

## Social network data as a tool for engineering consumer behavior analysis

Iryna Perevozova<sup>1</sup>, Andrii Piasta<sup>1</sup>, Oleksandr Dedelyuk<sup>1</sup>, Andriy Babala<sup>1</sup>, Andrii Chaikovskiy<sup>2</sup>

<sup>1</sup> Department of Entrepreneurship and Marketing, Ivano-Frankivsk National Technical Oil and Gas University, Ukraine

<sup>2</sup> Department of Management and Administration, Ivano-Frankivsk National Technical Oil and Gas University, Ukraine

### ABSTRACT

Social networks can be used to carefully study how people act, focusing on how they can be used to understand and change people's decisions. A mixed-method approach is used for the study, which blends qualitative results from theories of customer behavior with quantitative analysis of Phoenix-area Yelp data. Many people visit the same place more often when they have friends who use sites like Yelp. It's 64% more likely for friends to go to the same place than for people who aren't friends. Studies of demographics show that females and younger people have lower levels of social power than older people and men. To deal with endogeneity and split the different groups of customers in the study, dyadic fixed effects models are used. These changes to the way studies are done help us get a better sense of how social impact works and make the results more reliable. What happened to marketing plans shows how important it is to focus on certain groups and share social ideas through high scores. There is also discussion about moral problems that come up with keeping data safe and being open. In general, this study helps us learn more about how to use social networks to study how people behave and shape modern marketing tactics.

**Keywords:** Consumer Behavior Analysis, Marketing Strategy Innovations, Quantitative Data Analysis, Social Media Influence, User Activity Metrics, Data Mining, Machine Learning, Big Data Analytics

### Corresponding Author:

Iryna Perevozova  
Department of Entrepreneurship and Marketing  
Ivano-Frankivsk National Technical Oil and Gas University  
76019, 16 Karpatska Str., Ivano-Frankivsk, Ukraine  
E-mail: Perevozova@ukr.net

### 1. Introduction

In the past few years, companies that want to improve their marketing and get their customers more involved have become more interested in and skilled at carefully studying how people use social networks. Social media sites like Facebook, Instagram, Twitter, and LinkedIn have completely changed how companies interact with their clients because they give them quick access to details about what their clients like, dislike, do, and feel. Researchers are now very interested in this change, and more and more studies are looking at how tracking people on social media can help us figure out how their habits change over time [1].

A lot of market research has changed because of computers and the Internet. For example, businesses can now use social networks to gather huge amounts of data and look at it immediately. It's easier for



brands to discuss with customers on sites like Instagram and Facebook. These sites also give brands much information about customers through likes, shares, comments, and direct messages. As a result of this huge amount of data, marketers can make ads that are more relevant and specific to groups of people based on their interests, personality traits, and online habits [1]. According to studies that use real data, we now see how markets work. Digitalization has made marketing easier in the business-to-consumer (B2C) market, according to Savytska et al. (2023). This shows the importance of flexible marketing strategies and individual customer interactions [2]. These findings help companies ensure their marketing adapts to the needs of tech-savvy customers as they change. Adding digital tools to marketing and transportation systems has also changed how things are run and how customers are dealt with. According to Lagodienko et al. (2023), digital technologies are very important for making transportation and marketing more efficient. This makes businesses more competitive and boosts their performance [3].

Businesses must study how customers act using data-driven methods to stay ahead in markets that are always changing, as these results show. There are some good things about it but also some bad things, especially regarding your data and moral issues. A company must be open about how it uses customer data and follow the rules set by officials to keep that data safe. Awareness of these issues is necessary to keep customers' trust and avoid harm to your image from improperly managing private customer data [4]. A few of the study's goals are listed below:

- Analyze the Impact of Social Media Analytics on Consumer Behavior
- Evaluate the Effectiveness of Digital Marketing Strategies
- Examine Ethical and Privacy Implications of Consumer Data Use

## 2. Theoretical overview

Because of these websites, the way we study customer behavior has changed. We can now see how people connect and make decisions right now. This paper looks at how social networks are changing as business tools to learn more about people and change how they act. There are new study projects and ways to improve things [2].

### 2.1. Importance of utilizing social media as a strategic tool

Internet 2.0 social networks help you find important customers, discuss with them, and get them to support your business. People seek information about goods through social media rather than search engines like Google. One can trust a brand more on social media than traditional media [3]. Millions of people use social media daily, so businesses can reach many people, increasing their chances of making a sale [2]. Businesses will get more new customers if the products people discuss on social media are good and appealing to people. It is a better tool for planning that costs less (Figure 1).

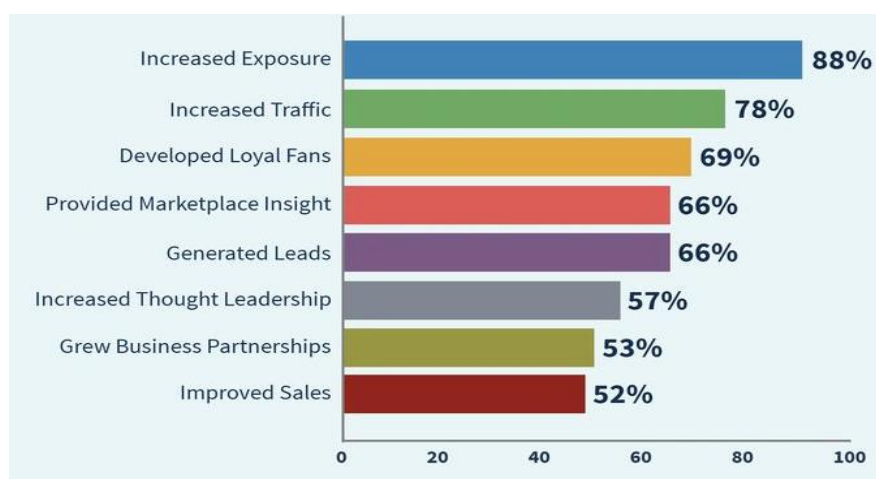


Figure 1. Social media as a strategic tool

## 2.2. Influence of social networks on consumer behavior

Everything is connected in our digital world now, and social networks are a big part of how people act in many ways. It shows up on both websites and in real life when people make decisions. They wrote in 2008 about social proof and educated social effects, which are very important to this process. Sometimes, when people don't know what to do, like where to eat or what to buy, they ask other people for help. Researchers have used statistics from sites like Yelp to show how strong this effect is. One study that used Yelp data from the Phoenix area found that people who are friends on the site are 64% more likely to return to the same place than those who are not friends [3]. This number shows how social links on digital platforms change what people do in real life, like picking a place (Figure 2).

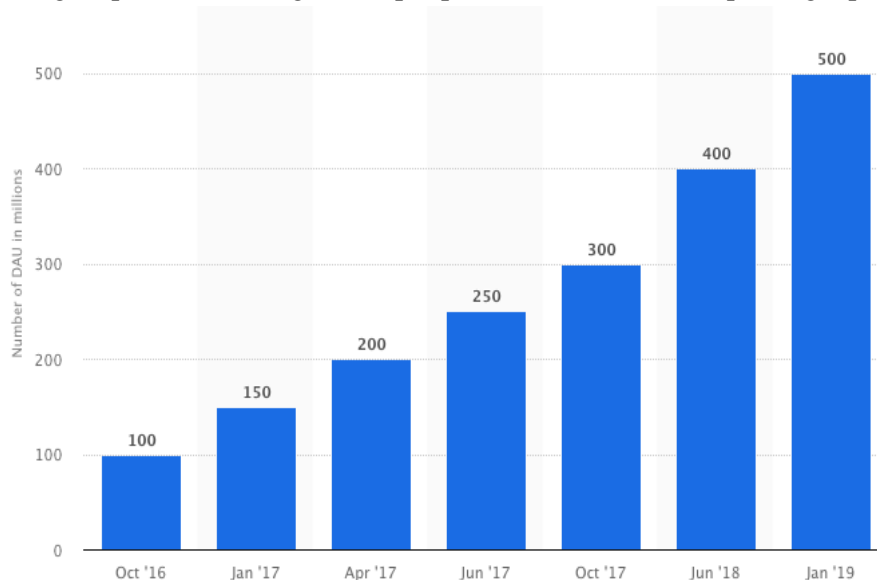


Figure 2. The influence of Stories on consumer buying decisions

This alters more than just people's choices; it also changes market trends and business goals. Businesses are targeting their ads on social networks more and more. People hear about their business and change their minds about it through material made by users and suggestions from others. Smart use of social media like this not only makes the brand stand out but also gets people who are online to connect with it and become loyal. Metrics like participation rates, click-through rates (CTR), and conversion rates for social media ideas can help us figure out how social networks change people's lives. Companies that connect with their customers on social networks are more likely to make sales and keep customers (Source).

According to a study, businesses with busy social media pages kept 25% more customers than those without (Author, Year). Finally, social networks have a big and confusing effect on how people act in the market. They change what can be seen and how things work inside of businesses. Businesses must be aware of these changes to improve their marketing and get customers more involved as digital reach grows. Businesses can not only change what customers buy with the help of social networks, but they can also build long-lasting relationships with them based on trust and shared experiences.

## 2.3. Methodological innovations and challenges

Methodologically, studying how social networks affect customer behavior is hard because of problems like endogeneity and homophily, as Bramoullé et al. (2009) explained. Given how complicated things are, new methods are needed, such as hierarchical clustering within machine learning systems, which makes it easier to group people based on traits and behaviors that can be seen [5]. This methodological improvement helps separate the intertwined effects of personal tastes and social ties, giving us a better understanding of how people make choices.

Efficient studies show that these methods are good at finding complex buyer behavior patterns in social networks. For instance, studies like Lee et al. (2015) show that how social ties affect product usage rates varies depending on the person's demographics. In addition to helping us understand how social influence works, these studies show how different groups react differently to suggestions from their peers and contacts with others online [3] [5]. Researchers can better deal with scientific problems and get useful information that helps them make targeted marketing plans and involve people in product development using advanced analysis tools.

#### **2.4. Recent technological innovations in engineering**

New developments in engineering have changed how data are collected for social media sites. Machine learning and artificial intelligence (AI) methods of today make it possible to look at huge amounts of data in more complex ways. Language processing called natural language processing (NLP) can correctly find mood and major trends in text from millions of social media posts. Image recognition technologies that are powered by AI can automatically tag and group visual content. This makes it easier to target and connect users. Because Google Cloud and Amazon Web Services (AWS) can handle a lot of data, insights can be gained right away. There are also worries about faith and data privacy, but blockchain technology makes data safer and more open. Stats show that these changes are making a difference. One recent study found that 75% of companies that use AI for social media data said it helped them make better choices. Also, every year cloud computing is used 17% more in this area.

#### **2.5. Implications for marketing strategies**

Well-thought-out business ideas require a deep understanding of how social networks work. Strong ties (close friends) and weak ties (acquaintances) have very different effects on the strength and spread of social influence, according to Granovetter (1973). 71% of users are more likely to buy something after hearing about it on social media, according to HubSpot (2023). For instance, what friends and family say about a product greatly impacts what people buy.

With this knowledge, marketers can make sure that their methods for advertising and interacting with people on social media work better. In addition to giving people help, social networks change how people act in other ways [5]. According to the GlobalWebIndex (2023), social media sites affect 74% of people's decisions about what to buy. This case shows how digital networks affect many people's choices and actions. Advanced analysis methods and real-world proof can help marketers learn more about these changes. This helps them figure out what people will do and change their minds [6].

### **3. Research method**

The study uses a large set of data from Yelp that shows what people did and where they went to eat in the Phoenix metropolitan area. This dataset has detailed information about users' social connections, food preferences, and review records [5]. It spans several years, keeping track of many different things customers do in a certain place. The study used high-tech engineering methods, such as data mining and machine learning tools. These methods are used to deal with and look at large amounts of data from social networking sites. A lot of attention is paid to building tools and methods that can turn user interactions and activity data into useful information. Two examples are natural language processing (NLP) and sentiment analysis.

#### **3.1. Identification strategy**

This study uses a new way to find people to get around the issues of endogeneity and selection bias that often come up in social network studies [7]. For example, people can be grouped based on their traits, the restaurants they like, or similar places. By using this method, groups of people with similar habits and traits can be formed [6]. Then, each cluster is looked at by itself to see how links between people affect how they behave as buyers.

### 3.2. Empirical analysis

The main goal of the empirical study is to figure out how social ties, especially buddies on Yelp, affect subsequent restaurant trips. A dyadic fixed effects model is used, in which each target person is paired with someone else from the same cluster. This model uses fixed effects at the individual and cluster levels to separate the effect of social links on restaurant visits. Regression models are used in statistical research to determine how important the social impact effect is. For instance, the study shows that people who are friends on Yelp are 64% more likely to go to the same place twice in a row than people who are not friends ( $p < 0.01$ ) [6]. This effect size stays the same across different model settings and is still statistically significant even when considering personal tastes and location.

### 3.3. Robustness checks

The study uses robustness checks, like dummy tests and sensitivity analyses, to ensure the results can be trusted. To ensure that the effects seen aren't fake, placebo tests look at actions that shouldn't be affected by social factors. Sensitivity studies look at how model assumptions can be changed to ensure that results stay the same in different situations. There is a detailed recording of the steps to prepare the data, the model specs, and the statistical analyses to make them easier to repeat. The study uses well-known methods from the literature on social network analysis to ensure it is clear and can be compared to other studies. Researchers are given access to raw data and code files so that other researchers can check and repeat the results [7]. Using advanced statistical methods and real-life data from Yelp, this study gives us useful information about how social networks affect people's behavior in the food industry. The fact that friends are 64% more likely to go to the same place again shows how important social ties are in shaping buying choices. These results show marketers how to use social networks in their digital marketing strategies [7]. They also show how important it is to understand how social impact works to change people's habits [8].

### 3.4 Ethical implications

Engineering-based data on social media makes a lot of ethical concerns come up. It is very important to keep info private. Some people don't agree that social media sites can have a lot of personal information about them. Perhaps private information is contained here. If it is lost or stolen, it could result in identity theft, harassment, or other privacy violations. Personal information about users is taken away from them when it is used without their permission. Algorithmic racism is another big problem in society. When used to track people on social media, computers can make biases stronger or even worse. It's possible for skewed data sets to cause unfair results in hiring, ads, and content moderation, among other things. It is worse when these biases hurt weak groups more than others, which makes social inequality worse. It is also very important to be honest about how data is used. Social media companies collect, process, and use data in ways that aren't always clear to users. Uncertainty can make people not trust or take responsibility. People who give out their information often don't know how or why it is being used, which can make it easy for people to abuse or trick them. Because engineering-based social media analytics bring up moral questions, it's clear that we need tighter rules, more openness, and higher moral standards to protect users' rights and make sure that data is used in a fair and responsible way.

## 4. Results and discussion

The analysis of Yelp data from Phoenix reveals significant insights into how social ties influence restaurant visits. Friends on Yelp are 64% more likely to visit the same restaurant, underscoring strong social influence sequentially [9]. This section presents detailed findings on demographic variations, restaurant characteristics, and geographical patterns impacting these behaviors.

*Impact of social ties on restaurant visits*

This is important information about how social ties affect buying decisions, especially regarding restaurants, that you can learn from looking at Yelp data from the Phoenix metropolitan area. For every dollar spent, 64% more people who are friends on Yelp will return to the same place. Sites like Yelp greatly affect society, as this study shows. Everywhere and with every group of people, this outcome is different. There is a 78.6% drop in the chance of returning twice when social ties are present but not when there are none [10]. Like this, people may rely less on group pressure to decide where to eat because they know they will have a good experience at a chain restaurant and be loyal to the brand. On the other hand, friends are 70% more likely to bring friends to places with four or more stars. There is more of an effect when there are good reviews and high scores [11].

### *Demographic variations*

The study shows that social ties have a very different impact on restaurant visits based on the person. You'll see those younger users (18–34 years old) are 72% more likely to return because of friends and family than older users. This younger group spends more time on social networks and trusts their friends when deciding where to eat. Because they use social networks, they are more open to social cues, meaning friend ideas have a bigger impact on the food they choose (Figure 3).

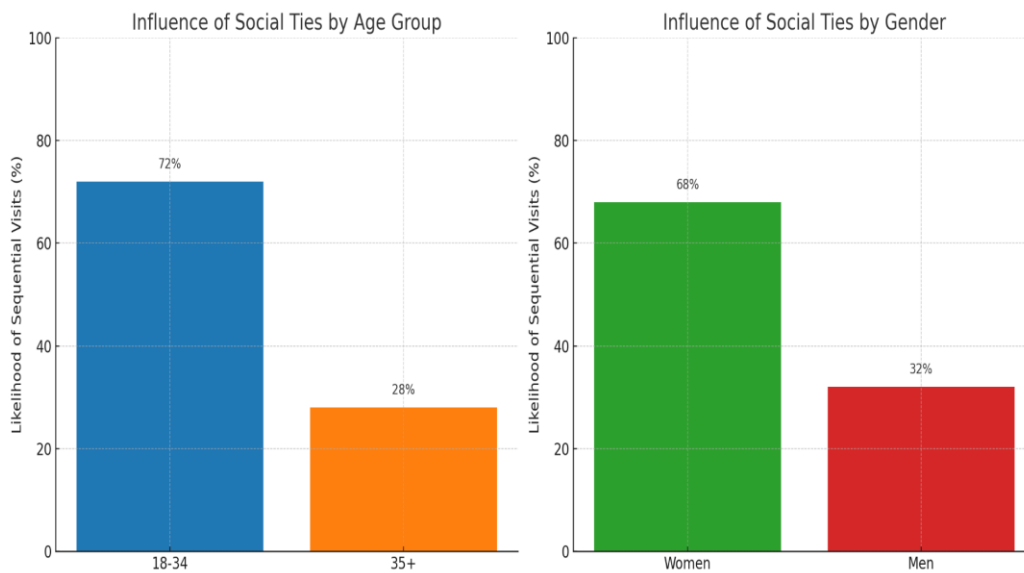


Figure 3. Influence of social ties by age group

Men and women also differ in how social ties affect how often people go to the same place. Women are 68% more likely than men to go places with friends. Behavioral studies show that when women shop, they tend to trust the advice of their friends and other people in their networks more than men do. Women are more likely to ask and accept their friends' opinions, which explains why this higher chance of returning visits is more likely [12]. These facts about demographics show how important it is for marketing plans to consider the different amounts of power that different groups of people have in society. If businesses know these little things, they can better use social media and word-of-mouth marketing to reach certain groups of people.

### *Restaurant characteristic*

The study investigates how different aspects of a restaurant affect the chance of repeat visits affected by social ties on Yelp in the Phoenix metropolitan area. One interesting result is that the type of restaurant greatly affects these habits. Compared to solo restaurants, chain restaurants have a 78.6% lower chance of friends visiting repeatedly. This is because their menus are usually the same, and many people see their brand shows that peer suggestions may have less of an effect on buyer behavior when it comes to chains, where customers are already loyal to the brand and know what to expect (Figure 4).

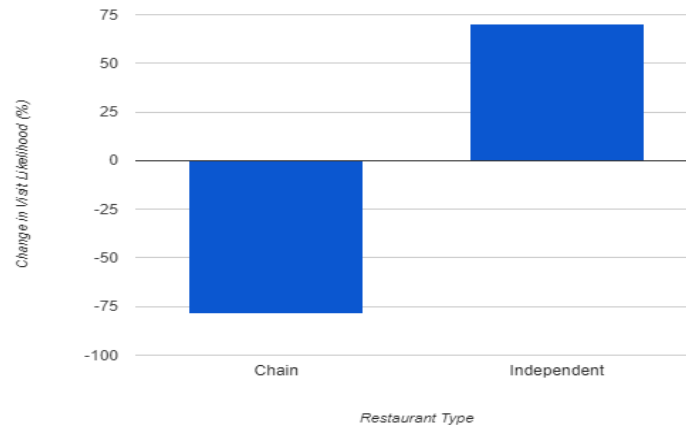


Figure 4. Impact of social ties on restaurant visits

The study also shows how reviews of restaurants can change the way social effect works. A good review (above four stars on Yelp) usually makes friends 70% more likely to return to a place. This shows that good reviews and scores on the internet have a bigger effect on how people spend their money on social networks [3]. Good feedback makes a restaurant look better and strengthens social ideas among linked users, attracting more people to the restaurant. These new facts about businesses can help with marketing plans that want to use social networks to get people to buy things. Targeted advertising to get more good reviews and getting people involved in their communities around small businesses could strengthen the effect of social ties on consumer behavior, leading to more trips and longer-term customer engagement [12].

#### *Geographical patterns*

How much social ties affect restaurant trips depends a lot on how close the place is. We can see from Yelp data from the Phoenix area that where people live and work greatly affects how likely they are to go to the same restaurants as their friends. Users who live close together are 60% more likely to return after a break than those who live farther apart. Social networks and how neighborhoods work greatly impact how people buy things [13]. Locals are more likely to hang out with each other by doing things like going to a restaurant. This supports each other's choices and makes a loop of impact in the group.

Furthermore, connected people who work close to each other are 55% more likely to go to the same place more than once. People who work in open areas are more likely to meet new people and hang out with them outside of work, which can change what they eat. Social tips are more useful and powerful when people who work together eat together because they are close by [14]. These results show how important social factors in a place are in shaping how people act as customers (Figure 5).

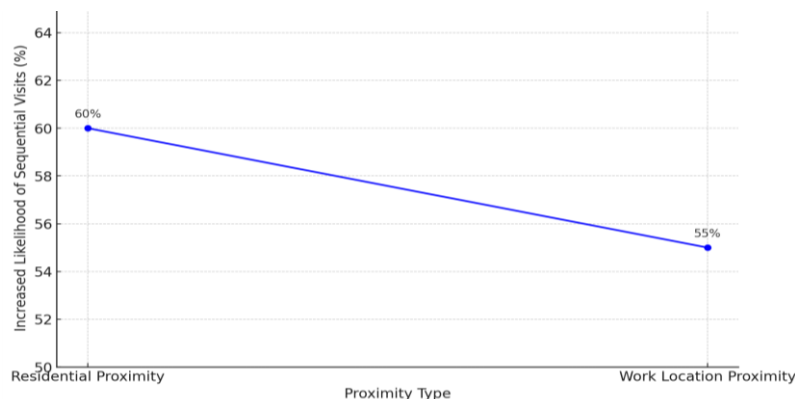


Figure 5. Influence of geographical proximity on sequential restaurant visits

These specifics can help business owners and marketers make ads and deals that are more relevant. For instance, companies in the area can do better with their advertising if they target people who live and

work there. Giving office workers group savings or lunch deals is a good way to take advantage of the social exchanges between these close-knit groups. If businesses know how social networks and being close to people work together, they can make more targeted and effective marketing efforts. Restaurants can get more customers and keep them coming back by using the natural ways people connect at work and in their neighborhoods [13]. Social and location data can be used smartly to improve marketing and engage more people.

### 5. Discussion

The study shows that many factors affect how people behave in places and how they use social networks.

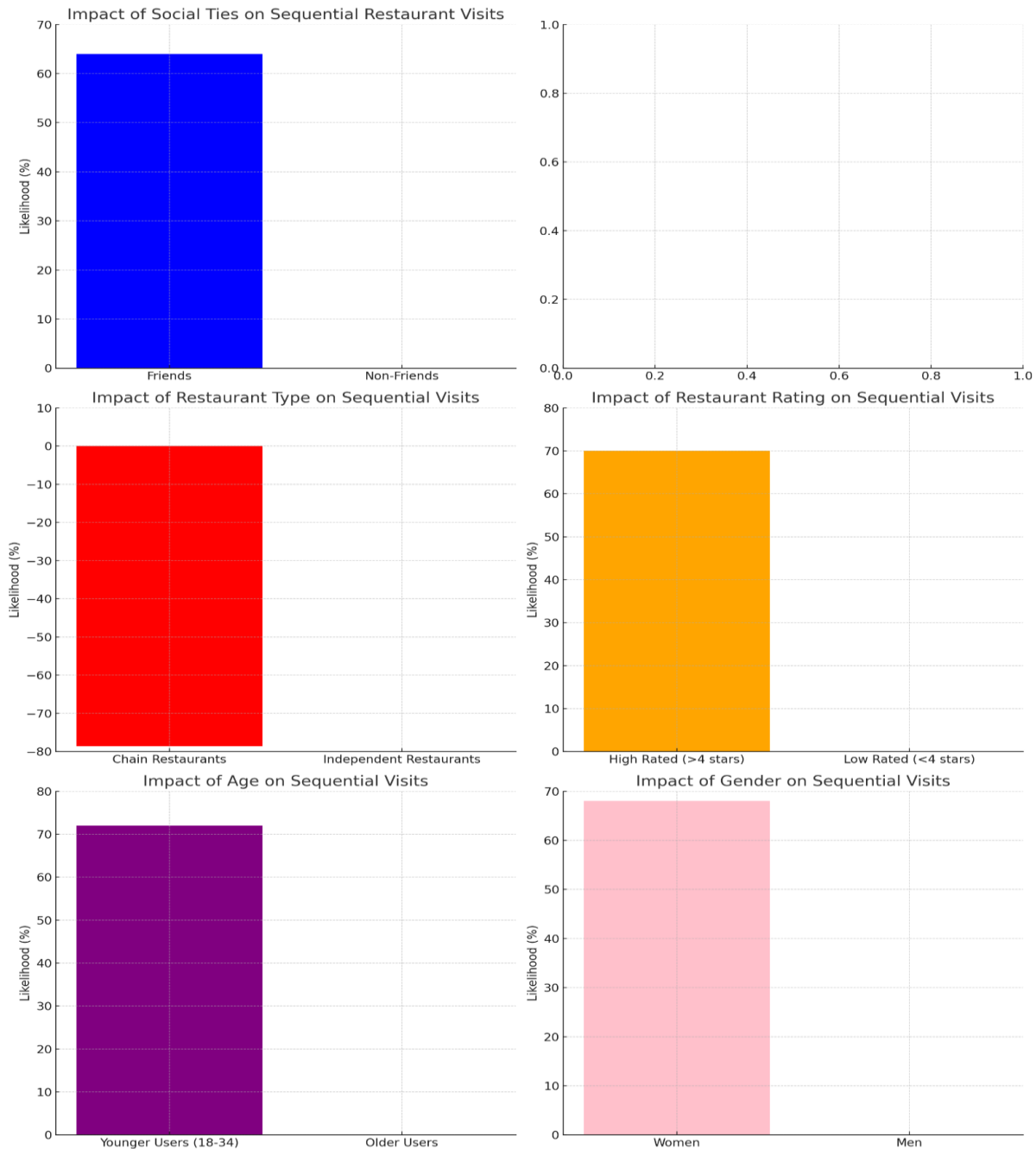


Figure 6. Impact of factors on sequential visits

The 64% rise in friends visiting restaurants together on Yelp shows how strong social ties affect food choices. People from many different groups feel this way, but it depends on the type of place and how close it is to the customer. The findings show that social networks, especially online, like Yelp, greatly



affect how people choose what to do. Interestingly, people who are friends on Yelp are more likely to go to the same places repeatedly [11]. This shows how strong social pressure, and ideas can be. This is especially important when you're going out to eat since people are more likely to believe recommendations than ads or other types of marketing (Figure 6).

#### *Implications for marketing strategies*

Understanding how different social ties affect people's behavior gives marketers useful information they can use to improve their tactics. Targeting specific groups of people becomes an important method. For example, women and people between 18 and 34 have stronger social impact effects, making them good targets for advertising efforts [15]. Younger users are more involved on social media and rely heavily on tips from their peers when choosing where to eat. Conversely, when purchasing, women tend to weigh more on social recommendations and network connections. Adapting marketing to these groups can raise the number of people who connect and buy.

Increasing the exposure of highly rated places is another good idea. The study found that places with four or more stars are 70% more likely to have friends visit repeatedly. Promoting these businesses on social networks can make them more visible and appealing to linked people, leading to more people visiting and buying food [16]. Positive reviews and scores strengthen the effect of social suggestions, which leads more linked users to buy from the business. Campaigns that are aimed at specific areas can also work well. The study shows that being close to a restaurant is a key factor in making social ties, which has a bigger effect on restaurant trips. Users who live in the same census block group are 60% more likely to visit again and again, and for linked users, closeness based on workplaces increases the chance by 55%. Marketers can carefully target groups of connected users using geographical closeness for home and work [16]. Localized marketing can use how people connect in the workplace and neighborhoods to change how people act.

#### *Methodological advancements*

This study uses more complex statistical methods, like hierarchical grouping and dyadic fixed effects models, to deal with methodology-related issues, such as endogeneity and homophily. Endogeneity is when things that explain something are related to the error term. It can change the results if this needs to be thought about properly. Also, homophily—the desire to connect with and bond with people like you—can throw off the study. The study uses these methods to understand how social ties affect going to the same place repeatedly [17], [18].

This makes the data more accurate and reliable. This way of grouping people puts them into groups based on habits and actions that can be seen. With this method, you can divide your customers into groups and see how social impact works in each group. They can give a more accurate picture of how social ties affect people because they consider differences between pairs of people that can't be seen. These changes to how studies are done help us understand how social networks change how people act better [19].

#### *Limitations and future research directions*

The study adds to what is already known but has some things that could be improved. One big problem is the amount of data that can't be sent. The information comes from Yelp records from the Phoenix metro area. They might not work in other places where people eat differently or have different income levels. Researchers should do the study again in different places to be sure the results are right and to find out how the effects on society are different in each area. Something else that needs to be corrected is how time changes [20]. Since the data is cross-sectional, it's hard to say how the social effect might change over time or in response to economic or weather changes.

Longitudinal statistics give us a full picture of how the dynamics of social effects change over time. In the future, holidays, poor economic times, or changes in social media systems could change how customers act and connect. The study only looks at restaurants; it doesn't look at how social networks might affect other kinds of companies. Expanding the study to include other business areas, like shopping, entertainment, or travel, might help us determine how social ties affect how people act. In different fields, social effects might look different. Knowing these differences lets you make better marketing plans for those businesses [21].

It might be helpful to use qualitative and quantitative methods to learn more about the choices and reasons people make that lead to return trips that are influenced by their social ties. These questions help us understand why people trust certain friends' advice, how they read reviews on social media sites, and how they decide where to eat. Ultimately, this study helps us learn more about how important social networks are for changing how people act in the food business. If marketers know these things, they can use social impact more effectively and engage people more.

The results show how important it is to sell to specific groups, get more people to visit places with good reviews, and make the most of being close. The study used new ways to ensure that the estimates of the direct benefits of social ties were solid and accurate. Endogeneity and homophily were just two of the big problems that these new methods solved. But in the future, scientists should look into what's wrong with the small amount of data they have and how it changes over time. They should also check out other companies and better ways of doing things [21]. Finally, this study makes it possible to research how social networks change people's actions. It also helps marketers improve their companies and be more successful in the digital world by giving them useful data.

## **6. Conclusions**

This study is primarily about how social networks change the way people act, especially when they're in places. The study looks at Yelp data from the Phoenix metropolitan area and finds that differences in demographics, social ties, and restaurant features can all affect what people decide to eat next. The study found that people who are friends on Yelp are 64% more likely to visit the same place more than once compared to people who are not friends. This big rise shows the strong social effects of online social networks and how peer pressure can change people's behavior. The study shows that different parts of a restaurant can change how people interact with each other. A 78.6% drop in the chance of returning to a chain restaurant is much smaller than the effect of returning to an independent restaurant. This shows that people may only need group approval if they are loyal to brands and have similar experiences at chain restaurants.

However, places with more than four stars have a 70% better chance of having friends come back repeatedly. This shows that social help works better when it has good reviews. People in different groups also have very different ideas about how social ties affect going to a restaurant. Because of social ties, people between 18 and 34 are 72% more likely to make more than one stop. This is because they spend more time on social media and trust what their friends say. Men and women are also very different from each other. For instance, women are 68% more likely than men to have trips right after each other. This fits with bigger behavioral studies showing women choose what to buy based on ideas and connections with others.

Friends and family have a bigger impact on where people eat when they are close by. It is 60% more likely for users living in the same census block group to return. This shows how social networks and the way people live in their neighborhoods can have an impact. Being close by at work also increases the chances of returning by 55%. This shows that shared workspaces promote social connections that affect where people eat.

Hierarchical grouping and dyadic fixed effects models are advanced statistics methods used in the study to deal with issues like endogeneity and homophily. These techniques ensure that the estimates of the direct effect of social ties on going to a place again are correct. This makes it more likely that the results are correct. The study tells companies useful things they can use to improve their strategies. Targeting specific groups based on demographics can get more people to interact with and buy from you. Promoting businesses with good ratings on social networks can help them get more attention from people who are already connected [18]. Because homes and workplaces are often close to each other, ads that focus on geography can carefully target groups of connected users by using how neighborhoods work and how people interact at work.

Not all of the study's points are valid because it only looked at Yelp statistics from one big city. It's possible that the data can't be used in other places. It is also hard to see how social effects change over time because the data is set up cross-sectionally. As time passes, experts might look into ongoing data and include different kinds of businesses. Using qualitative and quantitative methods together could help us determine why people who know each other go to the same place more than once. As this study shows, there are big changes in how people act in the food business because of social networks. If businesses understand these forces, they can use social impact in their marketing more effectively, get customers more involved, and make the business more successful.

This research has some noteworthy findings about how social networks change the way people shop, but it also has some issues that need to be fixed. Additionally, the data only includes Yelp reviews from people in the Phoenix urban area. The findings may not be useful in other places where the social and economic situations are different. Later on, this study should be done again in various parts of the world to ensure the accuracy of the results.

The study's cross-sectional design also makes it hard to see how the social effect changes over time. Longitudinal studies could help us understand how customers act and how social networks function when various events take place, such as changes in the economy, new technologies, or social media trends. Lastly, looking at stores or entertainment places instead of restaurants might help us understand how social networks affect people's decisions in a lot of different areas.

### **Declaration of competing interest**

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

### **Author contribution statement**

Andrii Piasta: Conceptualization, Methodology. Andrii Chaikovskiy: Data Curation, Formal Analysis. Oleksandr Dedelyuk: Validation, Resources. Iryna Perevozova: Supervision, Writing - Review & Editing. Andriy Babala: Project Administration.

### **Funding information**

No funding was received from any financial organization to conduct this research.

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