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Business Strategy and Competition Using the Game Theory

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ABSTRACT:

Social networking platforms have evolved into essential arenas for both individuals and businesses. This paper delves into the intricacies of competition and business strategy within the realm of social networking sites, utilizing game theory as a framework for analysis. Game theory offers a valuable lens for comprehending the strategic choices made by users and businesses in this dynamic and constantly evolving environment.

The research commences by examining the distinctive features of social networking sites, such as network effects and user-generated content, which wield significant influence over competition and strategy. Various scenarios, including user adoption and engagement, content creation and sharing, and monetization strategies, are scrutinized through the application of game theory models.

Key discoveries encompass insights into the competitive tactics deployed by businesses, the repercussions of user behavior on these tactics, and the challenges and opportunities inherent in these platforms. The paper also delves into the ramifications for market leaders, challengers, and new entrants, providing recommendations for adeptly navigating the social networking landscape.

By incorporating game theory into the exploration of social networking sites, this research enriches our comprehension of the intricate interplay between users, businesses, and the platform itself. It illuminates the strategic decisions made by stakeholders and lays the groundwork for formulating effective strategies in this intensely competitive and swiftly evolving digital ecosystem.

Keywords: Game theory, Interactive strategies, Optimum strategies, Value of the game

1. Introduction:

Competition is inherent in any business scenario, and effective decision-making becomes pivotal in influencing the revenue potential of organizations. The advent of social media platforms like Facebook, Instagram, Twitter, and blogs has transformed the way people share knowledge, experiences, and ideas, significantly impacting social, political, and economic behaviors. Analyzing the structure of social entities and understanding the patterns within these structures is facilitated by the social network perspective and its various analytical methods and theories.

In the contemporary digital era, social networking sites have emerged as prominent arenas for businesses to connect with their target audiences and vie for market dominance. With millions of users dedicating extensive hours online, competition on these platforms has intensified. To navigate the intricate dynamics of social media and gain a competitive advantage, businesses are increasingly turning to game theory as a strategic framework. Game theory, rooted in mathematics and economics, offers a valuable framework for analyzing and comprehending interactions, strategies, and outcomes within a competitive environment.

The likes of Facebook, Twitter, Instagram, and LinkedIn have redefined the dynamics of business-consumer interaction. These platforms provide businesses with a direct channel to reach their target audiences, create brand awareness, and foster engagement. However, the crowded and ever-changing landscape presents strategic challenges. Game theory proves instrumental in addressing these challenges, offering a structured approach to analyzing decisions and interactions in the social media game.

Identifying seven common features shared by Facebook and Instagram—Chatting Interface, Live Videos, Private or Public Accounts, Stories, Like and Comment, Group Creation, and Security—fulfills the fundamental assumption of game theory, emphasizing interaction between the two platforms. In the realm of game theory, Facebook and Instagram are considered as two players, and the shared features are viewed as distinct strategies.

2. Theoretical Framework

Applying game theory to business strategy on social networking sites involves understanding the competitive dynamics and decision-making processes of various players in the market.

Game theory can help businesses formulate and analyze their strategies by considering the interactions between competitors, users, and the platform itself. Applying game theory to business strategy on social networking sites is a complex and ongoing process. It's important to leverage data, feedback, and a deep understanding of the players involved to make informed decisions and maintain a competitive edge in the dynamic world of social networking.

Here's a theoretical framework for using game theory in this context:

1. Identify Players and Strategies:

- 1) **Players:** Identify the key players in the social networking site ecosystem. This may include users, other businesses, the social networking platform itself, and regulators.
- 2) **Strategies:** Determine the different strategies these players can adopt. For businesses, this could involve user acquisition, content creation, engagement, and monetization strategies.
2. **Payoff Matrices:** Construct payoff matrices that outline the potential outcomes and payoffs associated with different strategies. Payoffs can be quantified in terms of user engagement, revenue, market share, or any relevant KPI.
3. **Nash Equilibrium Analysis:** Analyze the game for Nash equilibrium, which are situations where no player has an incentive to unilaterally change their strategy. Understanding these equilibrium can help businesses anticipate the actions of competitors.
4. **Types of Games:** Determine the type of game you are in. Social networking businesses often engage in non-zero-sum games, where collaboration can lead to mutual benefits. However, zero-sum elements may exist in terms of market share or user attention.
5. **Strategic Moves:** Anticipate the possible moves of competitors and formulate strategies that react to or counteract their actions. Consider both short-term and long-term moves.
6. **Competition:** Recognize that in social networking, competition (cooperation and competition) is common. Businesses may cooperate in some areas while competing in others. Use game theory to identify the right balance.

3. Literature Review

The literature review initially concentrated on significant works in the field of social networking, and later it turned its attention to the element of game theory. This essay illustrates the relevance of and applications of the gratifications theory in social media. Additionally, a thorough understanding of how customers use social media is provided. This essay discusses the first thorough literature review in the field of social media research. The acceptance and use of social media also reflect a better understanding of its causes and impacts. This blog presents survey results from You Gov-Mint that show 71% of Facebook users also use Instagram, compared to 85% of Instagram users as of August 2018. . For the current Facebook and Instagram users as of June 2019, check out Napoleon Cat's blog. 18.6% of India's population as a whole uses Facebook, compared to 4.8% of Indians who use Instagram. In this study, the Facebook pages of for-profit organizations were analyzed for their content and the effects of the communication strategy used on the attitudes, purchasing intentions, and perceptions of the organization-public interaction among stakeholders.

4. Research Methodology

Research Methodology provides an analytical approach to solve a research problem. This section includes the following steps-

- 1) **Preparation of the questionnaire based on the purpose of the research work-** Here a Google form was designed to have the demography information of the respondents. In addition 14 questions were framed on the common features of the two competitors. 10 point linear scale was used to collect the data from the respondents. Every field was compulsory before submitting the online form. The advantage of the online form violates the presence of outliers and hence the validation of the data is satisfied.
- 2) **Identify the scope as to collect the data from the responses given by the end users-** A simple random sample technique was used to collect the data. A sample size of 100 was used on a heterogeneous group of respondents. These violets any prejudice related to any features.
- 3) **Conduction of Pilot survey to satisfy the reliability of the questionnaire model as per the purpose of the research work-** Initial sample of 20 respondents was collected for the Pilot survey. Cronbach's alpha reliability test was carried out in three ways.
- 4) **Graphical Representation-** After the successful completion of the reliability test, remaining 80 respondents were approached. Before preparing the bar graph, the 10 point scale data was transformed into five ordinal categories. 1-2: Sufficient, 3-4: Satisfactory, 5-6: Good, 7-8: Very Good and 9-10: Excellent. The general trends of the respondents can be identified by use of the graphical tools.

- 5) **Descriptive statistics-** The average value and standard deviation were calculated, as to identify the comparative figures and the consistency of the features.
- 6) **Regression analysis-** The concept of simple regression analysis is used in two ways: Y on X and X on Y. The output of regression analysis provides two parts i.e. Intercept which determine the by default value of Y when X=0. This is the point of interest for collecting the payoff values. The other part is the slope which determines the positive or negative impact of the independent variable on the dependent variable. This is not the concern for the formation of the game theory model.
- 7) **Game theory model:** A 7x7 reward matrix in the form of (axi, ayj) for the (i, j) cell can be entered based on the intercept data obtained from the two processes of Y on X and X on Y discussed above.
- 8) **Solution of the Game theory model-** Firstly keeping player A as major and player B as minor , all the first entries axi among (axi, ayj) are considered to find the value of the game and optimum strategies of the game. On the other side, keeping player B as major and player A as minor, all the second entries ayj among (axi, ayj) are considered to find the value of the game and optimum strategies of the game. The transpose of the original matrix values for ayj are taken to solve for the player B.
- 9) The final fact and figures can be reflected as the end results for both the players of the game theory.

4.1 Research Questions

- 1) Taking into account game theory, how can advertising strategically compete on social media platforms?
- 2) In response to the strategic interactions between marketers and users on social media, what are the variables influencing user behavior and advertising policies?
- 3) When the social media advertising market is examined using a game theory framework, what equilibrium results and potential market configurations emerge?

5. Data Analysis

Utilizing data analysis involves the process of converting data into valuable and comparable information, with a specific focus on the reactions that can generate a game theory model. The resultant outcomes can serve as a basis for selecting optimal strategies when employing a decision-making tool like the Game Theory model. The following outlines a step-by-step approach to data analysis:

5.1 Sample Size Foundation

Drawing from data regarding Facebook and Instagram users in India, an anticipation is made for 7,64,14,500 common users in 2022, respectively. Considering a margin of error of 10% for an exploratory study based on a consumer survey, a sample size of 95 is determined when default values for the confidence level and response distribution are set at 95% and 50%, respectively. As an approximate round-off for this research project, 100 samples were selected. A Google form was distributed to the college's stakeholders to collect relevant data.

5.2 Cronbach's Alpha Reliability Test

To evaluate the reliability of the model, a preliminary survey was conducted with an initial sample of 20 respondents, involving stakeholders from our institute in Mumbai. Table-I displays Cronbach's alpha values derived from responses pertaining to each of the seven features for Facebook and Instagram individually, as well as for both, providing an assessment of the overall reliability of the model.

Table- I: Reliability test for Pilot survey

Sr. No.	Index	No. of Items	Initial Sample Size	C. alpha value	Indication
1	Facebook	7	20	0.917	Excellent
2	Instagram	7	20	0.924	Excellent
3	Facebook and Instagram	14	20	0.903	Excellent

Interpretation of Table-I: The questionnaire is a fantastic tool for carrying out this research work because all three Cronbach's alpha values are higher than 0.90. For the remaining samples, the model is trustworthy for conducting the survey.

5.3 Graphical representation

This section is divided in two sub-sections as given below-

5.3.1 Demographic Information

The occupation of a person's demography can have an impact on social networking sites. Figure 1 shows the sample distribution of the heterogeneous groups.

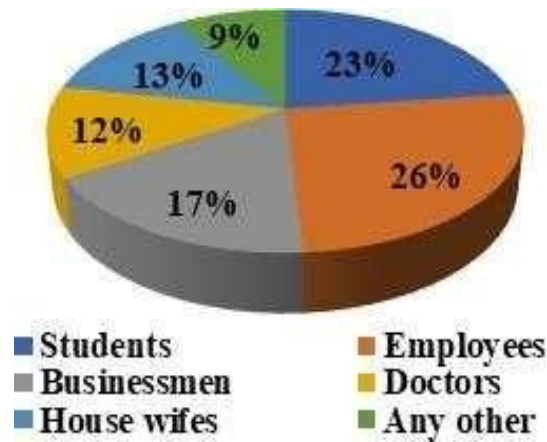


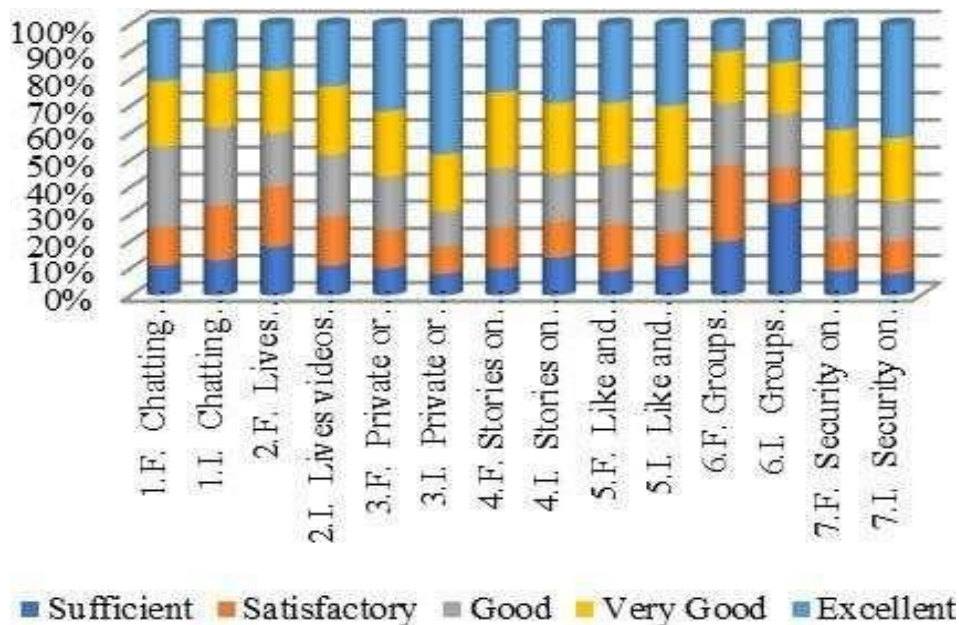
Fig. 1. Sample Distribution based on Occupation

Interpretation of Figure 1 : Students and employees make up over 50% of the sample. The remaining 50% includes them. The range of demographic data based on occupation represents variation and, as a result, mitigates any bias against any one characteristic.

5.3.2 Trend within the responses

The data, as previously described, was translated into 5 distinct ordinal categories. The stack bar chart can be used to determine the overall trend from the responses. Information on the various features of both competitors is shown in Fig. 2.

Fig. 2. Trends of responses on the seven features for the two players



Interpretation of Figure 2: Facebook's chat interface is superior to Instagram's. However, compared to live videos on Facebook, Instagram live videos are more popular with consumers. Facebook accounts, whether private or public, contribute more frequently than Instagram ones. Users enjoy Facebook and Instagram's stories, as well as their likes and comments. The group produced structures on both websites don't meet manipulator expectations. The security aspect on both community networking sites is the best.

5.4 Descriptive statistics

Finding the overall trend is aided by the data's dispersion and measure of central tendency. The relationship between Standard Deviation and Average Value shows how consistently respondents view Facebook and Instagram. The consistency levels for each characteristic across all Players are shown in the table below.

Table- II: Player wise Descriptive statistics for various features

Players	Features	Average	Std. Dev.	Coeff. of Variation (%)	Consistent Ranking by
Facebook	Chatting Interface	6.02	2.61	43.34	5
	Live videos	5.50	2.85	51.78	6
	Private or Public	6.57	2.83	43.12	4
	Stories	6.41	2.56	39.93	2**
	Like and Comments	6.57	2.72	41.35	3
	Group Created	4.83	2.66	55.14	7
	Security	6.90	2.75	39.92	1*
Instagram	Chatting Interface	5.62	2.57	45.79	5
	Live videos	6.25	2.78	44.53	4
	Private or Public	7.38	2.78	37.68	1*
	Stories	6.38	2.98	46.67	6
	Like and Comments	6.68	2.84	42.44	3
	Group Created	4.81	3.15	65.46	7
	Security	7.15	2.90	40.61	2**

Interpretation of Table -II: Security of Facebook is most consistent where as Stories is next consistent among all its features. On the other hand Private or Public account of Instagram is most consistent whereas Security is next among all its features. Group created found to be least consistent among the two players. Security in both cases is the consistent features which plays important role in the domain of social networking sites.

5.5. Game theory model

The consistency of Facebook's security is the highest, while the consistency of its stories is the second-highest. On the other hand, Instagram's Private or Public account is the most reliable, and Security is its second-best feature. The two players' group was judged to be the least consistent. Security is a constant trait that is significant in the world of social networking sites in both scenarios.

Table- III: Formation of 7x7 Game theory model

Features		Player B (Instagram)						
		Chatting Interface	Live videos	Private or Public	Stories	Like and Comments	Group Created	Security
Player A (Facebook)	Chatting Interface	(5.52, 5.10)	(4.79, 4.91)	(5.29, 6.70)	(5.51, 5.75)	(6.26, 6.93)	(5.74, 4.31)	(5.41, 6.51)
	Live videos	(4.23, 4.61)	(3.97, 4.97)	(3.86, 6.22)	(5.25, 6.15)	(5.48, 6.66)	(5.12, 4.28)	(6.15, 7.67)
	Private or Public	(5.50, 4.59)	(4.84, 4.49)	(3.67, 4.90)	(6.14, 5.90)	(5.84, 5.96)	(5.73, 3.39)	(6.20, 6.79)
	Stories	(5.80, 4.91)	(5.87, 5.60)	(5.57, 6.53)	(5.42, 5.03)	(5.67, 5.81)	(5.95, 3.87)	(6.13, 6.83)
	Like and Comments	(5.09, 4.07)	(4.87, 4.38)	(5.66, 6.53)	(5.13, 4.60)	(4.31, 4.26)	(5.54, 2.91)	(6.16, 6.71)
	Group Created	(3.57, 4.61)	(2.57, 4.34)	(2.89, 5.99)	(2.89, 4.54)	(2.74, 4.97)	(2.63, 1.72)	(4.88, 7.19)
	Security	(6.23, 4.90)	(6.52, 5.82)	(5.50, 6.05)	(6.93, 6.42)	(7.26, 7.08)	(7.19, 5.36)	(4.83, 4.93)

Interpretation of Table -III: The capture standards are all positive. The majority of the values fall between 5 and 7, indicating strong cell value bonds. Values between 1 and 3 on the other hand, show weak cell value connection.

5.6 Solution of Game theory model

Matrix The online feature of the game solver makes it possible to solve a matrix-style game in which Player I selects a row and Player II selects a column. The row and column that were jointly chosen indicate, as usual, the winnings of the row chooser and the closing of the column chooser in the matrix entry.

Case 1: Keeping player A as major (row chooser) and player B as minor (column chooser), the game can be solved as - The matrix is

5.52	4.23	5.50	5.80	5.09	3.57	6.23
4.79	3.97	4.84	5.87	4.87	2.57	6.52
5.29	3.86	3.67	5.57	5.66	2.89	5.50
5.51	5.25	6.14	5.42	5.13	2.89	6.93
6.26	5.48	5.84	5.67	4.31	2.74	7.26
5.74	5.12	5.73	5.95	5.54	2.63	7.19
5.41	6.15	6.20	6.13	6.16	4.88	4.83

The solution is: The value is 5.59.

An optimal strategy for Player A (Facebook) is:

(0, 0, 0, 0.02935, 0.55025, 0, 0.4204)

An optimal strategy for Player B (Instagram) is:

(0.07944, 0, 0.90232, 0, 0.01824, 0, 0)

Case 2: Keeping player B as major (row chooser) and player A as minor (column chooser), the game can be solved as- The matrix is

5.10	4.91	6.70	5.75	6.93	4.31	6.51
4.61	4.97	6.22	6.15	6.66	4.28	7.67
4.59	4.49	4.90	5.90	5.96	3.39	6.79
4.91	5.60	6.53	5.03	5.81	3.87	6.83
4.07	4.38	6.53	4.60	4.26	2.91	6.71
4.61	4.34	5.99	4.54	4.97	1.72	7.19
4.90	5.82	6.05	6.42	7.08	5.36	4.93

The solution is: The value is 5.93.

An optimal strategy for Player B (Instagram) is: (0, 0, 0.32607, 0, 0.29481, 0, 0.37912)

An optimal strategy for Player A (Facebook) is: (0, 0, 0.23636, 0, 0.31427, 0, 0.44937)

Interpretation of Solutions of games: Both times, the game's rating is between 5 and 6, which is acceptable to both players. The best possible strategy in both situations is three for both players.

In scenario 1, where Facebook dominates, features like Instagram stories, likes, and comments, as well as security, offer the best possible solutions. The main contribution came from likes, comments, and shares. However, Instagram may best compete with Facebook thanks to features like the Chatting Interface, private and public accounts, likes, and comments. Both the private and public features contribute significantly in this case.

In scenario 2, Features like Private or public accounts, Stories, and security offer the best solutions in Case 2, where Instagram outweighs Facebook. Finally, Facebook's best strategies in this case are the same characteristics.

6. Conclusion

Thus, a useful and workable solution can be provided with the right flow and use of data analyzing tools.

1. According to the Cronbach's alpha test, the model's reliability has been excellent for all seven features.
2. The data and information using graphical tools and descriptive statistics are adequate and place all seven qualities under evaluation above the average values.
3. The group that was created was proven to be the least reliable of the two players. Comparing their other features, Instagram's private and public account features were more consistent than Facebook's security feature. More privacy may be provided in the end as a result of the use of these features on the relevant platforms.
4. To create a 7x7 non-cooperative game, positive intercepts from regression analysis performed for both players are used as the payout values.
5. The game's value is above average in both situations, resulting in a win-win scenario that benefits both competitors. This demonstrates that the shared characteristics of these two social networking sites are satisfying to the end users.
6. Despite Facebook's dominance, it can be shown that Instagram's features are the most popular among all the techniques. However, Instagram's dominance over Facebook reflects the same traits as their most effective techniques.

7. Even in complex situations, the game theory model is a useful tool for decision-making. Given the expansion of the game theory model, we can substitute Twitter, LinkedIn, etc. for Instagram as a social networking site. The basis of interaction between them can be found in the shared characteristics of each competitor.

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