalführungskräfte, die auf eine attraktivere Positionierung des Unternehmens als Arbeitgeber abzielen, um die besten Arbeitnehmer bzw. Talente zu gewinnen. Zu den Zielen gehören auch die Senkung der Akquisitionskosten für neue Mitarbeiter und die Beschleunigung des Akquisitionsvorgangs, da angenommen wird, dass dank der genauen Definition der Arbeitgebermarke die Arbeitnehmer gewonnen werden können, deren Eigenschaften, Werte und Philosophie der Philosophie und den Werten des Unternehmens entsprechen. Die wichtigsten Funktionen des Employer Branding sind aus Sicht des Arbeitgebers Differenzierung bzw. Abgrenzung von Konkurrenten und Präferenzfunktion. Aus der Sicht des Arbeitnehmers liegt die wichtigste Funktion des Employer Branding in der Orientierung über Unternehmensphilosophie, Ziele, Strategie etc. Bevor die Arbeitgebermarke definiert wird, sollte eine Analyse von internen und externen Faktoren durchgeführt werden. Zu den internen Faktoren gehören bspw. Unternehmensstrategie, Unternehmenskultur Unternehmenswerte, Ressourcen etc. Von Nutzen ist die Analyse von Stärken bzw. Schwächen eines Arbeitgebers, die zum Beispiel mit der SWOT-Analyse durchgeführt werden kann. Das Ziel liegt unter anderem in der Ermittlung, was das Unternehmen den potentiellen Mitarbeitern anbieten kann. Zu den externen Faktoren gehören vor allem die Entwicklungen am Arbeitsmarkt. Anschließend sollten die Zielgruppen definiert und deren Anforderungen bzw. Wünsche und Bedürfnisse analysiert werden. Danach kann

die Arbeitgebermarke (Employer Value Proposition) definiert und durch klare Botschaften konkretisiert werden. Dabei sollten folgende Prinzipien eingehalten werden: Differenzierung (Abgrenzung von Konkurrenten), Relevanz, Authentizität und Attraktivität, Realistische Darstellung, Klarheit, Glaubwürdigkeit, direkte Ansprache. Die Arbeitgebermarke sollte der Identität des Unternehmens entsprechen und mit der Unternehmensvision, Unternehmenskultur, Unternehmensphilosophie übereinstimmen, damit die am besten geeigneten Mitarbeiter gewonnen werden können. Die Arbeitgebermarke sollte einzigartig sein. Das Grundversprechen sollte die Einzigartigkeit des Unternehmens als Arbeitgeber vermitteln und die emotionale Bindung der Arbeitnehmer erhöhen. Es ist wichtig dabei, dass die Versprechen, die das Unternehmen den potenziellen Arbeitnehmer gibt, erfüllt werden sollten. Sonst wird die Werbung des Arbeitgebers einen Gegeneffekt haben [13, 25–28].

Employer Branding ist ein systemischer Prozess. Deshalb sollte eine Positionierungsstrategie mithilfe eines Milestone-Plans, eines Aktionsplans bzw. eines Kommunikationsplans entwickelt werden. Bei der Entwicklung der Strategie sollte man sich von den folgenden Prinzipien leiten lassen: Widerspruchsfreiheit (nur die konsistenten Botschaften), Konstanz (systemische Ansprache), hohe Präsenz (durch alle möglichen Kontaktpunkte), Glaubwürdigkeit (nur die der Wirklichkeit entsprechenden Botschaften), Kreativität (attraktive und interessante Maßnahmen). Zu den erfolgskritischen Faktoren gehört auch die Ressourcenplanung. Ein wichtiger Bestandteil der Strategie ist das Markencontrolling. Die Markenwirkung bei den Zielgruppen sollte immer wieder überprüft werden [11, 10–12].

Der Nutzen von Employer Branding liegt darin, dass durch Differenzierung und Emotionalisierung der Arbeitgebermarke das Unternehmen positive Prädisposition auf dem Arbeitsmarkt erreichen und die am besten geeigneten Mitarbeiter gewinnen kann. Der Nutzen für Arbeitnehmer besteht darin, dass sie einen Arbeitgeber finden können, der ihnen außer monat-

licher Vergütung auch Identifikation, Sicherheit und Vertrauen anbieten kann. Als nachteilig können höhere Kosten betrachtet werden. Aber mittel- und langfristig sind die Kosten niedriger, da die gut angepassten Mitarbeiter langfristig im Unternehmen bleiben, wodurch das Unternehmen bei Kosten für Einstellung und Schulung spart. Und die am besten geeigneten Mitarbeiter zeichnen sich durch höhere Motivation und Leistungsstärke, was letztendlich die Kosten für Employer Branding abdeckt. Hinzu kommt auch, dass das Unternehmen mit der starken Arbeitgebermarke einen höheren Unternehmenswert haben wird und für Investoren attraktiver ist [14, 8].

Die Mitarbeiterbindung ist ein weiteres Instrument des Talentmanagements und kann zugleich als ein übergeordnetes Ziel der Förderung von Treue am Unternehmen bei den Mitarbeitern und von besseren Leistungen sowie als ein wechselseitiger Prozess der Beziehungen zwischen den Mitarbeitern und den Führungskräften bzw. dem Unternehmen betrachtet werden. Im Sinne der der Einstellung der Mitarbeiter wird Mitarbeiterbindung als Treue der Mitarbeiter verstanden, die sich im Wunsch zeigt, langfristig im Unternehmen zu bleiben, sowie in der Bereitschaft, leistungsstark, kreativ und verantwortlich zu handeln. Die Führungskräfte zielen darauf ab, die Treue der Mitarbeiter mit den Motivationsinstrumenten aufzubauen. Dazu gehören unter anderem: überdurchschnittliche monetäre Vergütung, Fringe Benefits (Altersversorgung, Zusatzversicherungen, Kinderbetreuungszuschuss, Dienstwagen, Mobiltelefon, Computer/Notebook etc.), Weiterbildungsmöglichkeiten (Fachkompetenzen-Schulungen, Managementprogramme, Seminare, Wissenstransfer-Kolloquien etc.), Entwicklungsmöglichkeiten (Coaching, persönlichkeitsorientierte Trainings, Sprachkursen, interkulturelle Programme etc.), Work-Life-Balance (Intelligente Verteilung der Arbeitszeit, Flexibilisierung von Zeit und Ort der Leistungserbringung, Resistenz- und Gesundheitsförderung), interne Werbekampagnen, Schaffung von Netzwerken für aktuelle und ehemalige Mitarbeiter,

Vermittlung von internen Karrierechancen, Diversity Management [16, 91–93].

Diese Instrumente sind allerdings fast identisch bei den Unternehmen, die ähnlich gewichtig sind und schaffen deshalb kaum wesentliche Wettbewerbsvorteile. Das Instrumentenpaket der großen Unternehmen schließt vorwiegend zahlreiche Fringe Benefits, Weiterbildungs- und Entwicklungsprogramme, Diversity Management und einige Elemente von Work-Life-Balance ein. Eines der Konzepte, das zum Beispiel in Start-up-Unternehmen umgesetzt werden kann, stellt der Bottom-Up-Ansatz dar. Der Bottom-Up-Ansatz kann als eine der Alternativen zu starren hierarchischen Pyramiden betrachtet werden. Der Bottom-Up-Ansatz hat eine Reihe von Ähnlichkeiten mit dem Empowerment-Konzept, unterscheidet sich aber von diesem dadurch, dass die Führungskraft eher die Rolle eines Vermittlers und eines Vorbildes, als die eines Coachs spielt. Der Ansatz zielt auf eine höhere Mitbeteiligung bzw. Autonomie der Mitarbeiter, Erhöhung deren Motivation, Förderung der Kreativität, Innovationsstärke und Leistungsstärke ab. Die Förderung erfolgt aber vorwiegend nicht direkt durch gezielte Maßnahmen, sondern durch inspirierende musterhafte Verhaltensweisen der Führungskraft. Die Führungskraft ist nicht Lehrer und Coach, sondern Lehrer und Vorbild. Die wichtigsten Vorbedingungen für die Einsetzung des Bottom-Up-Modells stellen die Bereitschaft der Mitarbeiter zur Eigenverantwortung und das Vertrauen der Führungskräfte in die Fähigkeiten der Mitarbeiter dar. Die wichtigsten Stolpersteine sind Ängste vor dem Chaos, Kontroll- und Machtverlust [12, 133–134].

Das klassische Modell des Ansatzes kann vor allem in solchen Unternehmen umgesetzt werden, die autonome Teams mit hierarchischen Strukturen kombinieren. Dabei sollten die Führungskräfte sich darum sorgen, dass keine Bürokratisierung dabei entsteht. Das moderne Modell des Ansatzes betrachtet das Unternehmen als ein Team, das aus gleichgestellten Beteiligten besteht. Die Entscheidungen werden gemeinsam getroffen, indem eine

endgültige Entscheidung ein Leader haben kann, der aber andere nicht zwingt, der Entscheidung zuzustimmen, sondern sie davon überzeugt, falls sich seine Vision von der Vision der Gruppe unterscheidet. Dieses Modell hat die meisten Vorteile, wie maximale Förderung der Autonomie, Kreativität, Innovationsstärke und Leistungskraft, ist aber nur in kleinen Unternehmen bzw. Start-up-Unternehmen am vollständigsten umsetzbar. Darüber hinaus gibt es auch solche Modelle des Ansatzes wie Autonomie ohne strategische Ausrichtung oder Autonomie ohne Interaktion, die aber kaum lebensfähig sind. Je nach eigenen Vorstellungen über die optimale Arbeitsorganisation, die Vision der Unternehmensphilosophie und unter Berücksichtigung der vorhandenen Ressourcen könnten die Start-up-Gründer das Employee Empowerment Konzept oder den Bottom-Up-Ansatz einsetzen, um den Anforderungen der modernen Arbeitswelt als erfolgreicher Arbeitgeber zu entsprechen. Von Bedeutung ist dabei die strategische Vision. Die Arbeitgebermarke kann nicht einfach ähnlich wie die Produktmarke verändert werden. Falls das Unternehmen ein bestimmtes Arbeits- und Führungsmodell wählt, sollte davon ausgegangen werden, dass dieses Modell nachhaltig und langfristig eingehalten werden muss [10, 127].

Ein weiteres Forschungsinteresse stellt auch die nähere Betrachtung der Möglichkeiten des Bottom-Up-Ansatzes dar. Heutzutage ist das Thema der Umsetzung des Bottom-Up-Ansatzes als ein Arbeits- und Führungsmodell nur wenig erforscht. Es wird angenommen, dass der Bottom-Up-Ansatz vor allem für kleine Unternehmen geeignet ist, während die Umsetzung des Bottom-Up-Ansatzes in größeren Unternehmen die Entscheidungsprozesse deutlich verlangsamen wird. Für die Start-up-Unternehmen bedeutet das, dass sie den Bottom-Up-Ansatz nur kurz- bzw. langfristig einsetzen können, oder langfristig, falls sie die Entwicklung des Unternehmens in eine größere Struktur nicht vorsehen. Deshalb sollte erforscht werden, welche Ausprägungen die auf dem Bottom-Up-Ansatz beruhenden Arbeits- und Führungsmodelle in mittleren

und großen Unternehmen haben können und wie sie technisch gestalten werden müssen, damit der Ansatz nachhaltig umgesetzt werden kann, ohne die Entscheidungsprozesse nicht zu beeinträchtigen [10, 133].

So sieht die Darstellung der modernen Arbeitswelt aus, in der Flexibilisierung aktiv erfolgt. Man hat die Analyse der Arbeitswelt im Fokus der modernen Tendenzen und Ansätze dargestellt.

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DEVELOPMENT A PREDICTIVE MODEL FOR AUTISM AMONG CHILDREN

Abstract

Objective: This study aims to 1) examine the predictors of Autism 2) build a predictive model for Autism using logistic regression model.

Methods: 2017 National Survey of Children's Health data was used for this study. The National Survey of Children's Health (NSCH) is being conducted by the U.S. Census Bureau for the U.S. Department of Health and Human Services' (HHS) Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB). It is designed to provide national and state-level information about the physical and emotional health and wellbeing of children under the age of 18 living in mailable residential housing units in the United States, their families and their communities, as well as information about the prevalence and impact of children with special health care needs.

All the participants who were eligible were randomly assigned into 2 groups: training sample and testing sample. A logistic regression model was built using training sample. Receiver operating characteristic (ROC) was calculated.

Results: About 2.82% of 19047 children had Autism, about 4.29% among 9789 male children and 1.28% among 9258 female children.

According to the logistic regression, when the first adult aged by 1 year, the children were more likely to have Autism (OR=1.018). When the first adult had worse mental health, the children were more likely to have Autism (OR=1.245).

When children's age increased by 1 year, the children were more likely to have autism (OR=1.046). Female children were less likely to have autism (OR=0.292). Children with normal birth weight has less likelihood to have autism (OR=0.453).

Children in a family which is hard to cover basics like food or housing were more likely to have autism (OR=1.264). Children who lived with mentally ill were less likely to have autism (OR=0.488). Children who lived with alcohol/drug problem were more likely to have autism (OR=1.650).

The area under curve was 0.7263. The optional cutoff time is 0.288. The mis-classification error was 0.027. The sensitivity rate is about 1.16% and the specificity is 99.95%.

Conclusions: In this study, we identified important of predictors of autism among children, for example children age, sex, mental health and alcohol/drug problems of adults.

Keywords: Autism, predictive model, children, mental health, logistic regression.

1. Instruction

About 1 in 6 (17%) children aged 3–17 years were diagnosed with a developmental disability, as reported by parents, during a study period of 2009–2017. These included autism, attention-deficit/hyperactivity disorder, blindness, and cerebral palsy, among others [1]. About 1 in 54 children has been identified with autism spectrum disorder (ASD) according to estimates from CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network [2].

In this study, we aim to: 1) examine the predictors of the having autism among children; 2) build a predictive model for having Autism using logistic regression model.

2. Data and Methods:

Data:

2017 National Survey of Children's Health data was used for this study. The National Survey of Children's Health (NSCH) is being conducted by the U. S. Census Bureau for the U. S. Department of Health and Human Services' (HHS) Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB). It is designed to provide national and state-level information about the physical and emotional health and wellbeing of children under the age of 18 living in mailable residential housing units in the United States, their families and their communities, as well as information about the prevalence and impact of children with special health care needs.

Models:

We also used logistic regression models to calculate the predicted risk. Logistic regression is a part of a category of statistical models called generalized linear models, and it allows one to predict a discrete outcome from a set of variables that may be continuous, discrete, dichotomous, or a combination of these. Typically, the dependent variable is dichotomous and the independent variables are either categorical or continuous.

The logistic regression model can be expressed with the formula:

$$\ln(P/1-P) = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \dots + \beta_n * X_n$$

Model evaluation:

The discriminatory ability – the capacity of the model to separate cases from non-cases, with 1.0 and 0.5 meaning perfect and random discrimination, respectively – was determined using receiver operating characteristic (ROC) curve analysis. ROC curves are commonly used to summarize the diagnostic accuracy of risk models and to assess the improvements made to such models that are gained from adding other risk factors. Sensitivity, specificity, and accuracy will be also calculated and compared. For all these measures, there exist statistical tests to determine whether one model exceeds another in discrimination ability.

Optimal Cutoff for Binary Classification maximizes the accuracy.

Mis-Classification Error is the proportion of all events that were incorrectly classified, for a given probability cutoff score.

Sensitivity: probability that a test result will be positive when the disease is present (true positive rate).

Specificity: probability that a test result will be negative when the disease is not present (true negative rate, expressed as a percentage).

Variables:

3 Results

About 2.82% of 19047 children had Autism, about 4.29% among 9789 male children and 1.28% among 9258 female children.

Basically, a corrgram is a graphical representation of the cells of a matrix of correlations. The idea is to display the pattern of correlations in terms of their signs and magnitudes using visual thinning and correlation-based variable ordering. Moreover, the cells of the matrix can be shaded or colored to show the correlation value. The positive correlations are shown in blue, while the negative correlations are shown in red; the darker the hue, the greater the magnitude of the correlation.

Autism Children in 2017 National Survey of Children's Health

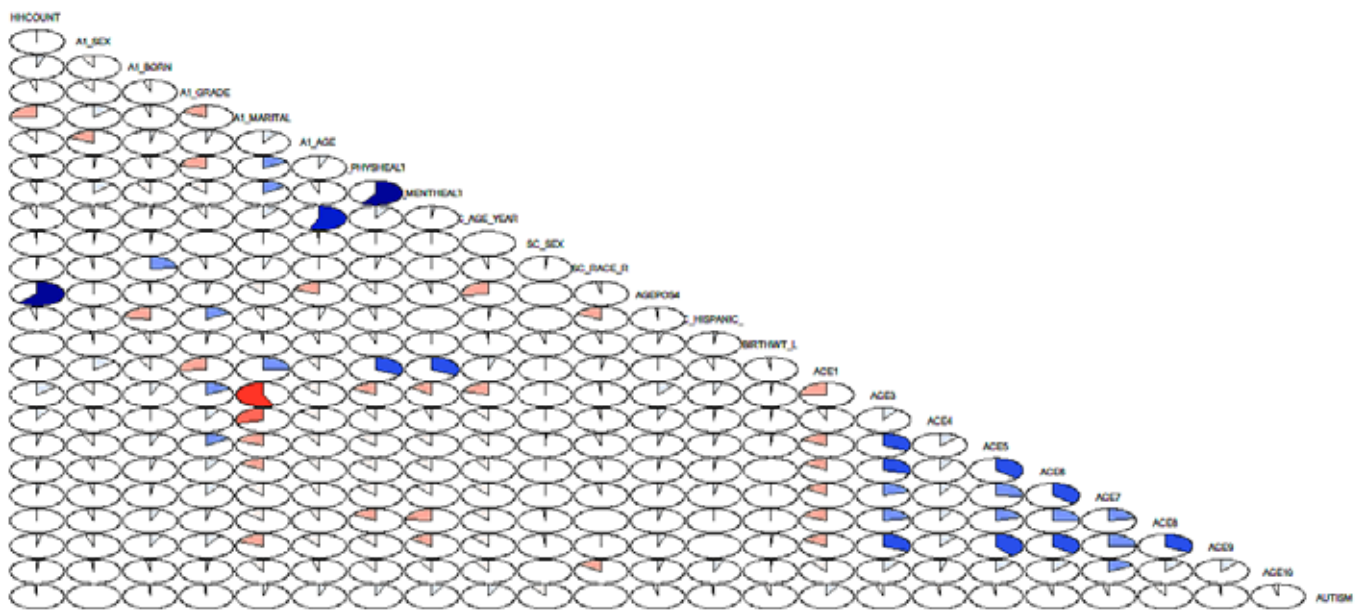


Figure 1. Matrix of correlations between variables

According to the logistic regression, when the first adult aged by 1 year, the children were more likely to have Autism (OR=1.018). When the first adult had worse mental health, the children were more likely to have Autism (OR=1.245).

When children's age increased by 1 year, the children were more likely to have autism (OR=1.046). Female children were less likely to have autism

(OR=0.292). Children with normal birth weight has less likelihood to have autism (OR=0.453).

Children in a family which is hard to Cover Basics Like Food or Housing were more likely to have autism (OR=1.264). Children who lived with mentally ill were less likely to have autism (OR=0.488). Children who lived with alcohol/drug problem were more likely to have autism (OR=1.650).

Table 1.– Logistic Regression

	Estimate	Std. Error	z value	Pr(> z)	
1	2	3	4	5	6
(Intercept)	0.912	1.350	0.676	0.499	
HHCOUNT	0.034	0.074	0.461	0.645	
A1_SEX	-0.238	0.135	-1.758	0.079	.
A1_BORN	-0.107	0.208	-0.514	0.607	
A1_GRADE	-0.013	0.035	-0.355	0.723	
A1_MARITAL	-0.002	0.062	-0.033	0.974	
A1_AGE	0.017	0.008	2.261	0.024	*
A1_PHYSHEALTH	0.000	0.086	-0.006	0.996	
A1_MENTHEALTH	0.219	0.085	2.568	0.010	*
SC_AGE_YEARS	0.045	0.015	2.973	0.003	**
SC_SEX	-1.229	0.145	-8.488	< 2e-16	***

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
SC_RACE_R	0.026	0.034	0.777	0.437	
AGEPOS4	-0.152	0.089	-1.715	0.086	.
SC_HISPANIC_R	-0.080	0.199	-0.402	0.687	
BIRTHWT_L	-0.791	0.174	-4.551	0.000	***
ACE1	0.234	0.076	3.064	0.002	**
ACE3	-0.039	0.177	-0.218	0.827	
ACE4	-0.299	0.306	-0.976	0.329	
ACE5	0.001	0.261	0.003	0.997	
ACE6	-0.155	0.259	-0.601	0.548	
ACE7	-0.460	0.252	-1.824	0.068	.
ACE8	-0.716	0.189	-3.789	0.000	***
ACE9	0.501	0.236	2.117	0.034	*
ACE10	-0.136	0.284	-0.480	0.631	

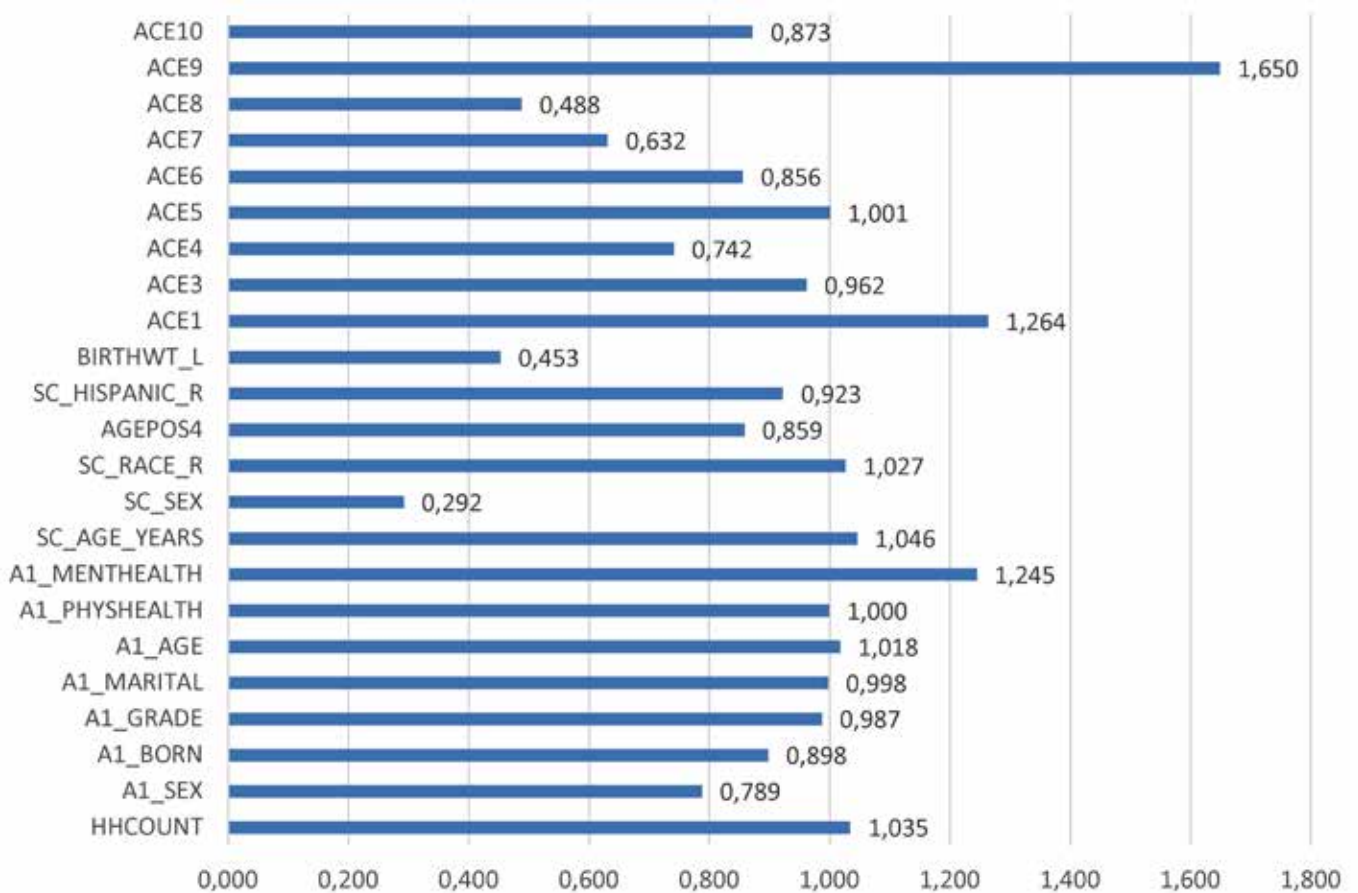


Figure 2. Odds Ratio Figure

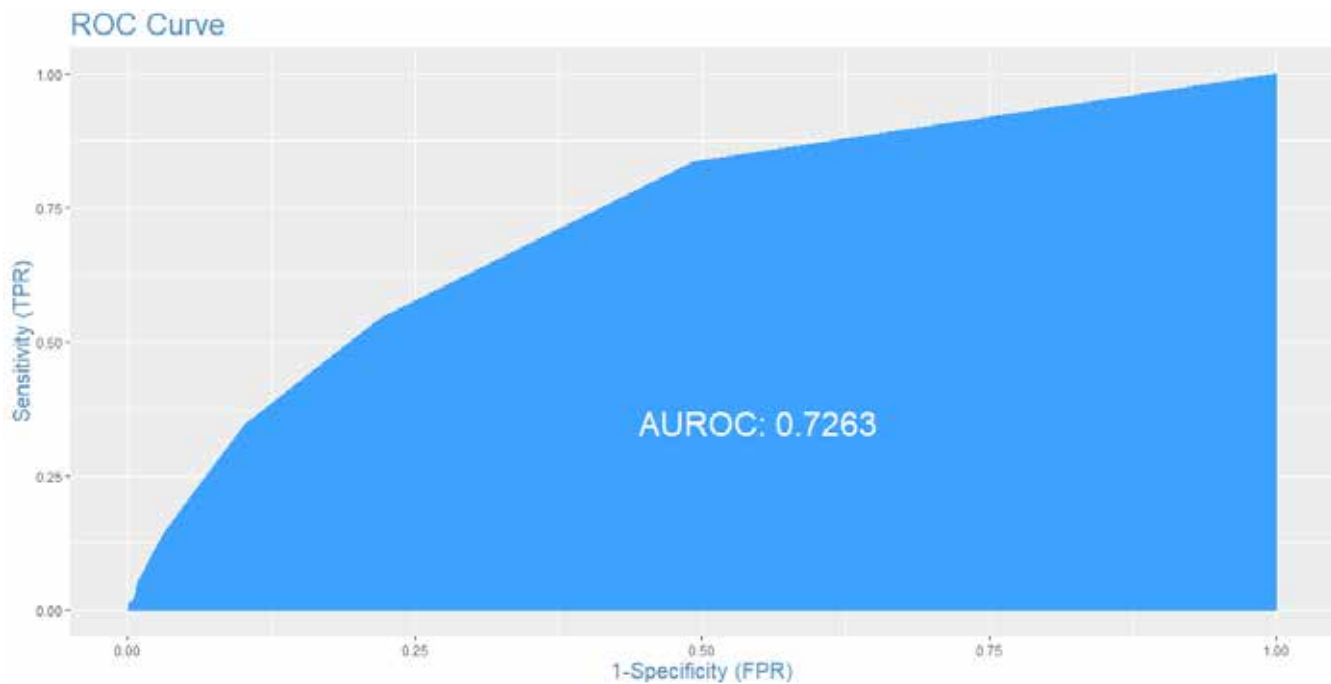


Figure 3. ROC in testing sample for Logistic Regression

The area under curve was 0.7263. The optional cutoff time is 0.288. The mis-classification error was 0.027. The sensitivity rate is about 1.16% and the specificity is 99.95%.

Table 2.

Cut-off	Sensitivity	Specificity
0.1	14.39%	96.8%
0.3	0.7%	99.9%
0.5	0%	100%

4. Discussions

About 2.82% of 19047 children had Autism, about 4.29% among 9789 male children and 1.28% among 9258 female children.

According to the logistic regression, when the first adult aged by 1 year, the children were more likely to have Autism (OR=1.018). When the first adult had worse mental health, the children were more likely to have Autism (OR=1.245).

When children's age increased by 1 year, the children were more likely to have autism (OR=1.046). Female children were less likely to have autism (OR=0.292). Children with normal birth weight has less likelihood to have autism (OR=0.453).

Children in a family which is hard to cover basics like food or housing were more likely to have autism (OR=1.264). Children who lived with mentally ill were less likely to have autism (OR=0.488). Children who lived with alcohol/drug problem were more likely to have autism (OR=1.650).

The area under curve was 0.7263. The optional cutoff time is 0.288. The mis-classification error was 0.027. The sensitivity rate is about 1.16% and the specificity is 99.95%.

Various studies, together with anecdotal evidence, suggest that the ratio of autistic males to females ranges from 2:1 to 16:1. The most-up-to-date estimate is 3:1. [3] some factors that increase the risk of developing ASD include: having a sibling with asd, having older parents, having certain genetic conditions (for example, people with conditions such as down syndrome, fragile x syndrome, and rett syndrome are more likely than others to have asd.), being born with a very low birth weight [4].

Conclusions: In this study, we identified important of predictors of autism among children, for example children age, sex, mental health and alcohol/drug problems of adults.

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DEVELOPMENT OF A PROFIT AND LOSS MODEL

Abstract. Year-over-year growth evaluates a company's financial progress over time. With the year-over-year growth formula, you and your lenders can compare two metrics within a given time period, such as revenue over a yearly, quarterly, or monthly basis.

The paper performs a year-over-year growth analysis for an accounting firm located in Europe called Generco Accounting Company.

We start with the ERP extraction of the source data for Generco. Within the extraction the ERP system has calculated net income for each year. The goal of this paper is to study year-over-year growth through establish profit and loss (P&L) model from scratch.

Keywords: Profit, Loss, Model, ERP System, financial progress.

1 Introduction

1.1 ERP Extraction

ERP (enterprise resource planning) is a data ware houses. Companies use ERP in order to collect, store and manage data from business activities. ERP extraction is the system data extraction, directing, and loading (EDL) method. The ERP is disclosed having a Data Export Workbench (DEW) application and Data Integrator (DI) application operating within an ERP system environment.

The most popular ERP system providers are Oracle and SAP. There are many versions of ERP software, such as Acumatica Cloud ERP [1], Net Suite [1], etc.

1.2 P&L (Profit and Loss) Model

A P&L Model is a process to establish profit and loss (P&L) statement from the ERP extraction. P&L statement is a report that details a company's revenue and expenses over a period of time (usually a quarter or fiscal year). The P&L statement, also called the income statement, shows whether a company lost money or made a profit during the reporting period.

1.3 When Your Business Needs a Profit and Loss Statement

As an accounting firm owner, one already has a number of responsibilities on your to-do list. Depending on your situation, one has to manage taxes,

monitor your business credit and finances, and perhaps even oversee daily sales or operations.

- You can use a P&L statement to improve your bottom line. By periodically taking stock of your company's income and expenses, you can get a better idea of how it's performing financially. You may discover how to boost your net income by increasing revenue, cutting expenses, or some combination of the two.
- Put your business in a better position to borrow. When you apply for business funding, lenders will often review your financial statements, including the P&L statement, as part of the application process. Of course, your business credit scores and reports are often among the key factors considered when you apply for a loan. Yet a P&L statement that shows your company is in the black can be a big plus.
- A P&L statement might be required. Is your company publicly traded? If so, you're likely required to file annual reports (and other reports) with the Securities and Exchange Commission (SEC). An income statement is part of the financial information your business must disclose in these reports.

- P&L statements can help you prepare your taxes. Unless you're an accountant or a big fan of numbers, you likely don't enjoy preparing your business tax return. Many business owners don't consider this particular obligation to be much fun. Yet if you prepare regular P&L statements, filling out your tax return could be less painful. Through your P&L, you'll already have access to much of the information you need.

It's understandable that you might feel worried about adding more duties to the ever-growing pile.

But once you get used to filling out your income statement template, you'll get faster at the process over time. Our research will help you complete this task and further provide you a year-over-year growth analysis with professional charting.

2. Data Extractions

2.1 ERP Extraction Worksheet

For the fiscal year 2016, we listed the below data from ERP extraction [3]. There are total 57 records in the data. Here we print out the first 16 records as an illustration.

Table 1. – ERP Extraction

Code	P&L account	Partner company	Name of partner company	Amounts	Account number
2001110000111111	Core business revenues	111111	External	(14,500,341)	2001110000
2001190000111111	Other revenues	111111	External	(4,794,856)	2001190000
20200000001009	Capitalized costs	1009	Green Ventures Ltd	(154,890)	2020000000
20200000001007	Capitalized costs	1007	Generco Sunshine JSC	(1,180,894)	2020000000
20200000001008	Capitalized costs	1008	Greenco Ltd	(793,080)	2020000000
2020000000111101	Capitalized costs	111101	Not assigned	(2,277,198)	2020000000
2021900000111111	Direct costs	111111	External	4,428,912	2021900000
2024080000111111	Freight outbound expenses	111111	External	16,978	2024080000
2024090000088	R&D expenses	88	Generco Ltd	2,245,438	2024090000
2024090000111111	R&D expenses	111111	External	16,606	2024090000
2041000000111111	Wages and salaries	111111	External	4,683,394	2041000000
2042000000111101	Pension contributions	111101	Not assigned	1,143,052	2042000000
2042000000088	Pension contributions	88	Generco Ltd	239,380	2042000000
2045000000111101	Severance indemnity contribution	111101	Not assigned	104,914	2045000000
2051210000111101	D&A	111101	Not assigned	2,003,262	2051210000
2051260000111101	D&A	111101	Not assigned	41,981	2051260000
20690100001	Corporate recharges	1	Greeny Ltd	(2,156,147)	2069010000
206901000014	Corporate recharges	14	Generco Cosmetics Ltd	(291,429)	2069010000
20690100001037	Corporate recharges	1037	Generco Canada JSC	–	2069010000

- The 2nd column named *P&L account*, showing the given amount of revenue or spending of the related to.
- The 3rd column named *partner company*, giving the accounting firm Generco extracts data from a holding is a holding entity, its financials and transactions with related company or third party company, each numbers of this column corresponds to a single partner company. All the 3rd party companies are under the same number.
- The 4th column is the name of the partner company.
- The 5th column is the amount of transactions; Revenues have negative sign, spending have positive sign.
- The 6th column is the account number referencing to a given P&L item in the account system of Generco. It is common practice to each company to assign an account number in order to facilities their use. We should be

careful to verify data sources for each year are homogeneous. If we spot any difference between them due to different formatting, different organization files, accounting changes.

For the fiscal year 2017, the data extraction got 82 records. We extracted the below data from ERP extraction. For the fiscal year 2018, the data extraction got 74 records.

Then our questions are How to organize data from three different years? How to build a P&L statement from scratch?

2.1 Create Identification Code

From the illustration we saw that neither partner company, nor the account number is unique. To better identify ERP extraction, we created a new code, in the 1st column, called *Code*. The Code is the combination of Account number + Partner company.

2.2 Create FY16 to FY18 P&L Extraction

Using Excel vlookup function, we can tabulate three years ERP extraction in one table as below

Table 2. – FY16 to FY18 ERP Extraction

Code	P&L account	Partner company	Name of Partner company	FY16	FY17	FY18
1	2	3	4	5	6	7
2001110000111111	Core business revenues	111111	External	14,500,341	15,792,899	14,431,341
2001190000111111	Other revenues	111111	External	4,794,856	6,960,218	6,373,618
20200000001009	Capitalized costs	1009	Green Ventures Ltd	154,890	–	–
20200000001007	Capitalized costs	1007	Generco Sunshine JSC	1,180,894	89,235	–
20200000001008	Capitalized costs	1008	Greenco Ltd	793,080	26,173	–
2020000000111101	Capitalized costs	111101	Not assigned	2,277,198	209,402	–
2021900000111111	Direct costs	111111	External	(4,428,912)	(5,463,189)	(5,674,152)
2024080000111111	Freight outbound expenses	111111	External	(16,978)	(343,675)	(350,371)

1	2	3	4	5	6	7
202409000088	R&D expenses	88	Generco Ltd	(2,245,438)	(1,980,162)	(3,116,017)
2024090000111111	R&D expenses	111111	External	(16,606)	(27,149)	(9,784)
2041000000111111	Wages and salaries	111111	External	(4,683,394)	(5,507,141)	(3,982,700)
2042000000111101	Pension contributions	111101	Not assigned	(1,143,052)	(2,057,298)	(1,709,689)
204200000088	Pension contributions	88	Generco Ltd	(239,380)	–	–

2.3 Mapping FY16 to FY18 P&L Extraction

We would like to simplify the P&L accounts into more abstract categories. Typical P&L categories are Revenue, Cost of goods sold, Operating expenses (non-factory personnel, rent utility expenses, marketing and advertising costs, travel expenses, service expenses, legal fees), D& A, Interest expenses, Extraordinary items, Taxes. According the items we extracted from ERP. We would like to sum them up to 20 categories.

Table 3.– P&L categories

1.	Net Sales
2.	Other revenues
3.	Recharges
4.	Total revenues
5.	Direct Costs

6.	Gross Margin
7.	Other operating expenses
8.	Personnel experiences
9.	Leasing
10.	Services
11.	Travel costs
12.	Other income
13.	Capitalized costs
14.	EBITDA
15.	D&A
16.	EBIT
17.	Financial items
18.	Extraordinary items
19.	Taxes
20.	Net Income

Category is added into the data as below.

Table 4.– Mapping P&L accounts into Category

Code	P&L account	Partner company	Name of Partner company	FY16	FY17	FY18
1	2	3	4	5	6	7
2001110000111111	Core business revenues	111111	External	14,500,341	15,792,899	14,431,341
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1	2	3	4	5	6	7
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204200000088	Pension contributions	88	Generco Ltd	(239,380)	–	–

3. P&L Statement

A periodic P&L statement can help manage business finances. Here we compare year 2016, 2017, 2018 statements in one table to see if net income is improving or declining. A P&L statement can also

help you when it's time to prepare your business tax return. All established businesses should prepare a P&L statement from time to time.

Using excel function SUMIF, the below P&L statement is created as below

Table 5.– P&L Statement

EUR in millions	FY16	FY17	FY18	Var% FY16-FY17	Var % FY17-FY18
1	2	3	4	5	6
Net Sales	14.5	16.1	15.0	11.4%	–6.8%
Other revenues	4.8	7.0	6.4	45.2%	–8.4%
Recharges	3.2	2.9	4.9	–9.2%	67.3%
Total Revenues	22.5	26.0	26.3	15.6%	1.1%
Direct costs	(4.4)	(5.5)	(5.7)	23.4%	3.9%
Gross Margin	18.1	20.6	20.6	13.7%	0.3%
Other operating expenses	(3.4)	(3.7)	(6.7)	9.1%	80.5%
Personnel expenses	(6.2)	(8.1)	(5.8)	30.8%	–27.7%
Leasing	(1.1)	(1.1)	1.6	–6.4%	<–100.0%
Services	(2.5)	(1.8)	(2.0)	–27.7%	6.4%

1	2	3	4	5	6
Travel costs	(1.8)	(2.4)	(2.5)	32.0%	5.1%
Other income	0.0	(0.0)	0.0	<-100.0%	<-100.0%
Capitalized costs	5.3	0.7	-	-85.9%	-100.0%
EBITDA	8.3	4.2	5.3	-48.9%	24.7%
D&A	(2.0)	(2.0)	(1.9)	-0.1%	-7.6%
EBIT	6.3	2.2	3.4	-64.8%	54.7%
Financial items	(2.8)	(2.7)	(2.3)	-4.6%	-17.0%
Extraordinary items	(0.0)	(4.6)	(0.0)	>100.0%	-99.8%
EBT	3.4	(5.1)	1.1	<-100.0%	<-100.0%
Taxes	(0.5)	(1.0)	(0.4)	>100.0%	-62.9%
Net Income	2.9	(6.1)	0.8	<-100.0%	<-100.0%
Gross Margin%	80.3%	79.0%	78.4%		
EBITDA%	36.9%	16.3%	20.1%		
EBIT%	27.8%	8.4%	12.9%		

Here all numbers in column FY16, FY17 and FY18 are the summation generated from table 4 by categories. The number is converted into million Euro.

ros. Say total revenues in 2016, 2017, 2018 are 22.5, 26.0, 26.3 million Euros respectively.

Table 6. – Total Revenues

	FY16	FY17	FY18
Net Sales	14.5	16.1	15.0
Other revenues	4.8	7.0	6.4
Recharges	3.2	2.9	4.9
Total Revenues	22.5	26.0	26.3

Breakdown of Revenues in FY16



Breakdown of Revenues in FY17



Breakdown of Revenues in FY18

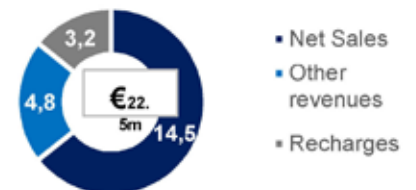


Figure 1. FY16-FY18 Revenues

The column **Var% FY16-FY17**, **Var% FY17-FY18** are percentage of variation calculated from FY16 to FY17, FY17 to FY18 respectively.

Example as **Var% FY16-FY17** is 11.4% for net sale is calculated as $(16.1 - 14.5) / 14.5$.

Calculating year-on-year percentage variations helps to understand how one item changed between two financial periods:

- See if revenues (or costs) grew, remained the same, or decreased;

- Gain an idea how the business is performing with respect to previous financial periods;
- How to do it? The function that has been applied above is quite long and deserves a breakdown. The idea is to avoid displaying insignificant percentage variations (e.g. 5467%, -343%, etc.). The function's breakdown is $IF (ISERROR ((F5/E5)-1); "n.a."; IF(((F5/E5)-1)>1; ">100.0\%"; IF(((F5/E5)-1)<-1; "<-100.0\%"; ((F5/E5)-1)))) [3]$.

The Gross Margin%, EBITA% and EBIT% are calculated from Gross Margin, EBITA and EBIT are percentage of total revenue.

Here EBIT is the Earnings before Interest, Taxes; EBITDA is Earnings Before Interest, Taxes, Depreciation and Amortization. EBITDA is a measure of a company's overall financial performance and is used as an alternative to simple earnings or net income in some circumstances. EBITDA, however, can be misleading because it strips out the cost of capital investments like property, plant, and equipment.

This metric also excludes expenses associated with debt by adding back interest expense and taxes to earnings. Nonetheless, it is a more precise measure of corporate performance since it is able to show earnings before the influence of accounting and financial deductions.

Simply put, EBITDA is a measure of profitability. While there is no legal requirement for companies to disclose their EBITDA, according to the U.S. generally accepted accounting principles (GAAP), it can be worked out and reported using the information found in a company's financial statements while the disclosure of EBIT/EBITDA is much more common in Europe than in the US [4].

We notice that the capitalized costs in Generco's operation expense have positive numbers in 2016 and 2017. This is a category that summaries both

capitalized costs and capitalized interests. When we have positive capitalized interests, this can generate positive number.

4. P&L Statement Analysis

Variety of analysis can be done in P&L statement analysis.

- Net Sales – Money earned when your company sells goods or services
- Operating Income and Expense – May include
 - Other operating expenses – R & D expenses, Marketing expenses, Software&IT, Legal expenses, Consulting fees, Misc costs, Misc extraordinary expenses, Other operative currency differences, Reimbursements+compensation for damages, Insurance expenses and Repairs/Maintenance costs etc ...;
 - Personnel expenses – Wages and salaries, Pension contributions, Severance indemnity contribution, other personnel expenses etc.;
 - Leasing – Rent and Lease Payments/Income earned from leasing equipment or property to others;
 - Services;
 - Travel costs;
 - Affiliate Commissions – Commissions received when your business promotes or sells another company's products or services.
- Non-Operating Income – May include interest earned on investments or savings

4.1 Revenues and Gross Margin%

Table 7. – Revenue and Gross Margin

	FY16	FY17	FY18
Total Revenues	22.5	26.0	26.3
Gross Margin%	80.3%	79.0%	78.4%

Apparently the revenues from 2016 to 2018 increase year by year, but Gross Margin% decrease.

FY16-FY18 Revenues and Gross Margin %

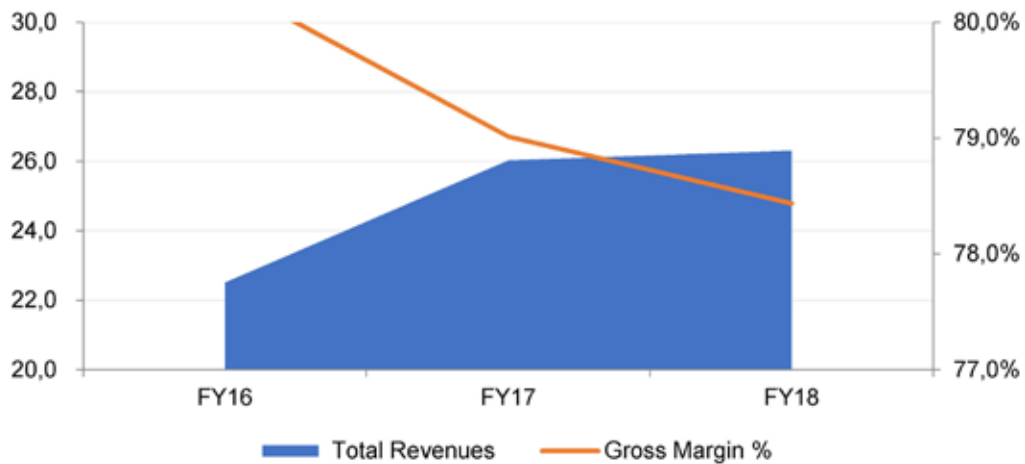


Figure 2. Revenue and Gross Margin

4.2 Operation Expense

Table 8. – Operation Expense

Operation Expense	FY16	FY17	FY18
Other operating expenses	(3.4)	(3.7)	(6.7)
Personnel expenses	(6.2)	(8.1)	(5.8)
Leasing	(1.1)	(1.1)	1.6
Services	(2.5)	(1.8)	(2.0)
Travel costs	(1.8)	(2.4)	(2.5)
Other income	0.0	(0.0)	0.0
Capitalized costs	5.3	0.7	-
EBITDA%	36.9%	16.3%	20.1%

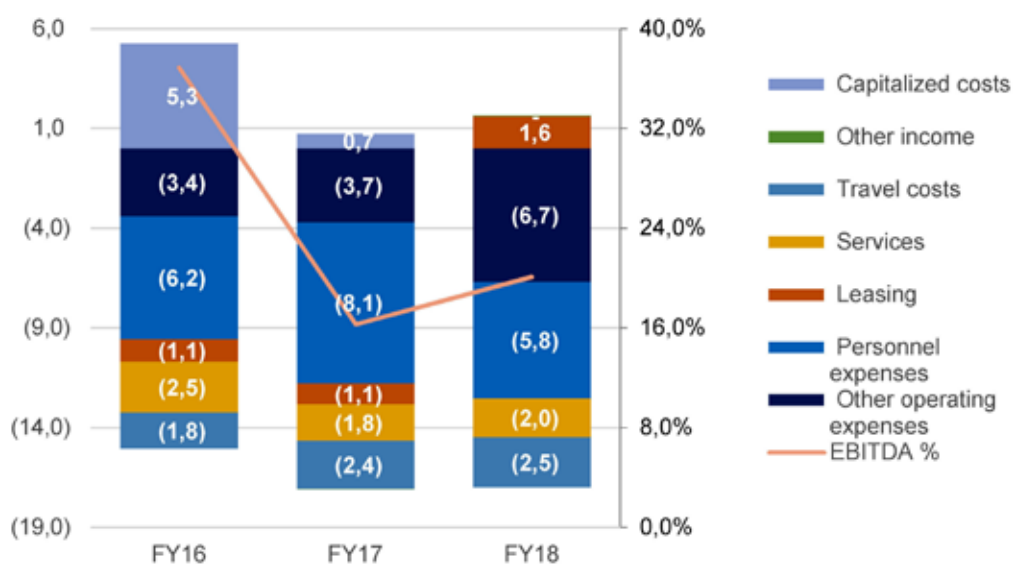


Figure 3. Operation Expense

Apparently the other operating expenses from 2016 to 2018 increase year by year. While we know that the total revenues increase year by year, with the increase of the other operating expenses, we may not have EBITDA% increase which is drawn as the light yellow line the (Figure 3).

4.3 EBITDA Bridge Chart

We would like to analysis how the EBITDA changes from 2016 to 2017 and from 2017 to 2018.

A bridge chart, also called waterfall chart will be very helpful to get the answer.

Table 9. – EBITDA from FY16 to FY17

EBITDA FY16	8.3
Change in Revenues	3.5
Change in Variable costs	-1.0
Change in Opex	(6.5)
EBITDA FY17	4.2

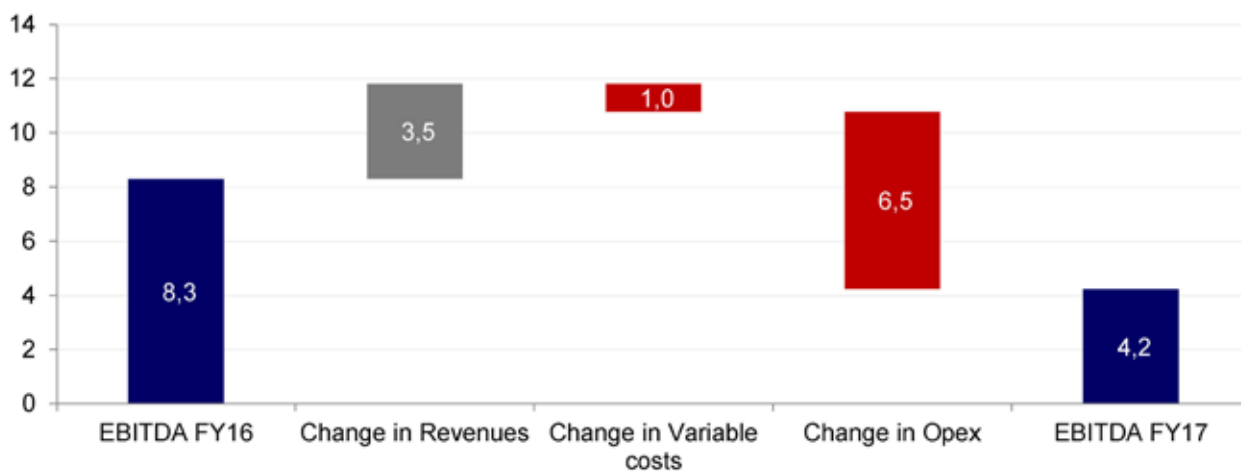


Figure 4. EBITDA bridge: FY16-FY17

Table 10. – EBITDA from FY17 to FY18

EBITDA FY17	4.2
Change in Revenues	0.3
Change in Variable costs	-0.2
Change in Opex	1.0
EBITDA FY18	5.3

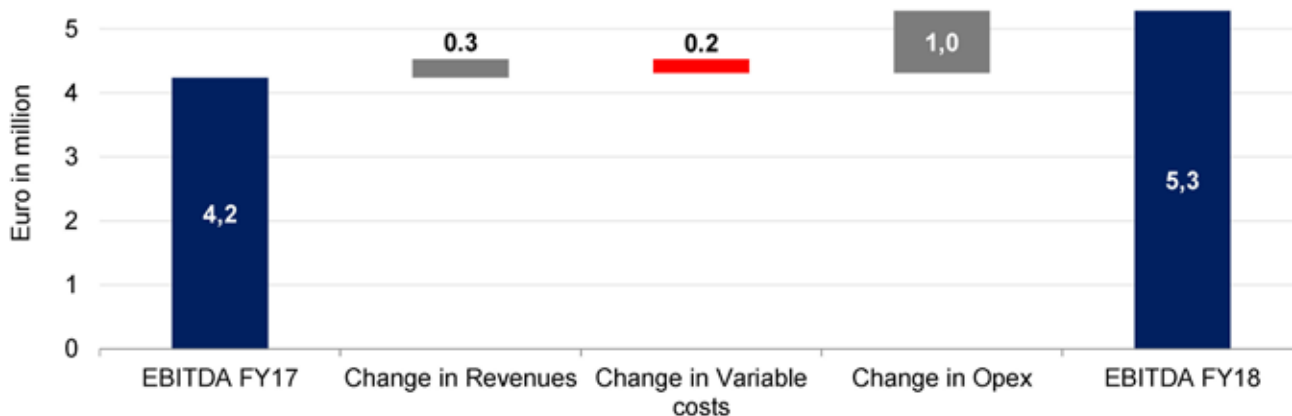


Figure 5. EBITDA bridge: FY17 to FY18

It is clearly shown that the change in revenue decreases from 3.5 to 0.3, the change in operation expense from negative 6.5 to positive 1.0

5. Conclusion

The Financial Model build is the most important in financial control, financial management, financial consulting, and advisory and Regulatory reporting. This research started from the scratch that extract Generco's ERP report to generated a P&L model for

Generco, then further analyze the financial status of the company.

This project work demonstrates the fundamental understanding of corporate finance and daily study work for your Investment Banking, Financial Advisory or Consulting career to create a graphical presentation of the company's P&L. This helps gain an in-depth understanding of the mechanics of company valuation.

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