

**PSYCHOLOGICAL TRIGGERS AND CONVERSION IN DIGITAL ADVERTISING:
EVIDENCE FROM AN EXPERIMENT IN THE SOLAR ENERGY SECTOR**

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Agradecimento à órgão de fomento:

Os pesquisadores agradecem à Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)

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INTRODUCTION

The digital advertising environment has become increasingly saturated, marked by heightened competition for consumer attention across multiple platforms. Within this scenario, the use of psychological triggers, defined as cognitive shortcuts that influence decision-making based on emotions, social norms, or perceived authority (Cialdini, 2021), has become a consolidated strategy in digital marketing. Ferreira (2019) highlights that these mechanisms activate emotional regions in the consumer's brain, particularly effective in visual formats and persuasive language as seen in paid social media ads.

Beyond technological sophistication, marketing strategies have shifted towards more human-centered and relational approaches. Vaynerchuk (2019) emphasizes that brands integrating digital actions with authentic narratives and real-world experiences foster deeper and longer-lasting relationships with consumers.

The solar energy sector, within the broader context of global energy transition, represents one of the fastest-growing renewable sources, especially in tropical regions such as Brazil (Richter, 2010). However, overcoming technical and economic barriers is crucial for its expansion, making effective communication strategies, including digital advertising, even more relevant.

Digital advertising accounted for 38.2% of total marketing investments in Brazil in 2023, with projections reaching 85% within five years. This information tend to reinforce the need for empirical studies that examine how psychological triggers impact the performance of paid advertising campaigns (CENP, 2024). Prior research has indicated the relevance of such triggers in influencing consumer behaviour (Häubl & Popkowski Leszczyc, 2019), yet there seems to be a scarcity of applied studies combining persuasion theory and experimentation with advertising platforms like Meta Ads in emerging markets.

Furthermore, recent studies reinforce the importance of examining psychological triggers from a behavioural and contextual perspective. Laran and Janiszewski (2009) demonstrate that consumer decision-making is not solely driven by isolated stimuli but is also influenced by the dynamic resolution of goal conflicts. In advertising contexts, this suggests that the simultaneous presence of multiple triggers—such as authority combined with scarcity—may produce either reinforcing or contradictory effects depending on the consumer's underlying motivational state. Understanding this interaction is especially relevant in sectors like solar energy, where both rational evaluation and emotional appeal coexist in the consumer journey.

Additionally, Kaptein and Eckles (2012) highlight the heterogeneity in the effects of online persuasion across different audience segments. Their findings show that not all consumers respond uniformly to the same psychological triggers, emphasizing the role of personalization and segmentation in optimizing campaign performance. This observation aligns with the strategic use of Meta Ads' advanced targeting features, which allow advertisers to adjust messages according to audience characteristics such as prior engagement, demographic profile, and interest clusters. Incorporating these nuances into experimental design enhances the applicability and generalizability of research findings in real-world marketing environments.

Thus, the current study aims to analyse how different psychological triggers, reciprocity, social proof, authority, and scarcity, affect engagement and conversion rates in paid advertising campaigns in the solar energy sector, using Meta Ads as the experimental platform.

THEORETICAL FRAMEWORK

Digital advertising has become increasingly reliant on persuasion strategies rooted in psychological principles. Chen, Xiao, and Mao (2021) highlight that persuasion techniques in social media, particularly those based on emotional appeal (pathos), directly influence user engagement, even when content is imprecise or contains misinformation. This illustrates that both cognitive and emotional factors are central to effective advertising in digital contexts. Similarly, Friedman et al. (2022) observe that, given the proliferation of stimuli across platforms, digital advertising today demands personalized approaches anchored in psychological mechanisms of influence. According to Cialdini (2021), key triggers such as reciprocity, scarcity, authority, and social proof function as mental shortcuts guiding decision-making in automatic and often unconscious ways.

These universal persuasion principles, as outlined by Cialdini (2021), are activated by environmental cues, allowing individuals to make rapid decisions without extensive cognitive effort. Ferreira (2019) complements this view by defining mental triggers as specific stimuli that activate emotional and impulsive behavioural zones in the brain, extensively used in marketing to guide choices and accelerate consumer decisions. In Table 1 we summarize the core triggers discussed in the literature and utilised in the current study:

Table 1
Core Psychological Triggers

Psychological Trigger	Definition	Key References
Social Proof	The tendency to adopt behaviours or decisions perceived as common or widely accepted, especially under uncertainty.	Cialdini (2021); Ferreira (2019); Shotton (2018); Mulla et al. (2018).
Reciprocity	A natural inclination to return favours or benefits received, creating a psychological obligation to reciprocate.	Cialdini (2021); Ferreira (2019); Melamed, Simpson & Abernathy. (2020); Chernyak et al. (2019); Hadland et al. (2018).
Authority	Trust in messages or offers coming from perceived experts or legitimate institutions, reinforced through symbols such as uniforms, titles, or certifications.	Cialdini (2021); Ferreira (2019); Dolinski & Grzyb (2020); Smith et al. (2020); Oh, Shafir & Torodov. (2020); Coppock, Ekins & Kirby, (2018)
Scarcity	The perception that a resource is limited in time or quantity increases its perceived value.	Cialdini (2021); Ferreira (2019); Shotton (2018); Park, Lalwani & Silvera, (2020); Häubl & Popkowski Leszczyc (2019)

Environmental stimuli can trigger automatic cognitive representations influencing behaviour without conscious awareness (Bargh & Williams, 2006). This is key to understanding how emotionally or socially primed advertising messages affect consumer actions. For instance, Shiv, Carmon, and Ariely (2005) demonstrate how simple marketing actions such as price positioning can modify not only perceptions but also actual consumption experiences via unconscious expectations.

From a broader perspective, Ferreira (2019) and Forner, Carvalho & Lopes (2024) note that despite widespread use of mental triggers in digital marketing, there is a lack of scientific rigor in measuring their objective effects, especially within platforms like Meta Ads. Empirical studies assessing performance indicators such as reach, impressions, initiated conversations, and cost per result are still needed.

The accelerated adoption of digital channels has positioned platforms like Meta Ads at the forefront of advertising strategies. According to Forner, Carvalho & Lopes (2024), these tools allow highly personalized and measurable consumer engagement. Meta Ads, previously known as Facebook Ads, integrates across Meta's main social networks (Facebook, Instagram,

Messenger, and WhatsApp), offering diverse campaign objectives such as engagement and lead generation.

Moreover, digital advertising's power to influence consumer behaviour via persuasive strategies is well-documented. Chen, Xiao, & Mao, (2021) confirm that even misinformation-based content in social media can shape user engagement through emotional appeals. Friedman et al. (2022) argue for the importance of understanding message characteristics—such as imagery, video use, and impactful phrasing—in shaping purchase decisions in saturated digital environments. Thus, integrating Meta Ads' technical features with psychological persuasion principles creates the potential for more effective campaigns. This study specifically evaluates the performance of different mental triggers under controlled conditions, focusing on lead generation via WhatsApp within the solar energy sector.

Psychological Triggers in Advertising Persuasion

Social proof is a psychological mechanism whereby individuals interpret others' behaviour as a guide for their own actions, especially under conditions of uncertainty. Cialdini (2021) conceptualizes this tendency as a heuristic rooted in evolutionary psychology. In the context of digital marketing, Ferreira (2019) notes that quantifiable social signals such as likes, reviews, and public comments significantly shape consumer purchase decisions. Shotton (2018) provides empirical evidence for this effect, demonstrating that sales of a product can double merely by labelling it as the "best-selling". Cialdini (2020) corroborates this phenomenon with findings from McDonald's restaurants in Brazil and Colombia, where visual and verbal cues marking items as "most popular" substantially increased sales among undecided consumers.

Social psychology research further substantiates the normative strength of social proof. Mulla et al. (2019) illustrate that perceived prevalence of specific behaviours within a social group, descriptive norms, can decisively influence individual attitudes and choices, extending even to sensitive contexts such as interpersonal violence.

Reciprocity, as identified by Cialdini (2021), is a fundamental principle in persuasive communication, predicated on individuals' inclination to return favours or benefits. Ferreira (2019) highlights its applicability in digital contexts, where offering free content or tools can establish a sense of symbolic obligation. Hadland et al. (2018) offer additional evidence from the pharmaceutical sector, showing how minor incentives correlate with increased prescription rates.

Behavioural studies reinforce the robustness of reciprocity across varied contexts. Melamed, Simpson and Abernathy (2020) confirm its persistence even when combined with other motivators, while Chernyak, Kang, and Kushnir (2019) document early developmental manifestations of this behaviour, suggesting deep cognitive roots. In digital advertising, providing free informational materials can activate reciprocity, prompting consumers to engage voluntarily. Consistent with Cialdini's (2021) theory, such exchanges create psychological debt that predisposes consumers to future compliance, enhancing conversion rates in targeted campaigns.

The authority trigger operates through individuals' predisposition to trust and follow instructions from perceived experts or legitimate institutions. Cialdini (2021) underscores this as a heuristic that streamlines decision-making under complexity. Empirical research by Dolinski and Grzyb (2020), drawing from Milgram's obedience experiments, confirms that this effect persists across diverse cultural settings and decision contexts. Ferreira (2019) expands on this by identifying specific visual and linguistic cues, uniforms, titles, statistics, that reinforce authority perceptions in marketing. Complementary studies by Oh, Shafir, and Todorov (2020), and Smith, Chandler, and Schwarz (2020), demonstrate that such cues influence consumer judgments on competence and reliability. Coppock, Ekins, and Kirby

(2018) further illustrate that content attributed to authoritative figures can induce lasting attitudinal shifts.

This psychological mechanism becomes particularly salient under conditions of uncertainty, where consumers seek external validation. Consistent with Cialdini (2021), presenting explicit indicators of authority enhances message credibility and facilitates behavioural compliance. The reviewed literature positions authority as a critical factor in persuasive digital communications, especially where consumer expertise is limited.

Scarcity is recognized as one of the most potent psychological triggers due to its association with loss aversion, a principle where individuals prioritize avoiding losses over acquiring equivalent gains (Cialdini, 2021). Shotton (2018) provides concrete evidence, showing increased consumer responsiveness when messages emphasize potential losses. Ferreira (2019) corroborates these findings, noting the widespread use of scarcity-based language in promotional strategies.

Furthermore, Park, Lalwani, and Silvera (2020) find that scarcity cues shift consumer focus from price evaluation to product availability, overriding rational decision processes. Häubl and Popkowski Leszczyc (2019) highlight similar effects in online auctions, where competitive dynamics intensify perceived value through scarcity. Cialdini (2021) emphasizes that scarcity triggers are most effective when opportunities are framed as temporally or quantitatively limited, a notion supported by Shotton's (2018) findings in utility service switching behaviour. In digital advertising, this mechanism functions as a cognitive filter, accelerating consumer decisions amidst information saturation.

The reviewed evidence consistently identifies reciprocity, social proof, authority, and scarcity as core psychological triggers underpinning digital persuasion strategies. Rooted in social and behavioural psychology frameworks (Cialdini, 2021; Ferreira, 2019), these triggers influence purchasing decisions through automated cognitive processes, often outside conscious awareness (Bargh & Williams, 2006). Current literature further corroborates these mechanisms, underscoring their relevance in environments characterized by high informational density and competitive stimuli (Mulla et al., 2018; Shiv, Carmon & Ariely, 2005; Dolinski & Grzyb, 2020; Oh, Shafir & Todorov, 2020; Park et al., 2020; Häubl & Popkowski Leszczyc, 2019).

METHODOLOGY

This study is characterized as exploratory qualitative research with incorporated quantitative elements, as it presents a controlled experiments in real-market conditions following Saunders, Lewis and Thornhill (2023). The primary goal is to develop an initial understanding of how mental triggers influence the performance of advertising campaigns within the solar energy sector, specifically targeting a microenterprise in Rio Grande do Norte, Brazil.

The study involved bibliographic review to develop the campaign content complemented by analysis of campaign performance data obtained via Meta Ads reports. Although qualitative in focus (Saunders, Lewis & Thornhill, 2023), basic quantitative techniques were applied to compare campaign outcomes, such as initiated conversations, reach, impressions, and cost per result (CPR). Data were analysed through measurement and comparison of numeric performance indicators extracted from Meta Ads reports, as described in Table 2:

Table 2
Metrics analysed

Analysis Metric	Description
Initiated Conversations	Clicks on the ad followed by spontaneous WhatsApp messages within 7 days.
Reach	Number of unique accounts that viewed the ads at least once.

Impressions	Total times ads were displayed on screen.
CPR (Cost per Result)	Average cost per desired action achieved through the ads.

The experiment ran for eight weeks using Meta Ads to promote campaigns for a solar energy solutions company. Eight ads were created with identical targeting, budget, objectives, and schedules, varying only by creative content applying specific mental triggers. Each trigger was tested across two separate weeks to enhance result consistency, as presented in Table 3:

Table 3
Experiment Implementation

Week	Start Date & Time	End Date & Time	Trigger	Application Description
1 & 5	21/04/2025 (00:01) 19/05/2025 (00:01)	25/04/2025 (23:59) 23/05/2025 (23:59)	Social Proof	Real client testimonials displayed through WhatsApp screenshots, highlighting savings and installation data.
2 & 6	28/04/2025 (00:01) 26/05/2025 (00:01)	02/05/2025 (23:59) 30/05/2025 (23:59)	Reciprocity	Free materials offered (e-books and energy-saving guides) sent directly via WhatsApp without commitment.
3 & 7	05/05/2025 (00:01) 02/06/2025 (00:01)	09/05/2025 (23:59) 06/06/2025 (23:59)	Authority	Use of certification seals, mention of over 10 years of experience, 115+ clients, and professional imagery.
4 & 8	12/05/2025 (00:01) 09/06/2025 (00:01)	16/05/2025 (23:59) 13/06/2025 (23:59)	Scarcity	Phrases such as "Last kits available" and "Final chance for 2024 pricing" to induce urgency.

To ensure methodological consistency and control across all experimental conditions, all campaigns were configured using identical settings within the Meta Ads platform (Forner, Carvalho & Lopes, 2024). Table 4 summarizes the key variables and their respective configurations:

Table 4
Campaign Settings

Meta Ads Variable	Definition	Configuration Used
Campaign Objective	Defines the desired user action upon viewing the ad, aligned with broader business goals.	Engagement (Messages via WhatsApp)
Budget Type	Determines whether the budget is allocated daily or across the total campaign duration. The Advantage+ system automatically manages budget distribution to optimize overall campaign results.	Total Budget with Advantage+ Activated
Bidding Strategy	Refers to the auction bid method used by Meta Ads to maximize measurable business outcomes such as sales, customer acquisition, or brand reach.	Highest Volume

The selection of "Engagement (Messages via WhatsApp)" as the campaign objective aimed to stimulate direct consumer interaction, considered a relevant performance metric in the context of service-oriented advertising (Forner, Carvalho & Lopes, 2024). By adopting a total budget with Advantage+ enabled, budget allocation was automatically optimized by the platform, ensuring efficient spending across ad sets. The "Highest Volume" bidding strategy was chosen to prioritize the maximization of total results, focusing on generating the largest possible number of initiated conversations, without imposing constraints on cost per result.

The experiment adopted a hierarchical segmentation strategy to avoid overlap and optimize budget allocation:

1. Instagram engagement in the past 365 days.
2. 1% Lookalike audience based on Instagram engagement.
3. Interests in solar energy and photovoltaics (Rio Grande do Norte, 24+ years).
4. General audience in Rio Grande do Norte, 24+ years.

Each campaign ran for one week, with daily KPI monitoring. At the end of eight weeks, data were consolidated and analysed using Power BI for visual comparison.

RESULTS AND DISCUSSIONS

The main results are presented in Figures 1, 2, 3 and 4:

Figure 1

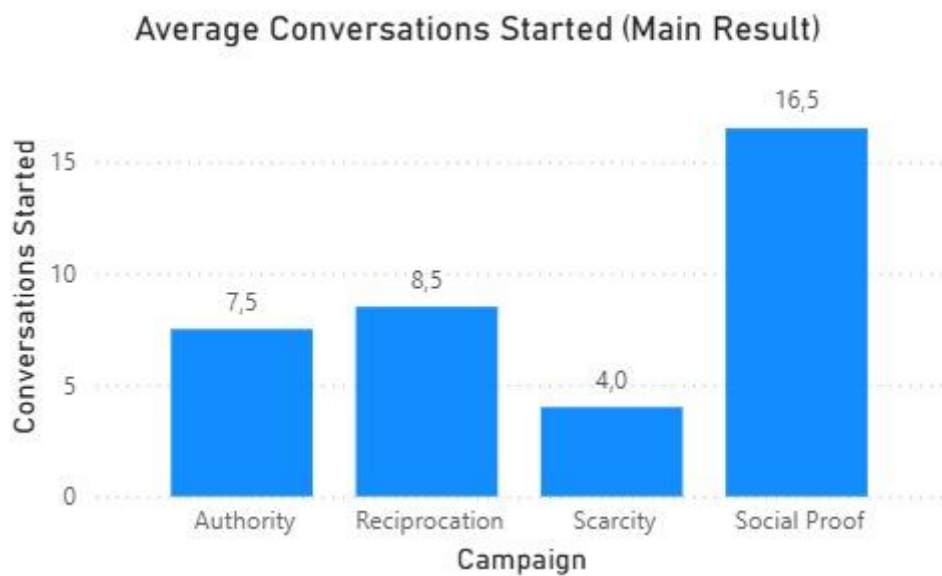


Figure 2

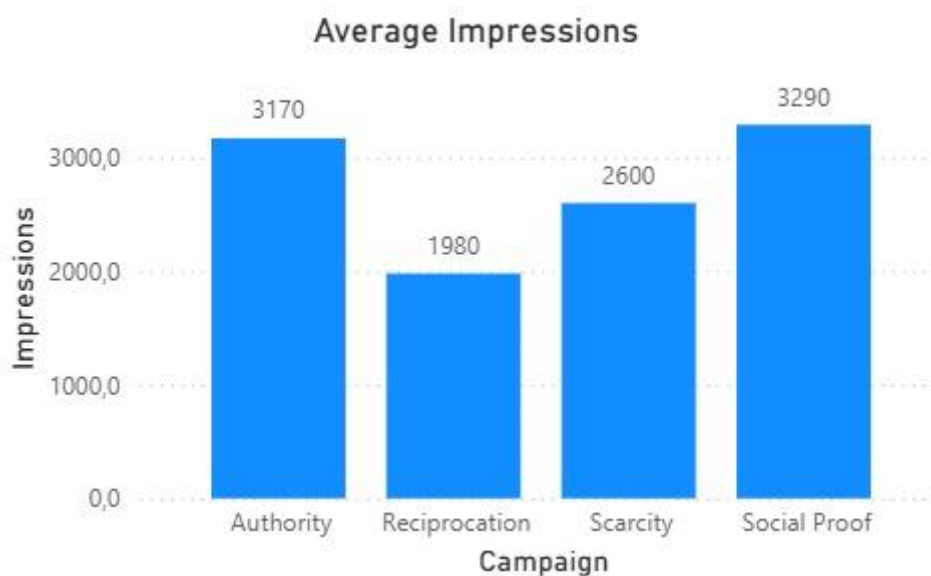


Figure 3

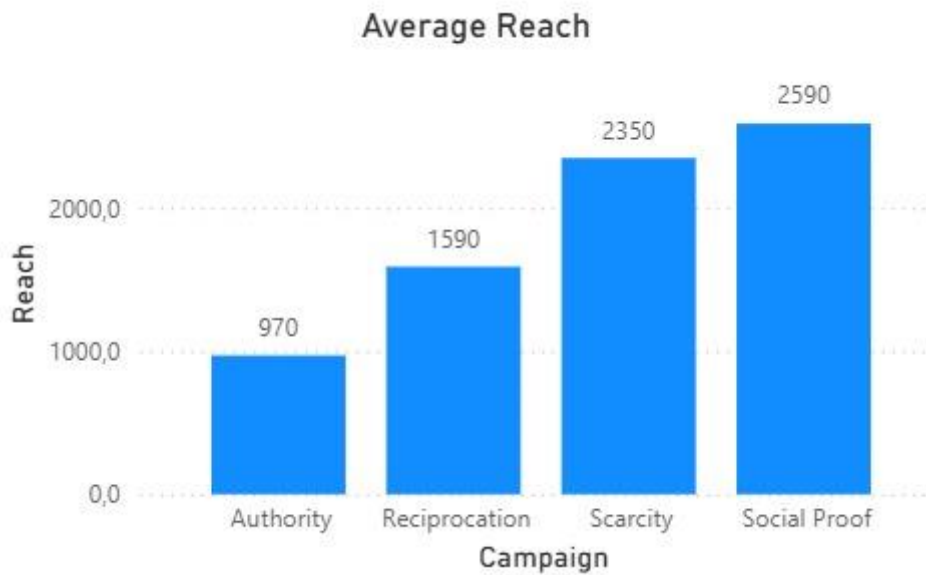
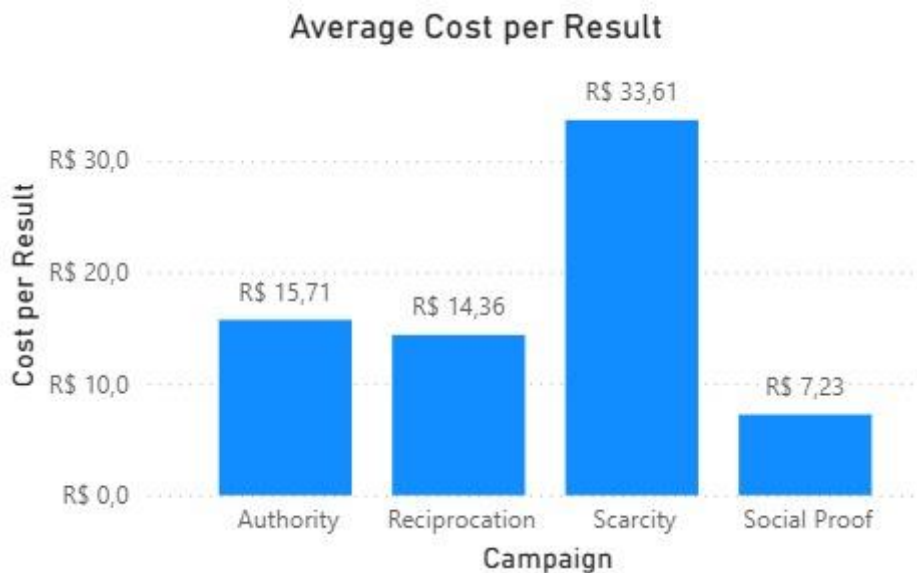


Figure 4



Authority

This subsection presents the results for campaigns utilizing the authority trigger, which aims to establish credibility through signals of expertise, market tenure, and technical specialization (Cialdini, 2021; Ferreira, 2019).

Campaign messages included the phrases "Leading solar energy provider in Rio Grande do Norte," "Over 10 years in the market," "More than 115 clients served," and "Certified technicians." According to Cialdini (2021), this strategy leverages the natural tendency to follow perceived experts.

As shown in Figures 1–4, authority-trigger campaigns averaged 7.5 initiated conversations, 971.5 reached users, 3,167 impressions, and a CPR of R\$ 15.71.

Although impressions were relatively high, reach was the lowest amongst all campaigns. Initiated conversations performed worse than social proof and reciprocity triggers but outperformed scarcity. This suggests that while authority may have conveyed trust, it did not generate as much direct engagement as other triggers.

Consumer response to authority depends on active perception of expertise, which may have been limited by visual language, message clarity, or brand familiarity. As Ferreira (2019)

notes, authority is often more effective in contexts requiring technical trust or institutional credibility.

Scarcity

The scarcity trigger is based on the principle that people value limited resources more highly (Cialdini, 2021). Scarcity induces urgency and exclusivity, encouraging quicker decisions to avoid missing opportunities. Ferreira (2019) reinforces its application in promotional contexts using phrases like "last units available."

In the campaign, the phrases "Last chance to secure your system at 2024 pricing" and "Last kits available" were employed. However, the results indicated lower performance: only 4 initiated conversations (the lowest across all triggers), an average reach of 2,354, 2,604 impressions, and the highest CPR at R\$ 33.61.

Despite reaching a relatively broad audience, engagement was limited. Park, Lalwani, and Silvera (2020) suggest that perceived scarcity can sometimes inhibit impulsive decisions if not paired with high perceived value or social proof. Shotton (2018) also argues that scarcity is more effective when tied to avoiding loss of something already possessed rather than initial acquisition.

Thus, whilst theory supports scarcity as an effective persuasion trigger, empirical results here show suboptimal performance, potentially due to the product's high-investment nature, message framing, or lack of reinforcing elements.

Social Proof

Social proof operates on the premise that individuals follow the actions of others, especially under uncertainty (Cialdini, 2021). Ferreira (2019) emphasizes its strength when similar individuals and ambiguous situations are involved.

In the experiment, the company leveraged real customer testimonials through screenshots of satisfied client conversations. This approach aligns with findings from Mulla et al. (2018), highlighting the decisive role of authentic reviews and perceived norms. Social proof campaigns delivered the strongest results: 16.5 initiated conversations on average, 2,592 reached users, 3,294 impressions, and the lowest CPR at R\$ 7.23.

These outcomes suggest social proof was the most effective trigger in driving both clicks and real engagement. This aligns with Shotton (2018), who demonstrated that "best-seller" labels doubled beer sales in London pubs, and Cialdini et al. (2020), who noted sales increases with "most popular" stickers at McDonald's. Empirical evidence seems to suggest that real, contextualized social proof resonates strongly with target audiences in high-involvement sectors like solar energy.

Reciprocity

Reciprocity is rooted in the human tendency to return favours (Cialdini, 2021). Ferreira (2019) notes that in digital contexts, offering free materials can create a symbolic debt, increasing conversion likelihood.

In this case, free materials included an e-book on saving energy costs and a guide with tips for reducing electricity bills. The message explicitly stated that these benefits were free and without obligation, consistent with Hadland et al. (2018), who observed increased favourable decisions following small offers.

Results showed positive, though moderate, outcomes: 8.5 initiated conversations on average, 1,589.5 reach, 1,984.5 impressions, and an average CPR of R\$ 14.36. Reciprocity generated the second-highest conversation rate, suggesting good acceptance. However, reach and impressions were lower than scarcity campaigns, indicating possibly narrower audience impact.

Despite this, reciprocity's relative effectiveness confirms Melamed, Simpson and Abernathy (2020), who demonstrated its robustness even alongside other incentives. The experiment reinforces reciprocity's potential in paid traffic strategies, especially when the free offer aligns with the final product, as seen with educational materials related to energy savings.

4.1 Engagement Funnels

Figures 5, 6, 7 and 8 present a comparative overview of the engagement funnels generated by each psychological trigger tested throughout the experiment. Each funnel illustrates key performance indicators, including the number of initiated conversations, reach, impressions, and cost per result (CPR), providing a visual synthesis of how each trigger influenced user interaction within the paid advertising campaigns.

Figure 5

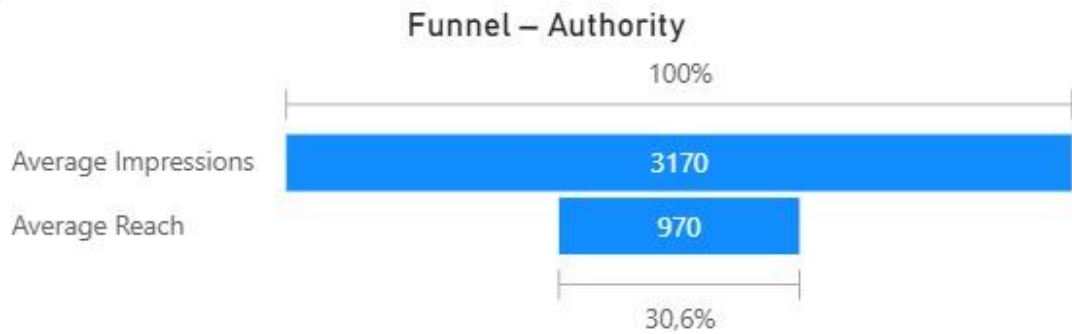


Figure 6

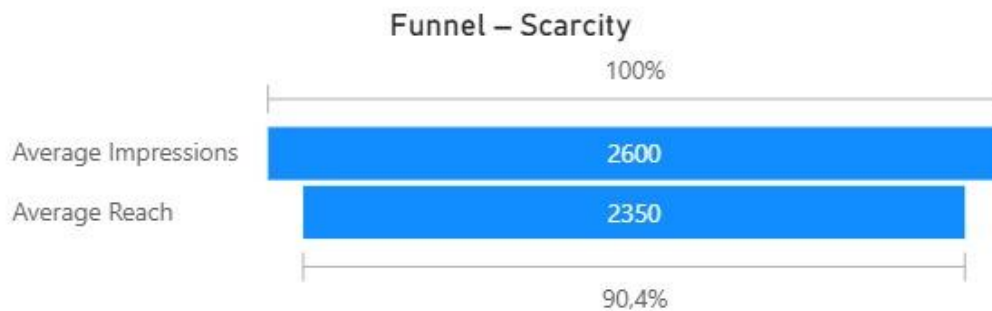


Figure 7

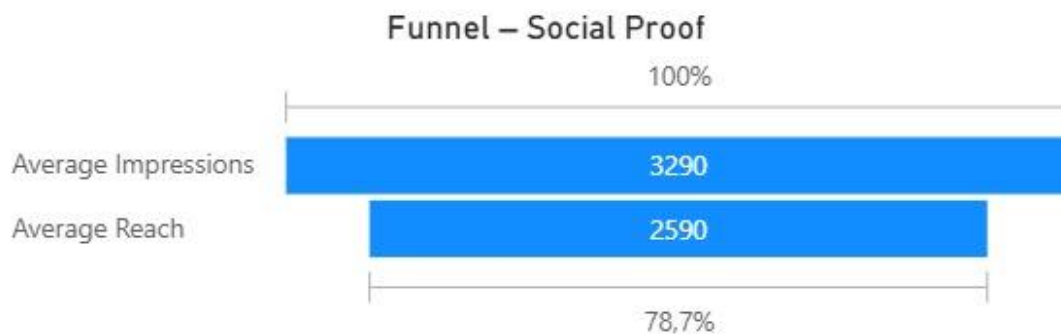
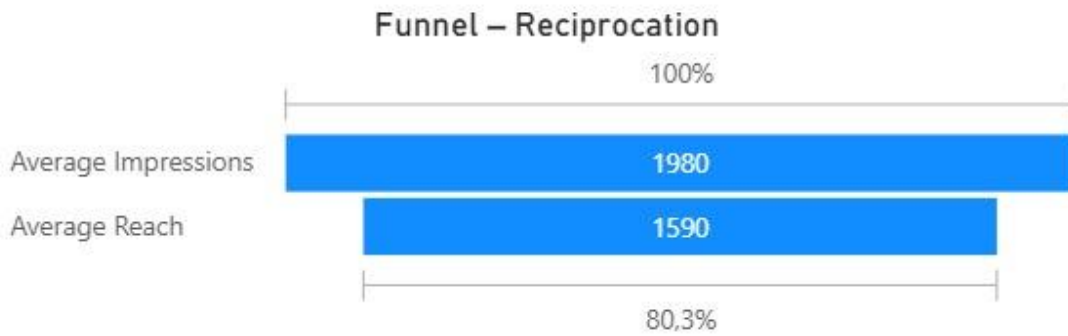


Figure 8



The data analysis conducted over the eight weeks of campaign deployment on Meta Ads revealed significant differences in the performance of each psychological trigger. Based on the performance indicators, initiated conversations, reach, impressions, and cost per result (CPR), it was observed that the social proof trigger yielded the most favourable outcomes in terms of both conversions and investment efficiency, presenting the highest average number of initiated conversations and the lowest CPR.

In this context, such findings suggest that, for the company analysed, the use of testimonials and reviews from satisfied customers serves as a highly effective strategy to generate engagement and attract new leads. From a managerial perspective, the practical implication is clear: increasing the use of social proof (Figure 7) elements in future campaigns may improve the return on advertising investment while simultaneously strengthening the brand's credibility and authority within the solar energy sector.

Conversely, the scarcity-based campaign (Figure 6), despite reaching a relatively broad audience, showed the weakest performance on the main indicator and registered the highest CPR, suggesting lower effectiveness in lead generation within the analysed context. Additionally, the reciprocity and authority triggers demonstrated intermediate performance levels, the latter being more effective in driving conversions, while the former achieved a greater volume of impressions (Figures 8 and 5).

Taken together, the diversity of results indicates that the effectiveness of each psychological trigger depends not only on its theoretical foundation but also on the quality of creative execution, the context of application, and the audience's familiarity with the brand. Furthermore, the alignment between the stimulus and the audience's perception appears to have been critical to the campaign's success, as supported by the works of Cialdini (2021) and Ferreira (2019).

Thus, the data presented in this article may offer relevant empirical evidence for critically understanding how different psychological triggers perform in paid digital media environments, highlighting variations in their effectiveness depending on the type of stimulus used and the level of engagement generated by the campaigns.

FINAL CONSIDERATIONS

The present work aimed to analyse the effectiveness of four psychological triggers, authority, scarcity, social proof, and reciprocity, within paid advertising campaigns on Meta Ads, focusing specifically on their impact on engagement and conversion rates in the solar energy sector. By integrating theories from persuasion psychology (Cialdini, 2021; Ferreira, 2019) with practical digital marketing strategies, the study sought to generate insights relevant for small Brazilian businesses operating in strategic industries linked to the national energy transition (Richter, 2010).

Through controlled experiments in real-market conditions, as recommended by Saunders, Lewis, and Thornhill (2023), this study employed standardized campaigns, identical audience segmentations, and Power BI data analysis to ensure analytical precision. The results clearly demonstrated differentiated effectiveness amongst the triggers: social proof emerged as the most successful strategy, yielding the highest number of initiated conversations and the lowest cost per result. Reciprocity and authority showed intermediate results, while scarcity underperformed, particularly in the context of high-investment products like photovoltaic systems.

These findings reinforce the relevance of adopting humanized communication strategies in digital marketing. Echoing Vaynerchuk (2019), the study demonstrates that authenticity and genuine consumer connection, embodied through social proof, produce superior advertising outcomes compared to more traditional urgency-based approaches. By offering empirical evidence from real-world campaigns, this research bridges theoretical frameworks with practical application, contributing directly to more strategic and evidence-driven traffic management practices.

The main contributions of this study include: (i) providing empirical validation of psychological trigger theories within renewable energy digital marketing; (ii) presenting a replicable methodological framework that combines controlled experimentation with applied data analysis; and (iii) generating actionable managerial insights for small businesses and marketing professionals aiming to optimize paid media strategies in resource-constrained and highly competitive markets as energy transition.

However, all research is subject to inherent limitations. In this case, the scope was restricted to a single company and sector, limiting generalizability. Furthermore, lead conversion beyond the initial WhatsApp conversation was not tracked, preventing full-funnel analysis. The experiment's duration of eight weeks also limits insights into seasonal or medium-term behavioural changes.

Future research should therefore expand sample diversity across sectors and business sizes, incorporate longitudinal tracking from initial engagement to final sale, and explore the combined use of multiple triggers within single ad creatives. Through these extensions, it will be possible to further enrich the understanding of psychological triggers in digital marketing and contribute to the development of more effective, ethical, and consumer-centred communication strategies.

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