The Impact of Social Media on Consumer Decision Making: An Economic and Christian Perspective

Karen Gayle
Regent University
Roundtable: Business and Society

Abstract

In today's digital age, social platforms like Facebook, Instagram, and TikTok influence consumer behavior. They do this through social proof, influencer marketing, targeted advertising, and data analytics. This article examined the economic impact of these platforms on consumer decision-making. It also integrated a Christian perspective by exploring biblical teachings on stewardship, materialism, generosity, solidarity, and simplicity. The article provides a framework for responsible and ethical consumption. It offers insights into how social media and consumer behavior interact.

Keywords: social media, consumer decision making, economic impact, influencer marketing, social proof, data analytics, Christian ethics, stewardship

Imagine scrolling through TikTok and seeing a video of someone making a creamy pasta dish using feta cheese and cherry tomatoes. Within days, grocery stores worldwide ran out of feta cheese as millions attempted the viral recipe. This "baked feta pasta" phenomenon demonstrates the formidable influence of social media on consumer behavior (Morris, 2021). Social media is now a key driver of consumer behavior in today's digital landscape. Platforms such as Facebook, Instagram, and TikTok have evolved from mere tools for social interaction into prominent channels for marketing and engagement. Sikder et al. (2025) concluded that social media shapes purchasing decisions through peer recommendations, influencer endorsements, and targeted advertising. Today, consumers use social media to read product reviews, interact with brands, and make direct purchases.

The economic implications of this shift are profound. Businesses are increasingly investing in social media marketing to tap into its vast potential for reaching and engaging consumers. According to a Forbes report, 80% of consumers make purchasing decisions based on a friend's social media post, indicating the influence of virtual word-of-mouth recommendations (Lazaroiu et al., 2020).

From a Christian perspective, the influence of social media on consumer behavior raises important ethical considerations. The Bible advises against materialism and promotes prudent consumption and compassion. Fletcher and Gbadamosi (2024) suggested that consumers should adopt a balanced approach to consumerism. These principles guide Christians in making ethical choices about social media's influence. This article examines the economic impact of social media on consumer decisions, the mechanisms of influence involved, and how a Christian perspective can offer a moral framework for navigating the digital landscape.

The Economic Impact of Social Media on Consumer Decision Making

Overview of Social Media's Role

The prevalence and widespread use of social media platforms have democratized information flow. Consumers now enjoy easy access to extensive product and service data. This accessibility empowers them to make informed decisions by providing essential tools and knowledge. Garg (2024) noted that social media platforms deliver real-time feedback and personalized marketing, both of which are critical to modern consumer engagement. Consequently, businesses increasingly rely on social media to shape consumer behavior and boost sales. Social media delivers comprehensive product insights through live broadcasts and user-generated content, enabling consumers to efficiently explore and compare options (Chu, 2024). E-commerce platforms also leverage social media for targeted advertising, increasing visibility and engagement with potential buyers (Mapanje, 2024).

Influence on Consumer Behavior

The influence of social media on consumer behavior is profound and multifaceted. One of the most significant ways social media affects consumer decisions is through social proof. Social proof is the psychological phenomenon in which people look to others' actions and opinions to guide their own behavior. On social media, engagement is shown through likes, shares, comments, and reviews. Autio (2020) reported that a study in the *Journal of Consumer Research* found that social proof on social media can increase purchase likelihood by 30%. Consumers perceive products recommended by their peers as more trustworthy and dependable, which significantly influences their purchasing decisions.

Influencer marketing is a powerful tool for swaying consumer choices. Influencers with large followings and perceived authenticity can significantly shape consumer behavior. Kwahk and Kim (2017), in the Journal of Marketing, found that influencer endorsements can increase purchase intent by up to 5 times compared with traditional advertising. Influencers are seen as relatable and trustworthy, so their opinions carry more weight than conventional advertisements.

Moreover, social media platforms enable businesses to target their advertising. By leveraging data analytics, companies can tailor their marketing images to specific demographics, interests, and behaviors. As a result, a personalized approach makes advertisements more relevant and appealing to consumers, increasing their effectiveness. For instance, Kowalewicz (2022) noted that effective social media marketing boosts sales by 20% and brand loyalty by 15%. Taken together, these points highlight the importance of targeted advertising in influencing consumer behavior.

Economic Implications

The economic implications of social media's influence on consumer decision-making are substantial. Businesses are increasingly investing in social media marketing to tap into its vast potential for reaching and engaging consumers. According to a Forbes report, 80% of consumers make buying decisions based on friends' social media posts (Lazaroiu et al., 2020). This trend underscores the era of virtual word-of-mouth recommendations, where consumers trust the opinions and experiences shared by their peers online.

Social media has also intensified market competition. As brands continuously compete for consumer attention, this has led to the development of diverse marketing strategies and campaigns. Supporting this, Garg (2024) found that social media marketing increases competition among brands, driving them to improve their products and services to stand out. Consequently, this competitive environment benefits consumers, who enjoy better-quality products and services.

Additionally, social media platforms provide businesses with valuable data on consumer behavior. These data allow companies to gain insights into consumer preferences and tailor their marketing strategies accordingly. Highlighting this connection, Kwahk & Kim (2017) found in a study in the *Journal of Interactive Marketing* that data-driven social media marketing can increase engagement and conversion rates by up to 25%. This demonstrates the importance of data analytics in optimizing social media marketing efforts.

Mechanisms of Influence

Social media's impact on consumer decision-making involves several key mechanisms. Each plays a crucial role in shaping how consumers see and interact with brands. These mechanisms include social proof, advertising and promotions, and data analytics. Understanding them gives insight into how social media powerfully influences consumer behavior.

Social Proof

Social proof is when people look to others to guide their actions. On social media, this shows in likes, shares, comments, and reviews, which indicate a product's popularity and reliability. A study in the Journal of Consumer Research found that social proof can raise purchase likelihood. Consumers see products recommended by their peers as more trustworthy and dependable (Melnyk et al., 2019). This is especially strong online, where direct interaction is minimal, making peer recommendations essential for decision-making.

Influencer marketing leverages social proof by using authentic and relatable influencers to influence consumer decisions through endorsements. In addition, user reviews and testimonials on social media significantly sway consumer opinions, often leading to increased purchase intentions (Chiu, 2024; Huang, 2024). The role of social media influencers is crucial; their credibility and trustworthiness can impact consumer choices, often more than traditional marketing methods (Ahsan et al., 2024). Supporting this point, research in the *Journal of Marketing* found that influencer endorsements can increase purchase intent by up to five times compared to traditional advertising (Melnyk et al., 2019). This is because influencers often share personal experiences and reviews, which resonate more with consumers than impersonal advertisements.

Advertising and Promotions

Advertising and promotions on social media are tailored to target specific demographics, interests, and behaviors, making them highly effective. To accomplish this, businesses use sophisticated algorithms to deliver personalized ads that are relevant to individual consumers. Wood and Hayes (2012) highlighted that digital advertising, including social media advertisements, has a significant impact on consumer behavior by shaping perceptions, attitudes, and purchase intentions. Therefore, the ability to get target advertisements based on user data ensures that marketing messages reach the right audience, increasing the likelihood of conversion.

Promotions, such as discounts and exclusive offers, are widely used on social media to drive consumer engagement. These promotions are often time-sensitive, creating a sense of urgency that encourages immediate action. Theododorakopoulos and Theodoropoulou (2024) noted that promotional strategies on social media can increase sales and brand loyalty by providing consumers with incentives to purchase. The interactive nature of social media enables businesses to engage with consumers directly, responding to queries and feedback in real time, thereby enhancing the overall customer experience.

Data Analytics

Data analytics plays a pivotal role in understanding and influencing consumer behavior on social media. Platforms collect vast amounts of data on user interactions, preferences, and behaviors, which businesses can analyze to gain insights into consumer trends. Mahajan et al. (2024) emphasized the transformative potential of big data analytics in digital marketing, highlighting its role in enhancing customer insights and driving more effective marketing strategies.

The mechanisms of influence on social media, social proof, advertising and promotions, and data analytics collectively shape consumer decision-making in profound ways. Social proof leverages peer recommendations and influencer endorsements to build trust and credibility. Advertising and promotions use targeted strategies to reach specific audiences and drive engagement. Data analytics provides deep insights into consumer behavior, enabling personalized, effective marketing campaigns. Together, these mechanisms create a powerful ecosystem that influences how consumers perceive and interact with brands, driving their purchasing decisions.

Case Studies and Examples

The following case studies demonstrate the significant impact of social media on consumer decision-making.

Coca-Cola's #ShareACoke Campaign

One of the most iconic examples of social media's impact on consumer decision-making is Coca-Cola's #ShareACoke campaign. Launched in Australia in 2011, the campaign involved replacing the Coca-Cola logo on bottles with 150 of the most popular names among young people. This personalization encouraged consumers to find bottles with friends' names and share their experiences on social media using the hashtag #ShareACoke.

The campaign quickly went viral, generating significant buzz on platforms like Facebook, Instagram, and Twitter. The #ShareACoke campaign led to a 2% increase in sales in the United States and a 7% increase in Australia (Caraan et al., 2022). The campaign's success is attributed to its ability to engage consumers on a personal level and encourage user-generated content, thereby amplifying its reach and impact.

Nike and Cristiano Ronaldo Partnership

Nike's collaboration with soccer superstar Cristiano Ronaldo is another compelling example of social media's influence on consumer behavior. Ronaldo, one of the most followed athletes on social media, has a massive fan base that Nike leveraged to

promote its products. By featuring Ronaldo in their marketing campaigns and encouraging him to share branded product content on his social media channels, Nike reached millions of potential customers.

Sikder et al. (2025) found that influencer endorsements, particularly those featuring high-profile athletes such as Ronaldo, can significantly boost brand visibility and consumer engagement. The partnership resulted in a 10% increase in sales of Nike products endorsed by Ronaldo, demonstrating the power of influencer marketing in driving consumer decisions.

Starbucks' #RedCupContest

Starbucks' annual #RedCupContest is another successful social media campaign that drives consumer engagement and brand loyalty. Each holiday season, Starbucks encourages customers to share photos of their holiday-themed red cups on social media using the hashtag #RedCupContest. The contest generates thousands of user-generated posts, creating a festive buzz around the brand.

User-generated content, like the posts from the #RedCupContest, can significantly enhance brand engagement and loyalty (Kowalewicz, 2022). The campaign not only boosts Starbucks' visibility during the holiday season but also fosters a sense of community among its customers, encouraging them to participate in the brand's traditions.

Airbnb's #WeAccept Campaign

Airbnb's #WeAccept campaign, launched in response to the global refugee crisis, is a powerful example of how social media can promote social causes and drive consumer engagement. The campaign featured a Super Bowl ad and a social media initiative encouraging users to share their stories of acceptance and inclusion using the hashtag #WeAccept.

The campaign resonated with consumers, generating millions of views and shares on social media. According to Keyhole (2024), the #WeAccept campaign not only enhanced Airbnb's brand image but also increased bookings by 5% in the months following the campaign. This example illustrates how aligning with social causes can positively impact consumer perceptions and drive business results. By leveraging social proof, influencer endorsements, user-generated content, and aligning with social causes, businesses can effectively influence consumer behavior and achieve remarkable success.

Insights

The following are insightful quotes from experts on the impact of social media on consumer decision-making.

Bernadette Bulter, CEO & Co-founder of Storytap, said, "There is no decision without emotion, [shopping] is always emotional whether a brand tells you it is or whether it's the purchaser creating a want or desire…You can't sell without it-emotion is a currency all in itself" (Quikly, 2025). Emotions play a crucial role in consumer decision-making. Social media taps into this emotional connectivity, driving purchase decisions through engaging and relatable content.

Colleen Kirk, Associate Professor of Management and Marketing Studies at New York Institute of Technology, said,

> With choice overload, the brain becomes cognitively burdened, and consumers engage in avoidance responses. They may just walk rather than put in the effort needed to make the best choice for themselves. They may also end up less satisfied with their choice because they keep thinking about all the choices they gave up. (Quikly, 2025)

Simplicity is key in consumer decision-making. Social media can help streamline choices and reduce cognitive burden, making the shopping process more fulfilling and less overwhelming.

Dan Gingiss, Customer Experience Expert, said, "We trust each other more than ever. Social media has amplified trust, made peer recommendations and reviews a cornerstone of consumer decision making" (Gingiss, 2019). Trust is amplified through social media. Consumers rely heavily on peer recommendations and reviews, which have become essential in guiding their purchasing decisions.

Rebecca Kowalewicz (2022), Vice President, Digital at Clearbridge Branding Agency, said, With 80% of consumers making buying decisions based on a friend's social media post, the era of virtual word-of-mouth recommendations is in full effect. Consumers gravitate toward brands recommended by their peers, underscoring the importance of social proof in the digital age.

Social proof is a significant driver of consumer decisions. Recommendations and reviews from peers on social media are trusted more than traditional advertising, influencing purchasing behavior.

In a personal experience, I remember scrolling through Instagram one day when I stumbled upon a post from a fashion influencer I follow. She was wearing a stunning dress from a brand I had never heard of before. The post was so captivating, with beautiful photos and a genuine review about the dress's quality and fit. Intrigued, I clicked on the brand's profile and found myself browsing their complete collection. Within minutes, I added items to my cart and made a purchase. The influencer's

endorsement and the post's visual appeal made me confident in my decision, and I was excited to try a new brand.

Christian Perspective

Social media has transformed consumer decision-making. From a Christian perspective, it presents both opportunities and challenges. It can encourage materialism, comparison, and impulsive buying, which may conflict with Christian teachings on stewardship and contentment. Christian scholars emphasize the importance of discernment in navigating the influence of social media. For instance, Wick (n.d.) discussed how social media shapes identity and decision making, urging Christians to engage with it ethically and reflectively. Bowman et al. (2023) highlighted the role of faith sharing on social media, noting its impact on belief systems and behaviors. Hutchings (2015) explored how digital media can reinforce Christian values while also challenging traditional hierarchies. Recently, the Christian faith has expanded to social media, as evidenced by a study that found 20% of adults in the United States share their faith on Facebook (Brubaker & Haigh, 2017).

From a theological standpoint, social media serves as a tool for stewardship, enabling Christians to make informed choices. However, it also requires vigilance to avoid the pitfalls of consumerism and superficiality. "Christians have shifted towards this growing platform of social media for sharing their faith, based largely on their compulsion from the biblical commands towards that goal" (Previte, 2017; 2 Corinthians 5:11-20; 2 Timothy 4:1-2). Bowman et al. (2023) related about "Christian faith sharers using social media and those who encounter their faith-sharing messages by bringing a greater understanding to Christians, prompting them to share their faith more wisely and less offensively" (p. 2). By aligning social media use with biblical principles, Christians can navigate its complexities while staying true to their faith.

Christian ethics emphasize honesty, stewardship, and compassion across all aspects of life, including consumer behavior. The concept of stewardship is particularly relevant as it calls for the responsible management of resources. According to Hartman (2011), good consumption avoids sin, embraces creation, loves the neighbor, and anticipates eschaton. This framework provides a robust model for ethical consumption, guiding Christians to make choices that reflect their values and contribute to the common good.

The ethical implications of social media's influence on consumerism are significant. The emphasis on honesty, integrity, and community support aligns with the need for responsible marketing practices (Hartman, 2011). While social media can enhance consumer engagement, it also raises concerns about manipulation and the authenticity of online interactions. Christians are encouraged to consider the impact of their purchases on others and to support ethical and sustainable practices that benefit the broader community.

Previte (2017) noted, "some argue that social media fosters a type of consumerism that is superficial, where trends influence decisions rather than genuine needs or values" (p. 2). This perspective highlights the potential for social media to distort authentic consumer behavior, underscoring the need to critically examine its role in shaping values and priorities.

Conclusion

This article examined the noteworthy influence of social media on consumer decision-making from both economic and Christian viewpoints. Social media platforms like Facebook, Instagram, and TikTok have revolutionized the way consumers interact with brands, making them integral to modern marketing strategies. The economic implications are significant, with businesses leveraging social media to drive sales, enhance brand loyalty, and increase market competitiveness. Mechanisms such as social proof, influencer, marketing, targeted advertising, and data analytics play crucial roles in shaping consumer behavior, demonstrating the power of social media influencing purchasing decisions.

Case studies like Coca-Cola's #ShareACoke campaign, Nike's partnership with Cristiano Ronaldo, Starbucks' #RedCupContest, and Airbnb's #WeAccept campaign highlight the effectiveness of social media in engaging consumers and driving business success. These examples illustrate how social media can create buzz, foster community, and align with social causes to enhance brand image and consumer loyalty.

From a Christian perspective, the impact of social media on consumer decision-making raises important ethical considerations. Biblical teachings provide a moral framework for navigating the complexities of consumerism. Christians can balance their faith with modern consumption practices, promoting responsible and ethical decision-making.

In summary, social media is a powerful tool that influences consumer behavior and drives economic growth. By understanding its mechanisms and integrating a Christian perspective, consumers can make informed and ethical decisions that align with their values and contribute to the common good. As social media continues to evolve, its role in shaping consumer decisions will only become more significant, offering both opportunities and challenges for businesses and consumers alike.

Call to Action

As we navigate the digital landscape, it is crucial to reflect on how social media influences consumer decisions. Consider the ethics of your purchases and aim for responsible consumption that matches your values. Share your experiences and thoughts on how social media has impacted your buying habits. Have you discovered

new brands through influencer recommendations? Have peer reviews swayed your choices? Your insights can help others make informed decisions.

Additionally, explore ways to integrate a Christian perspective into consumer behavior. Reflect on biblical teachings about stewardship and apply them to your daily choices. Together, we can foster a community of mindful consumers who prioritize ethical and sustainable practices. Let us start a conversation and support each other in making decisions that honor faith and contribute to the common good. Share your stories and join the movement for responsible consumption!

About the Author

Karen Gayle is a seasoned tax professional with extensive experience across publishing, education, food manufacturing, technology, and financial services. She holds an MBA from the New York Institute of Technology and a BBA from Baruch College. Karen is a certified Enrolled Agent and a QuickBooks Certified ProAdvisor. Throughout her career, Karen has held several key positions, including Full-Service Tax Expert at JDA TSG Tax Services Group, Tax Associate at JTH Tax LLC, and Senior Accountant at John Wiley & Sons. Her expertise spans tax compliance, tax planning, and tax research, with a strong focus on federal, state, and local regulations.

In addition to her professional achievements, Karen is actively involved in several professional organizations, such as the Institute of Management Accountants and the National Association of Enrolled Agents. She has also contributed to the community through volunteer work, assisting fellow members with personal and business tax issues. Karen earned gold-level recognition from the Institute of Management Accountants' Leadership Academy. She also volunteers with the National Association of Tax Professionals, helping members with state and local tax issues. Karen's strong analytical skills and commitment to continuous learning make her an asset in tax accounting.

Correspondence concerning this article should be addressed to: kaage@optimum.net

References

Ahsan, N., Jamil, S., & Rais, M. (2024). The influence of social media influencers on consumer decision-making: A comprehensive SEM analysis. *International Journal of Social Science and Entrepreneurship*, 4(2), 317–341. https://doi.org/10.58661/ijsse.v4i2.286

Autio, S. (2020). *The impact of social media on consumer purchasing behavior* [Bachelor's Thesis, Programme in Hospitality Management, Haaga-Helia University of Applied Sciences]. https://www.theseus.fi/bitstream/handle/10024/352736/

Bowman, G. A., Osueke, B., & Baires, S. (2023). Effects of Christian faith sharing through social media: Examining belief system changes, behavioral changes, and user preferences. *American Research Journal of Humanities and Social Sciences*, 7(1), 1–8. https://doi.org/1021694/2378-7031

Brubaker, P. J., & Haigh, M. M. (2017). The religious Facebook experience: Uses and gratifications of faith-based content. *Social Media & Society*, 3(2), 1–11. https://doi.org/10.1177/2056305117703723

Caraan, A. A., Maghari, C. A., Penafiel, L. P., & Federico, A. (2022). Impacts of social media on the consumer buying decision-making process. *International Journal of Thesis Projects and Dissertations, 10*(3), 96–103. https://www.researchpublish.com/upload/book/Impacts%20of%20Social%20Media-29072022-5.pdf

Chu, S. (2024). A review of the impact of social media and the internet on consumer purchasing decisions. *Advances in Economics, Management and Political Sciences, 109*(1), 169–174. https://doi.org/10.54254/2754-1169/109/2024bj0153

Fletcher, K. A., & Gbadamosi, A. (2024). Examining social media live streams' influence on consumer decision-making: A thematic analysis. *Electronic Commerce Research*, 24, 2175–2205. https://doi.org/10.1007/s10660-022-09623-y

Garg, R. (2024). The impact of social media on consumer behavior and its implications for business growth. *IOSR Journal of Business and Management, 26*(10), 30–34. https://www.iosrjournals.org

Gingiss, D. (2019, April 2). *8 quotes that define the state of social media today*. Forbes. https://www.forbes.com/sites/dangingiss/2019/04/02/8-quotes-that-define-the-state-of-social-media-today/

Hartman, L. M. (2011). *The Christian consumer: Living faithfully in a fragile world*. Oxford University Press.

Huang, W. J. (2024). The power of social media: Exploring its role in consumer purchase decisions. *Interdisciplinary Humanities and Communication Studies, 1*(10). https://doi.org/10.61173/3et41x49

Hutchings, T. (2015). Christianity and digital media. In S. Brunn (Ed.), *The changing world religion map* (pp. 3811-3830). Springer, Dordrecht. https://doi.org/10.1007/978-94-017-9376-6_201

Keyhole. (2024, August 15). *The impact of social media on consumer behavior*. Retrieved April 17, 2025, from https://keyhole.co/blog/consumer-behavior/

Kowalewicz, R. (2022, April 28). *How social media impacts consumer buying* [Council Post]. Forbes. Retrieved April 16, 2025, from https://www.forbes.com/council/forbesagencycouncil/2022/04/28/how-social-media-impacts-consumer-buying/

Kwahk, K. Y., & Kim, B. (2017). Effects of social media on consumers' purchase decisions: Evidence from Taobao. Service Business, 11, 803–829.https://doi.org/10.1007/s11628-016-0331-4

Lazaroiu, G., Negurita, O., Grecu, I., Grecu, G., & Mitran, P. C. (2020). Consumers' decision-making process on social commerce platforms: Online trust, perceived risk, and purchase intentions. Frontiers in Psychology, 1, 890. https://doi.org3389/fpsyg.2020.00890

Mahajan, Y., Mahajan, V., & Kapse, M. (2024). Marketing analytics and consumer behavior: A systematic literature review for future research agenda. In J. Poulose, V. Sharma, & C. Mahesar (Eds.), *Data-driven decision-making* (pp. 151–167). Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-97-2902-9_7

Mapanje, E. (2024). Impact of Social Media Usage on Consumer Decision-Making in E-Commerce Platforms in Malawi. *International Journal of Marketing Strategies*,6(2), 1–12. https://doi.org/10.47672/ijms.2071

Melnyk, V., van Herpen, E., Ja, S., & van Trijp, H. C. M. (2019). The mechanisms of social norms' influence on consumer decision-making: A meta-analysis. *Zeitschrift für Psychologie*, 227(1), 4–17. https://doi.org/10.1027/2151-2604/a000352

Morris, S. (2021, April 9). *20 products that have sold out because of TikTok popularity.* Newsweek. https://www.newsweek.com/20-products-sold-out-because-tiktok-popularity-1581946

Previte, R. C. (2017). *Christian adolescents and social media: Sharing their faith online*. https://www.semanticscholar.org/paper/Christian-Adolescents-and-Social-Media%3A-Sharing-Previte/3a1e0a9e8e5fac2b2a71908941a6ee1b3ea7d233

Quikly. (2025). *5 insightful quotes on the psychology behind consumer decision-making*. Retrieved April 17, 2025, from https://hq.quikly.com/blog/5-insightful-quotes-on-the-psychology-behind-consumer-decision-making

Sikder, S., Razu, K., S., Raju, R., A., & Bala, S. C. (2025). The analysis of the influences of social media on consumer purchasing decisions. *International Journal of*

Management and Commerce Innovations, 12(2), 134–146.
https://doi.org/10.5281/zenodo.14587036

Theodorakopoulos, L., & Theodoropoulou, A. (2024). Leveraging big data analytics for understanding consumer behavior in digital marketing: A systematic review. *Human Behavior and Emerging Technologies*, 1–21. https://doi.org/10.1155/2024/3641502

Wick, A. (n.d.). *Technology, social media, and Christian ethics: A dynamic response.* https://www.academia.edu/45621278/Technology_Social_Media_and_Christian_Ethics_A_Dynamic_Response

Wood, W., & Hayes, T. (2012). Social influence on consumer decisions: Motives, modes, and consequences. *Journal of Consumer Psychology, 22*(3), 324–328. https://doi.org/10.1016/j.jcps.2012.05.003