

Would you read a news article that was written by a bot?
**Source and message credibility in automated news in relation to readers' choice of digital
financial news**
A quantitative research

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Abstract

Automated news is arguably one of the most contentious technological disruptions in the field of journalistic publication. The reasoning behind this is that conventional method of news indicated a systemic dependence on human resources with intermittent interference of machinery in the publishing process. Automation in news publication, financial or other, is an penetration of machinery, digitization and artificial intelligence into a literature-heavy world. Automation in news publication can potentially be developed and implemented cross-news-column, meaning financial news is merely the beginning of such disruption. This has long sparked heated discussion among professions in news reporting and journalism due to its existential threat of stealing jobs and replacing human in the news workforce. Nevertheless, research on automated news and its implication have not been as diverse in scope of impact, cause and future implications as it should.

Financial news is one of the must-have columns of any business and economics newspaper. Its influence is more tangible than other columns in a newspaper due to its prevalence in the field of financial instrument trading and investment. As a result, the requirement of precision and creditworthiness for financial news reporting is upheld higher than other columns in the spectrum such as real estate and energy.

This study was an attempt to contribute to the limited literature, regarding the customer perception of automated news by answering questions such as how automated financial news are perceived by financial news readers. As a result, to answer the question how financial news readers feel about automated news, the main research question is *“Do message and source credibility of automated news affect finance news readers’ choice of news readership?”*

The sentiment was based on customer perception of source and message of automated news to determine which element decides the level of trustworthiness. The selected research method was quantitative which was conducted in a form of a survey that was created on Qualtrics. The survey was then distributed via personal connections and LinkedIn direct messages. The data from questionnaire was analyzed with SPSS to gain descriptive analytics on five elements, namely accuracy, completion, believability, trust, bias, all of which contribute to news credibility.

The main finding of the study is that audience perceive financial news, both automated and human-written, in certain degree of credibility. The most surprising findings was that messages found in automated news content was deemed more accurate than human-written news content. Another notable findings was that the source of automated news content was perceived to achieve more reader satisfaction than human-written news content. The study also found that, because of the lack of sources in online journalism’s publication, financial news readers tend to rely on news medium and message cues found along a news article to decide where the information was credible or not.

Researchers need to investigate automated news content and the disruption of automation in both creation and publication stages to further reflect readers’ attitude towards automation in news content. Journalists and news companies should determine which elements to be optimized using artificial intelligence and which type of news reporting content should be prioritized using the existing human journalist resources.

Keyword: *Automated journalism, financial news, news readership, customer centric approach, reader perception*

Preface

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CHAPTER I – INTRODUCTION

A press agency is an establishment that is operated as a company, with costs, budgets, and business strategies (Aguiar, 2016). Like any company, a press agency must find a sustainable strategy to maintain certain objectives while staying profitable and advancing towards a long-term goal (Bielsa, 2008). Moreover, press agencies play a vital role in producing a large amount of monotonous jobs which entail a great degree of repetition (Stenvall, 2011). Modern approaches to cost-effective strategies among press agencies made it possible to automate certain phases of editorial production, creating a steady flow of news content (Jääskeläinen & Yanatma, 2019).

A recent report on digital users by Reuters Institute revealed that given 96 percent of the Dutch population has access to Internet, 58 percent of the Dutch digital users read news from their smartphones while online news was reported to be the leading choice of outlet, slowly trumping over traditional print media in the Netherlands throughout 2015-2019 (Newman, Fletcher, Kalogeropoulos & Nielsen, 2019).

Graefe and Andreas (2016) claimed that while news consumers had similar sentiments regarding human-written and machine-generated news products, automated news was rated more credit-worthy than its counterpart. The two authors inferred that automated news proved usefulness to news readers, especially those regularly following financial news, to quickly grasp information. This called for a series of questions about news consumption among press agencies, such as whether there is a potential niche market for (semi)-automated news content and what news consumers specifically demand from press agencies. Such questions resonate the most with press agencies that have already developed software to deliver news stories like *ANP (Het Algemeen Nederlands Persbureau or General Dutch Press)* in the Netherlands (Bilton, 2017).

Subsequently, the early adoption of automation in news production opened the door to possibilities in producing news stories that entail tedious work such as reporting annual earnings and stock market fluctuations (Forbes, 2009). Additionally, automated news coverage can shorten the time gap between the actual event and the information regarding the event being circulated on news outlets (Haim & Graefe, 2017).

For instance, in 2014, *Associated Press (AP)* launched automated news coverage of nearly 2,500 small companies that previously had not received *AP's* reporting efforts (McFarland, 2015). In October 2014, it was reported that within the first two days of a company's earnings fluctuations being reported, its stock trading weight saw a whopping 11 percent increase on average (Simmons, 2017). In similar cases, automated news gave a competitive advantage for professionals in financial fields as it was a quicker way to provide facts (Graefe & Andreas, 2016).

Graefe et al. (2018) concluded that while machine-generated news stories, especially financial news stories, were rated credible despite being seen "boring and dry", human-written news articles ranked higher than its counterpart in terms of "readability". However, the study showed the sophisticated narratives produced by human journalists were seen less trustworthy.

From a business perspective, technological application in any stage of production spells cost efficiency and shortens production time, which is time-appropriate in the 2010s considering the growing demand for fast and real-time news updates from the mass audience (Azemi et al., 2019). From a journalistic perspective, this is considered both an imminent threat and an opportunity for the nature of journalism, both in reporting and editorial (Newman, 2019). Accompanied by data storytelling, a new era of newswriting has been developed dramatically as the computers could scour giant data to locate the diverse and exact information that the no journalists can do with much less cost (Hammond, cited in Levy, 2012). T

That being said, the extent of technological interference in news production depends on the nature of each article. Common observation shows that facts and figure-heavy articles require a lot of data analysis and data selection, of which automated journalism takes advantage (Sivarajah et al., 2017). However, a critique-heavy article would highlight the journalistic role of a writer (Thomas, 2013).

Financial news has witnessed automation for more than five years since the first machine-assisted news article was produced in 2014 (Simmons, 2017). Another reason financial news is chosen as the primary research object was due to its facts and figures-based nature (Barthel & Worden, 2021), which is the key argument in the "human versus automation" topic. This calls for insightful remarks from news readers whose perception and readership shall be involved in the study. Lastly, financial news was chosen for in-depth analysis was due to the researcher's experience in finance as well as corporate and government investment news reporting, which could be of help to the study's journalistic angle.

Societal relevance

Digital news readership in the context of rising pervasiveness of automated journalism (Price, Sanders & Wyatt, 2021) in financial news reporting has called for both societal and commercial relevance. The social relevance involves two primary factors, namely customers' habit of following news on a regular basis and the problem of authorship in journalism.

Take digital news readership in the Netherlands as an example. Wennekers and de Haan (2017) reported that among the European population aged above 15 years old, the Dutch population ranked fifth out of 28 European countries in terms of the frequency of news readership. The research also showed that an average of 39 percent of the surveyed Dutch

participants followed the news via social media channels daily and weekly. According to the study, an editorial team was not necessarily a contributor of such modern news products circulated on social media due to large demand of fast information in the Netherlands as opposed to the traditional news outlets' carefully-curated news products (Wennekers & de Haan, 2017).

The societal relevance of investigating automated news consumption comes from "transparency", which is a norm in traditional journalism (Karlsson, 2011). Such a journalistic norm in the digitally transformative phase in news readership is more consequential as readers access digital news content in a raw venue, meaning unedited and open to editorialization as a story escalates (Fitzgerald, n.d).

Due to the disruptive nature of automation (Kumar, Suhaib & Asjad, 2021) in news production, there is a rising concern about whether news readers demand figures and facts reporting from a news outlet or criticism and editorialisation from human journalists (Graefe et al, 2018). News production outsourced to content-generating software proposed a challenge to news agencies as this sets forth a precedent involving human resources within a news organisation.

Journalists' jobs are downsizing due to cost-efficient business strategies which could spell fears and unsettlement among individuals holding occupations involving literary and creative sense such as writers and journalists (Pithan, Vaclavik, & Oltramari, 2018). As a result, it is of immense importance to discuss such a shift in the human resource management within a news organisation as well as to discuss how journalism would be presented in the next course of five years.

News content being churned out on an hourly basis as being reported by leading news agencies in North America like *Forbes* (Suciu , 2019) and the global agency of *Associated Press* (AP) had leeway to the discussion of authorship within the field of journalism. This not only challenges the very traditional definition of authorship but also opened the door to a multitude of legal and social aspects (Wahl-Jorgensen & Hanitzsch, 2009). The legal matter would explicate the liability of a news author and the hidden legal risk of libel lawsuits (defamatory accusations) potentially originated from mass automation within financial/business news production (Lewis, Sanders, & Carmody, 2019). The presence of automated journalism in news production can spell out challenges to the traditional understanding of concepts such as freedom of speech, especially regarding the First Amendment clause in the United States (Lewis, Sanders, & Carmody, 2019).

Moreover, the social matter refers to a paradigm shift within the editorial field which challenges the traditional role of a journalist exclusive to the elite writers. For instance, AP was reported to circulate algorithm-based news stories since 2014. In contrary to the common notion that automation posing threats to journalists' jobs, automated news stories helped journalists shift their focus onto critical and investigative works by clearing up to 20 percent of their time spent on

content editing (Marconi, Siegman & Machine Journalist, 2017). The social relevance also emerges in the context of authorship rights and recognition between human and bot journalists, which is exemplified in the case of source citing.

Academic relevance

Previous studies have demonstrated large attention to the dynamic between financial news coverage and trading activities like stock price predictions.

Schumer and Chen (2010) concluded that the hefty amount of daily financial news, however insightful to traders and brokers, made it impossible to closely monitor the news flow and predict the stock price movement without the involvement of machine learning. On that account, machine learning-based prediction algorithms proved to be considerably more efficient than human price experts. Hagenau, Liebmann and Neumann (2013) discovered that the stock price movement was dependent on a series of financial news stories. Meanwhile, the guess-ability of stock price was well smaller than 100% accurate if it was based on intelligence gained from financial news.

Furthermore, Shynkevich et al. (2015) found out that it was possible to enhance the accuracy of stock price prediction thanks to the simultaneous use of five categories of financial news, including financial news in finance industry in general, finance sub-industry like stock and bond, finance group industry and sector as well as news coverage of a specific stock. However, the academic research focusing on readers' point of view regarding the application of disruptive technologies in financial automated journalism remained in its infancy.

Research Question

Based on the above discussions, this study targeted at revealing the financial news consumers' perception on automated news, specifically its credibility of source and messages, in Netherlands. On that account, the research question was developed: *Do source and message credibility in automated news affect readers' choice of digital financial news?*

To answer question, relevant concepts were taken into careful consideration to understand the relationship between the credibility of automated news and the selectivity of financial news readers. In the following sections, the concept of automated journalism and its credibility in terms of source and content will be elaborated. After that, the financial news readership along with the relationship between credibility and selectivity behaviour of finance new reader will be elaborated as well.

CHAPTER II – LITERATURE REVIEW

2.1. Automated journalism/news

Automated journalism is a concept of journalism in which disruptive technologies such as algorithms automate news content production based on structured data (Graefe, 2016). There have been developments in discovering the underlying notions of applying technological advancement into the production of news. Among the data-driven approaches to formulate business strategies and new structures, automated journalism is considered one of the most disruptive measures, carrying a multitude of unpredictable implications and unforeseeable direction to the next phase of journalism (Carlson, 2015). Sharing the same idea with Carlson (2015), Monti (2019) defined the term “automated journalism” as an integral part of the post-industrial journalism. They stated the involvement of AI in journalism was to automatically generate stories without the participation of humans, except for the developer of the algorithm.

From a broader perspective, Ali and Hassoun (2019) consider automated journalism as one among four major categories of journalism practice (besides data journalism, algorithm journalism, and metrics-driven journalism) under the influence of artificial intelligence. According to Ali and Hassoun (2019)’s viewpoint, automated journalism describes the journalistic content which is automatically produced under the assistance of technologies. With automated journalism, data is automatically converted into narrative news texts (Ali & Hasoun, 2019).

Pioneering research into automated journalism was conducted by Graefe (2016) in his *Guide to Automated Journalism*. The technology, he argues, offers unprecedented opportunities to produce a large number of articles in different languages in an extremely short space of time. The technology also allows managerial staff to lower production costs while at the same time increases profit margins.

Equally, however, fears are rife that an increase in available articles could lead to information overload, resulting in a lack of orientation in an already “noisy” digital news environment. The wide and growing availability of news is predicted to eventually create burden for readers in selecting the news content which is relevant to their topic of interests (Graefe et al., 2018, p. 12).

Concerns also revolve around the fact that automation could lead to the gradual disappearance of newsroom jobs that are characterised by data intensity, such as weather reports and financial news coverage (Carlson, 2015). Furthermore, algorithms cannot fill the gap that would be left by human journalists should the technology lead to a gradual elimination of such rank-and-file roles: “Algorithms cannot interrogate data or even establish causality and are

therefore reduced the capacity of journalists in observing the facts and formulating or orienting the public's perspective" (Graefe et al., 2016, p. 6).

Or, in other words, it is possible for algorithms to identify the situation but impossible to explain the situation (Haim & Graefe, 2017). It was advised that journalists focus their attention on skills that give them a competitive advantage over increased automation, that is, their ability to create in-depth, investigative journalism that would still require journalists to ask probing questions and to apply a healthy amount of scepticism.

Previous studies ranged from experimental studies of readers' perceptions of automated journalism (Haim & Graefe, 2017) to workshops allowing journalists to experiment with software themselves (Thurman et al., 2017) or as design partners for AI-based tools in journalism (Gutierrez-Lopez et al., 2019). Some of these involved in-depth interviews with practitioners in the field, which is a widely used method with the purpose of understanding more about the experiences, attitudes and perspectives of people when choosing the interested group of journalism professionals (Hermida & Young, 2017, p. 173).

Far less research has thus far uncovered how journalists themselves perceive the phenomenon of automated journalism and its impact in the workplace. However, it is essential to better comprehend how the role of journalism is not just understood as a profession, but as an ideology, giving insights into how journalists attribute their labour with meaning (Deuze, 2005). It is also pivotal to understand how journalists navigate in an environment characterised by frequent innovations, illuminating, not least, the way in which these technologies reproduce, represent or replace the behaviours and ideology of journalism professionals (Young & Hermida, 2015, p. 384).

It further sheds light on what journalists understand their own role and the ways in which this understanding makes their tasks become meaningful and how their job's significance is justified and highlighted (Hanitzsch & Vos, 2017, p. 115). This is a necessary notion to revisit in a media environment best characterised by significant disruption in an increasingly dense, complex, hybrid, multi-channel, interactive and participatory information environment.

2.2. Financial news

Financial news was deemed to have an impactful effect on the outcome of stock price and trading movement. For example, a sentiment analysis into financial news coverage dated over five years (2003-2008) in Hong Kong showed that the sentiment underlying in the semantics of financial news stories had a remarkable impact on the predictability of stock price return, helping financial professionals compare the performance of financial sub-industries in different markets and produce more accurate forecast of future stock price movement (Li, Xie, Chen, Wang & Deng, 2014).

Financial news stories are a source of information that reports and reflects the time-based price of credit default swaps (CDS), which is a credit-based derivative agreement between two parties, a purchaser and a seller where the purchaser deposits a regular payment and receives returns (or a payoff) under the circumstance of a similar credit event and/or a history of default recurring transactions (Vavpetič, Novak, Grčar, Mozetič & Lavrač, 2013).

Schumaker (2010) suggested that the semantics of financial news stories had a major impact on the outcome of the stock market performance of S&P 500 companies' stock trading activities in 2005. Words like "comparable", "charge", "summit" and "green" posed great discounts on stock price. Notably, if the word "hereto" appears in a financial news article, the stock price was more likely to drop by \$0.0029. In contrast, words such as "announcing", "front", "smaller", "planted" and "crude" were more likely to produce a growth in stock return (Schumaker, 2010).

Textual information in financial news was analysed to better forecast stock prices based on contextual characteristics (Hagenau et al., 2013). The analysis of the research paper was similar to the premise of this study, yet differed in the intent. Previous research in financial news in the context of automated journalism was not as rigorously conducted as the topic of financial news and its influence over market volatility (Danzon-Chambaud, 2021). As a result, it is of paramount importance to further study readers' sentimentality towards finance journalism in the context of evolving machine learning.

Financial journalists have to face with the annoyance of quarterly financial reporting which requires them to scan corporations' earnings reports and use the collected output from such scanning assignment to put those figures into pro-forma articles which are template-based. Such repetition of work is monotonous but necessary for investors and professionals to make trading decisions (Haim & Graefe, 2017).

With automated financial news in practice, organizations are benefited with greater coverage of financial news, yet must be willing to accept the possible inaccuracies of such sensitive news reports (Wilding et al., 2018). Automated financial news coverage can affect the desired increase in liquidity, further stir up stock price movement and expose higher risks to retail investors (Haim & Graefe, 2017).

2.3. Source and message credibility

Early academic interests about credibility as a concept dated back to the 1960s, amounting to more than 60 years of theoretical literature on the subject (Hovland & Weiss, 1951). Credibility refers to the trust-related feature which is regarded as the perceived believability of certain sources' content. In order to evaluate credibility, various dimensions such as accuracy and bias should be

taken into careful consideration simultaneously (Ahmad & Jan, 2018). Thus, credibility plays an important role in the field of journalism. As Kovach and Rosenstiel (2021) postulated for the 4th time since 2001, transparency is an indicator of the respect a journalist has for their audience, a motivator of their public interest, and therefore the credibility of their opinion.

In fact, there are three types of credibility, which are message credibility, source credibility and medium credibility. First of all, medium credibility has regard for the channel (which might be either television, newspaper or other types of media) via which the messages and sources are delivered (Golan, 2010). Meanwhile, message credibility focuses on the content and source credibility highlights the role of an author. The role of credibility in journalism is of critical importance because the readers are incapable of verifying all pieces of information provided in a new coverage. Instead, readers have to rely on a story's credibility in order to accurately mediate reality (Harcup, 2015). Therefore, it is sensible to make credibility a focus point of academic research as it is critical to constructing a healthy relationship between readership and journalism.

There are various prior researches into the concept of source credibility (Reich, 2011), medium credibility (Kioussis, 2001) and message credibility (Borah, 2014). There are also studies which focused on the relationship between those types of credibility. For instance, the lack of source credibility which is a recurring issue in online journalism motivates the readers to base on the medium or message cues in order to verify the credibility of a news story (Metzger & Flanagin, 2015).

Nevertheless, it is most frequent for readers to be provided with respective authorships (Graefe et al., 2016) in which the relationship between message and source credibility becomes related. As long as the credibility of source is high, the message will be also considered as credible (Roberts, 2010). Although the positive relationship between trust in medium and source credibility was acknowledged, this study did not pay much attention to medium credibility (Lucassen & Schraagen, 2012). The reason underlying this might be explained by the fact that only print publications apply journalistic algorithms.

Previous researches into the concept of automated journalism and its credibility is proved to be helpful to the line of research in credibility. According to Carlson (2015), automated journalism in relation to perceived credibility might be understood as "algorithmic processes that convert data into narrative news texts with limited to no human intervention beyond the initial programming". However, attention of previous studies seems to be too much focused on journalists (Kim & Kim, 2016) and the way automated journalism affect journalists' skills (Van Dalen, 2012).

Previous studies measured the nuance of how automated articles are perceived by news reader in different countries in Europe and East Asia, including Sweden (Clerwall, 2014), the Netherlands (Van Der Kaa & Kraemer, 2014), Germany (Graefe et al, 2016) and South Korea (Jung et al., 2017). Those researches shared the same focus of quality evaluations in which the first three papers mentioned credibility assessment and quality assessment as the same concept. Meanwhile, the final piece of paper developed by Jung et al. (2017) only refers to credibility as one of the integral parts of the broader concept of quality assessment.

In terms of message credibility, the algorithms automatically create the content which was proven to have higher credibility score than the articles written by journalists (Graefe et al., 2016). It is highlighted that although the differences in message credibility between automated and traditional journalists were perceived to be not significant (Clerwall, 2014), such finding based on too small a sample of only 46 respondents which cannot generalize about the whole field of journalism. In consequence, hypothesis 1 is proposed as follows.

H1: Financial news readers' perceived message credibility of automated journalism content higher than that of human-written content.

In terms of source credibility, the differences was pointed out between the source credibility of articles produced by algorithm and human (Graefe et al., 2016). Accordingly, Tandoc et al (2020) highlighted that when the news was written by human journalists, the source credibility was stable regardless of the objectivity of the news coverage. Nevertheless, if the news was written by algorithm, the source credibility was proved to be higher, given that the news was objective. Combined authorship between human journalists and algorithm was proved to have significantly high source credibility if the news was objective. Consequently, hypothesis 2 is proposed as follows:

H2: Financial news readers' perceived source credibility of an algorithm author higher than that of a human author.

The current papers which focus on the comparison between automated and human journalism only in isolated condition. However, in this study, due to the lack of evidence regarding the reader perception toward co-authorship of algorithm and human journalists, there is no additional hypothesis to be added regarding this combination.

2.4. Customer-centric approach

Customization, or personalization, has been an emerging marketing trend among organizations in which customers' online activities were individualized by user-based data collected by marketers (Dangi & Malik, 2017). Retention rate, which is defined as the percentage of customers continuing purchasing and using products/services of suppliers (Aspinall, Nancarrow,

& Stone, 2001), is also among the most talked-about factors among organizations. Retention rate is accentuated among news agencies whose customer base allegedly was going through a phase of instability and uncertainty (Johan et al., 2020).

Thanks to the customer-driven approach, or reader-centric in this case, the experience of news reading could be tailored to each news reader, ensuring a strong bond between the newsreader base and a news organization (Shah & Dastidar, 2019). News readership is not only experienced through the act of reading a news article but also harbours other possible interactions among news consumers, the news organization and journalists (Vishnupriya, Kathiravan, & Sriram, 2014). Thanks to the customer-centric approach, news readership was more likely to have a remarkable impact on a news consumer's daily routine as well as their intention towards the news outlet (Domingo, 2008).

It might be questioned that whether the organization maintains a customer-centric approach if their service is developed without the intervention of human. Nevertheless, these two concepts are not that much conflicted (Pardo-Jaramillo et al, 2020). Along with the emergence of “customer-centric AI” concept, it is expected that the interactions with customers will be expanded. So, the question is what customer-centric AI is really about.

Specifically, it is understandable that the customer-centric AI enables the organization to exploit personalized experiences at scale without the involvement of any manual programming (Omale, 2019). Personalization at scale is important for organization to gain sustainable competitive advantages (Stablow, 2017). Nevertheless, the task of gaining high-quality customer experiences by obtaining personalized interactivity at scale is excessively challenging.

Enterprises, especially those with a large customer base, might not have adequate resources to individually respond to customers' inquiry in a timely manner. With customer-centric AI, this problem could be definitely solved. Customers usually give certain groups of common questions which could be automatically replied with an industry standard response (Shah et al, 2006).

Questions such as "what do news readers of a certain column need from journalists and editors?" and "to what extent can computer-generated journalism satisfy such demand" could be answered through a rigorous search for typical news readers of a news organization and in-depth analysis into their specific demand for a news column, especially financial news in this case. The reader-oriented approach also allowed the researcher to later create a 'buyer persona' or a 'reader persona' where the image of typical news readers can be visualized and in turn, becomes relevant to news organizations as content producers (Cruz & Karatzas, 2017).

2.5. News readership

The dynamic between financial news coverage and the stock market movement was proven to have a close encounter. For example, an investigation led by *Harvard Business Review* into news readers behaviour in 2016 unveiled that finance professionals like hedge fund managers and broker-dealers were among the heaviest consumers of financial news content. Specifically, despite constituting only 8 percent of total financial workers, hedge fund managers consumed 27 percent of total news articles concerning matters of financial industry and sub-industries (Fedyk, 2016).

The measure of cost-efficiency within a news organization does not necessarily equate with positive feedback from news consumers. News readership was believed to be closely connected with news sharing among financial professionals as a way of tightening a sense of community and reciprocity, allowing professionals to discuss stock market fluctuations and make subsequent projections like proceeding with an investment decision (Goh et al., 2019).

Before the introduction of automated journalism, it was news readers' trust in a news organization's credibility that assured the stability in news readership, especially among loyal news subscribers (Wilding et al., 2018). However, the incorporation of a content generator would be a 'brow-furrower' since the transparency and the trustworthiness of a machine lies in a grey area, which means news consumers cannot pinpoint whether they could still place their trust in such a disruptive approach towards content production (Wölker & Powell, 2018).

News audiences also show their concerns toward the news dissemination and content customization by news written by bots. Specifically, the content which is personalized by the algorithmic journalism might result in the fragmentation of the public opinion (Graefe, 2016). Additionally, algorithmic journalism might create "news echo chambers" which might change the perspective of news readers, except the ones who have already agreed with the rather nuanced message of the news before.

2.6. News selection

With the purpose of examining the impacts of automated contents' credibility on reader's choice of news, the research makes attempts to identify the relationship between news consumption and automated news content. This association depicts a unique approach of this paper as it branches out to solely financial news. In fact, the prior studies focusing on the relationship between credibility and the selection of news readers are relatively limited, leaving a gap in the literature (Winter & Kramer, 2014; Williams, 2012).

In this paper, news selection will follow the definition by Oxford Dictionaries (n.d.) which renders this concept as the careful selection of the articles that are most appropriate and adequate to read. The selection of credible news is affected by the fact that data is abundantly available but is rarely reviewed.

Distinctly, the behaviour patterns of readers toward news selection is associated closely with the matter of utility (Williams, 2012). It is highlighted by Winter and Kramer (2014) that the news selection behaviour of readers in the online platforms is affected strongly by their evaluation of source credibility. Findings from Winter and Kramer (2014) also indicated that credibility assessment is not the sole factor determining users' choice of news in the market. Instead, news selection is also affected by whether the source is read for longer, selected more frequently or selected previously or not.

Winter and Kramer (2012) posited that the content of the message also strongly affects the readers' selection of news. It is more frequently for the two-sided blog articles to be selected by readers than the one-sided content. On this account, the role of message quality, involving the credibility evaluation and perceived balance in an argument covered in news, is proved to be significant. Therefore, source and message credibility are effective in predicting readers' decision to select certain content. As a result, the following hypotheses are provided as follows:

H3a. Source credibility of automated news positively affects the likelihood of financial news readers to select automated news articles for consumption.

H3b. Message credibility of automated news positively affects the likelihood of financial news readers to select news journalism articles for consumption.

2.7. Conceptual model

This study targeted at addressing the literature gap in investigating financial news consumers' perception on automated news, specifically the credibility a news story's source and messages, in Netherlands. This led to the research question: *Do source and message credibility in automated news affect readers' choice of digital financial news in the Netherlands?*

Regarding news reader's perception on automated financial news, previous research largely focused on readers' perceptions of automated journalism (Haim & Graefe, 2017). However, the branch of automated financial news has received less attention in terms of news reader's perception and general reading behaviours.

Additionally, studies about automated financial news in relation to other reader-centric factors such as perceived credibility and reading behaviours remained infancy comparing to the more sought-after subject of financial news impacting trading markets (Danzon-Chambaud, 2021).

Source, medium and message credibility have been the focus of credibility studies (Kioussis, 2001; Reich, 2011; Borah, 2014). However, research on the credibility of financial news

in the context of automation in news production was not vastly explored, leaving room for future studies to dive in specific news column in the context of automated journalism.

Furthermore, due to the challenge of data privacy, it was proven extremely challenging to gain insights into user experience (Stablow, 2017) without tracking internet content consumption through means such as third-party cookies.

In fact, Google together with a multitude of online browsers, announced the near end of third-party cookies by the end of 2023, protecting its user privacy by ceasing the activity tracking practice (Lomas, 2021). As a result, research attempts on online activities' personalization for financial news readers can only reach a limited number of attributes of reader behaviours.

Previous research showed algorithm could create news content ranked higher in terms of message credibility with a small study sample of 46 respondents (Robert, 2010). This sparked curiosity in whether the results remain unchanged if the sample population were larger and asked specific questions about whether a news story's message is (1) inaccurate or accurate, (2) incomplete or complete, (3) unbelievable or believable, (4) can be trusted or cannot be trusted, and (5) biased or not biased.

Thus, the hypothesis H1 was developed below to test if accuracy, completion, believability, trustworthiness, and bias influenced the credibility of a new story's message.

H1: Financial news readers' perceived message credibility of automated journalism content higher than that of human-written content.

Additionally, the credibility of a news story's source is ranked higher if it was produced with the interference of algorithms (Tandoc et al, 2020). This led to the question of whether the credibility of a new story's source remains high thanks to perceived objectivity and influences news reader's perception if it is (1) inaccurate or accurate, (2) fair or unfair, (3) tells the whole story or does not tell the whole story, (4) can be trusted or cannot be trusted, and (5) unbiased or biased.

Consequently, the hypothesis H2 was developed below to test if accuracy, completion, believability, trustworthiness, and bias influenced the credibility of a new story's source.

H2: Financial news readers' perceived source credibility of an algorithm author higher than that of a human author.

Furthermore, the credibility of a news story's source and message proved efficient in forecasting news readers' decisions to select automated news or human-written news (Winter & Kramer, 2012). As a result, the hypothesis H3, with two parts, was developed to test if:

H3a. The credibility of a news story's source affects the likelihood of financial news readers to select automated news articles for consumption, and

H3b. The credibility of a news story's message affects the likelihood of financial news readers to select automated news articles for consumption.

The conceptual model below is an visual interpretation of three formulated hypotheses, based on the literature review and the research question developed.

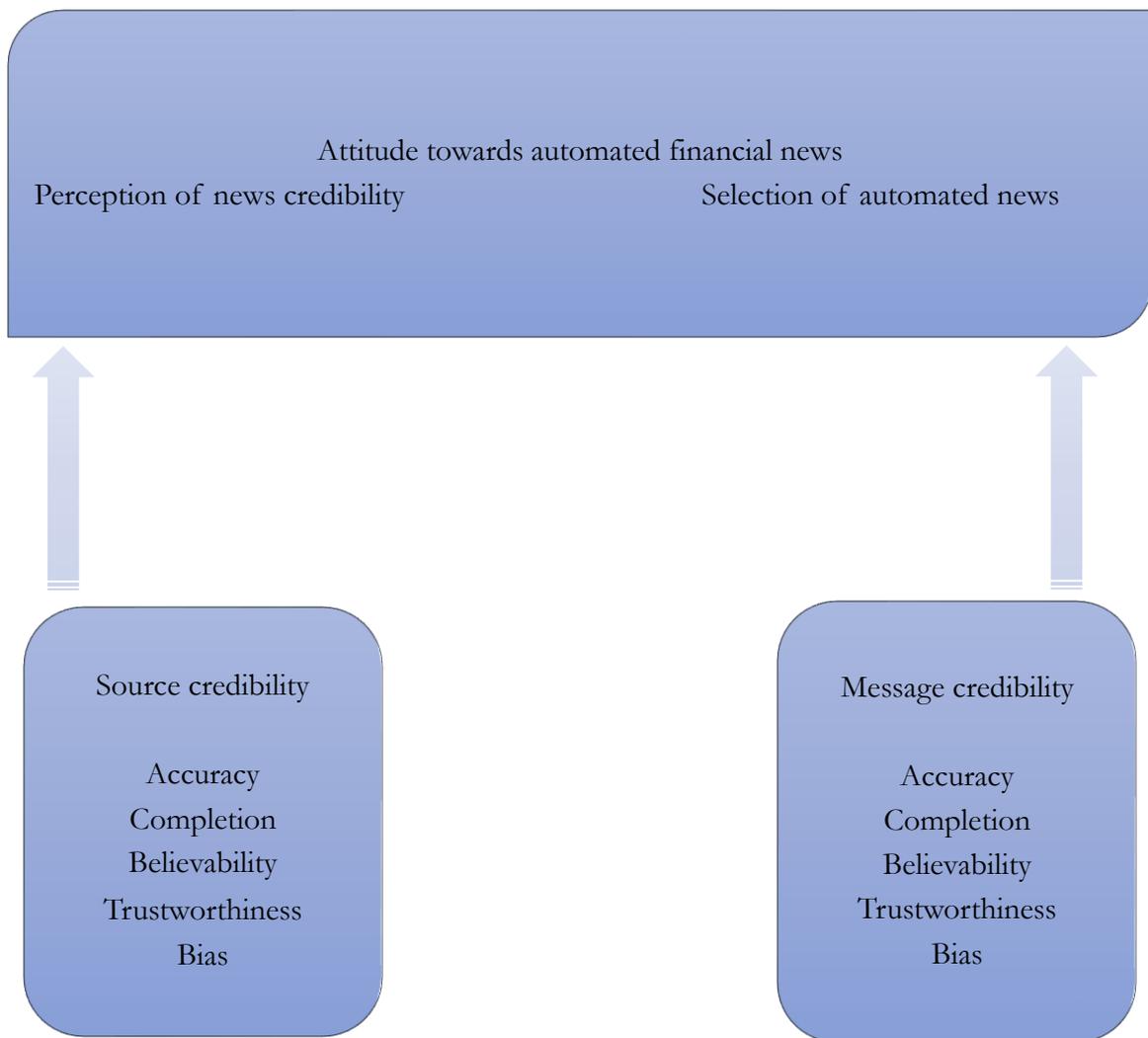


Figure 1. Conceptual model for news reader's attitude towards automated financial news, perceived credibility of a news story's message and source.

CHAPTER III – METHODOLOGY

3.1. Research Design

Quantitative research design is closely followed under the application of survey questionnaire. This decision is motivated by the recommendation by Punch (2003) who highlighted that quantitative research is useful in examining the association of variables. Thus, due to the purpose of developing the relationship between variables, the selection of quantitative research is proved to be appropriate (Punch, 2003; Apuke, 2017; Mohajan, 2021).

Specifically, this paper recognizes the possible association of the characteristics of automated journalism and readers' news selection for consumption. In addition to that, the research aims at examining possible relationships between news readers' identification and their level of likelihood to select automated journalism articles for consumption.

According to Punch (2003), the quantitative research design is theory driven with the purpose of examining the way the world works. Within quantitative research, the whole world is seen as the comprise of various different variables which interconnect and the role of researcher is to find the explanation for those relationship (Punch, 2003; Mohajan, 2021).

Meanwhile, the selection of quantitative approach is due to the inappropriateness of qualitative research design. Qualitative research design is less structured and more fluid which provides a subjective perspective toward the issue of interest and is proved to be not suitable for the objective of this research (Ratner, 2002). It is more suitable for the qualitative research to develop theories rather than test theories like the quantitative research (McLeod, 2019; Yilmaz, 2013).

Quantitative research design with the selection of survey as the main data collection instrument is also expected to be a fit option. Specifically, survey questionnaire is useful in collecting large amount of data in a short time (Jones, Baxter, & Khanduja, 2013) which is useful for prediction of relationship between variables (McLeod, 2018). Survey questionnaire is also useful for the comparison between different groups of people with different characteristics (Lavrakas, 2008). As a result, it is suitable for the aim of examining the possible relationships between news readers' identification and their level of likelihood to select automated journalism articles for consumption.

3.2. Data Collection Method

With the purpose of collecting quantitative data about readers' perceptions in relations to the credibility of finance automated news as well as the impacts of different characteristics of

automated news on readers' financial news selection, survey questionnaires is one of the most suitable instruments for quantitative data collection (Young, 2015).

As the main data collection instrument of the research, the survey questionnaire is proved to be the most convenient tool to distribute on an online platform provided by Google Docs because of its convenience in forming the survey, delivering the survey to targeted respondents, and downloading the data after the survey is completed (Edelmayer, 2020). In the beginning of the survey questionnaire, the research description explains the objective of the research as well as some criteria which the respondents should meet before deciding to proceed with the survey questionnaire. The questionnaire was conducted within one month from 1st April 2021 to 30th April 2021.

3.3. Sampling Technique

Regarding respondent selection, there are certain characteristics which the respondents should meet in order to be involved in the survey. In this research, non-probability sampling technique is chosen in approaching individuals who are young investors, traders, stockbrokers, and hard-core financial news readers aged 18 to 45 as they could be seen as the most active players in the trading markets, especially in the Europe (Arifuzzaman et al., 2014). Young investors, traders, stockbrokers and hard-core financial news readers are the ones who are computer-literate as well as well-informed of automated news coverage available on online platforms (Barrett, 2021). With using this technique, the survey respondents are chosen randomly by all financial news readers selected thanks to professional referrals and professional groups on LinkedIn.

Specifically, researcher used professional connections and referrals to distribute surveys to the target audience. Researcher also reached out to professionals joining groups on LinkedIn such as VPNN (Vietnamese Professionals Network in the Netherlands, CFA Program Candidates and Software & Technology Professionals: Managers | HR | Recruiters | Blockchain | Investors (BIG)). These two characteristics were the necessary requirements for the respondents of the survey. Other demographic and social conditions are excluded from this survey.

Furthermore, non-probability convenience sampling technique was chosen as the major sampling technique to select the respondents within the identified target population. While the probability technique provides respondents with an equal chance to participate in the survey questionnaire, the non-probability sampling technique bases on certain requirements to select the respondents for the survey (Ayhan, 2011). Should the respondents were willing to complete the survey, they would click on the link and send their responses (Etikan & Bala, 2017). This technique ensures that all respondents are voluntarily participating in the research and agreeing with the way that the data will be used.

3.4. Data Analysis Method

SPSS software version 20.0 was used as a supportive tool in interpreting the numeric primary data collected from the survey. Specifically, in order to achieve the research objectives, the following SPSS tests are run:

- ***Descriptive analysis***

This analysis helps to provide the frequencies of each choice in the research participants' response. It provides an overview of the trend in the selection of the respondents, enabling the researcher to have an outlook on the sample population' opinions. This is seen as the simplest way to present the development and distribution trend of the data set (Yellapu, 2018).

- ***Reliability Test***

The application of reliability test under the application of SPSS with Cronbach's Alpha value consideration is proved to be efficient in evaluating the data validation (Rosaroso, 2015). If the standards of reliability test are met, the set of data is confirmed to maintain a high consistency level, meaning that the results might be the same even under different conditions of testing.

If the collected dataset maintain high internal consistency level, findings are expected to be accurate as well. Sharing the same idea, Rosaroso (2015) implies that the reliability level of the dataset could be well measured with Cronbach's alpha in reliability test. Findings from reliability test also provides researcher with the information regarding "score variance and the covariance among its components".

The standards required by reliability test under SPSS software are listed as follows:

- ✓ The value of Alpha Coefficient is not lower than all Cronbach's Alpha if Item Deleted
- ✓ Cronbach Alpha Coefficient for all items are of 0.7 or higher
- ✓ Corrected Item-Total Correlation is higher than 0.3

- ***Factor Analysis Test***

Beside reliability test, it is popular for researchers to apply factor analysis test with the purpose of measuring the necessity of the variables involved in the frameworks as well as its validation (Shrestha, 2021). Factor analysis test, thus, is well-known to reduce unnecessary and unobservable variables among the variables in the market (Zeynivandnezhad, Rashed, & Kaooni, 2019). On the account of factor analysis test, the below standards should be satisfied:

- ✓ Bartlett's Test of Sphericity is 0.000
- ✓ The Kaiser-Meyer-Olkin Measure of Sampling Adequacy is between 0.5 and 1. The closer the KMO value to the 1, the better the factor analysis is.
- ✓ The component matrix table is not lower than 0.5

✓ The total initial eigenvalues are higher than 50%

- ***Multiple Regression analysis***

With the purpose of evaluating the relationship between two determinants especially the dependable relationship between independent variable and the target (dependent) one, the application of regression analysis is proved to be significant. Findings from regression analysis help to adapt the model and the relationship among variables (Draper & Smith, 2018).

There are various ways to classify regression models which might be either linear or non-linear models; applicable for either quantitative or qualitative data; parametric or non-parametric models; focusing on two or more determinants; classic or modern framework (Sen & Srivastava, 2016).

3.5. Operationalization – Measurements

Operationalization of the constructs in the measurement scale is proved to be a critical step in the methodology section of a quantitative research (Punch, 2003). Punch (2003) also highlighted that operationalization plays a significant role in ensuring that the researcher keeps the research in line with the objectives. Via operationalization, the validity and reliability of the constructs in the framework are tested to identify which construct should remain in the research.

The principal component factor analysis and Cronbach's alpha reliability test were used as the main measurement techniques in the operationalization process. The application of principle component factor analysis and Cronbach's alpha reliability test is popular in quantitative survey to test the internal consistency and necessity of the involved variables (Hof, 2012).

The existing measurement in the previous scale of measurement was decided to be applied in this research either totally or partially. Punch (2003) implied that the use of established variables could ensure the accuracy of the measurement in the future studies.

The survey was developed in Google Form – a widely applied form for survey design. The copy of survey questionnaire could be found in the Appendix A of this research. Via Google Form, the survey was distributed online, allowing respondents to stay anonymous during their participation in the survey. The distribution process of the survey will be explained more on the sampling section.

Finally, the use of Google Form in the survey made the collection and extraction of data to SPSS relatively convenient. Data analysis section will further explain the use of SPSS software.

3.5.1. Filter Questions

Initially, the survey begins with filter questions with the purpose of selecting the respondents with the appropriate characteristics following the survey's plan. There are in fact three filter questions regarding three major characteristics of the respondents. First of all, the

respondents should be traders, stockbrokers and hard-core financial news readers who significantly consume financial news (Schutt, 2018). Secondly, they should be familiar with the Internet. Thirdly, they have the habit of consuming financial news.

3.5.2. Demographics

The role of demographic factors in affecting respondents' behaviours as well as their motivation to select the source of financial news for consumption is proved to be critical (Malthouse & Calder, 2006). Therefore, in the questionnaire, various demographic information such as gender, age, and educational level were selected. These three variables are included in the regression analysis as the control variables to examine the relational impacts of news readers' demographic factors on their likelihood to select automated news articles.

Specifically, the gender variable was evaluated via the three multiple choice options including Male, Female and Prefer not to say. Meanwhile, age variable was measured via two choices including From 18 to 45 years old and Others. In terms of education, there were four options available for selection including Undergraduate, Academic, Undergraduate, Applied science, Post-graduate, and Executive/Professional degree.

3.5.3. Independent Variables – Message Credibility and Source Credibility

In this research, the main independent variables are message credibility and source credibility of automated news. Particularly, these two variables will be measured by the Meyer's (1988) and Flanagin and Metzger's (2000) scales. These two scales were previously used by various researchers investigating automated journalism such as the study by Chesney and Su (2010) or Flanagin and Metzger (2007).

Various studies used both Meyer's (1988) and Flanagin and Metzger's (2000) scales in combination to test the likelihood of readers to select automated news articles for consumption (Hughes et al., 2014; Conlin & Roberts, 2016). Roberts (2010) made attempts to retest these two scales individually, concluding that both of these two scales are valid and reliable to be applied in combination. Thus, in this paper, the researcher will also apply the scales by Meyer's (1988) and Flanagin and Metzger (2000) at the same time.

Specifically, the message credibility and source credibility of automated news are advisable to be measured on a 5-point Likert scale as in the study by Clerwall (2014). The scale for the message credibility and source credibility ranged from "strongly disagree" – the lowest rank of agreement, to "strongly agree" – the highest rank of agreement to the statement.

Message credibility is evaluated via the adoption of Roberts (2010) including five major determinants including (1) inaccurate or accurate, (2) incomplete or complete, (3) unbelievable or believable, (4) can be trusted or cannot be trusted, and (5) biased or not biased. Meanwhile, the

scale of source credibility consists of five variables as well including (1) inaccurate or accurate, (2) fair or unfair, (3) tells the whole story or does not tell the whole story, (4) can be trusted or cannot be trusted, and (5) unbiased or biased. In fact, principal component factor analysis and Cronbach's alpha reliability test are conducted to measure the validity and reliability of the scale (Hof, 2012).

The credibility of automated news source was measured with 5 items. According to the reliability analysis, it is highlighted that the scale for source credibility is relatively high with the Cronbach's Alpha value of 0.836 (table 3.1) which is higher than the expected 0.50. Findings from the reliability test of the credibility of automated news source are presented in the following tables.

There are no items to be deleted from the variable because all Cronbach's Alpha if Item Deleted are higher than the Cronbach's Alpha value of 0.836 while all Corrected Item-Total Correlation values are not lower than the standard of 0.3 (table 3.2).

Table 3.1. Reliability statistics of the perceived credibility of automated news source.

Cronbach's Alpha	N of Items
.836	5

Table 3.2. Item-Total statistics of the perceived credibility of automated news source

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Accuracy of digital financial news source	11.9900	7.040	.624	.808
Completion of digital financial news source	12.0600	6.744	.710	.783
Believability of digital financial news source	12.2200	7.224	.562	.825
Trustworthiness of digital financial news source	12.2500	6.735	.759	.770
Bias of digital financial news source	12.2000	7.677	.545	.828

At the same time, the perceived credibility of automated news message was measured with 5 items as well. With the Cronbach's Alpha value of 0.688 (table 3.3) which proves a neutrally reliable only. However, all factors of this variables still passed the reliability test with all Cronbach's

Alpha if Item Deleted are smaller than the Cronbach's Alpha and all Corrected Item-Total Correlation are larger than 0.3 (table 3.4).

Table 3.3. Reliability statistics of the credibility of automated news message

Cronbach's Alpha	N of Items
.688	5

Table 3.4. Item-Total statistics of the perceived credibility of automated news message

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Accuracy of digital financial news message	14.3800	4.400	.325	.610
Completion of digital financial news message	14.7800	2.820	.531	.598
Believability of digital financial news message	14.7500	2.836	.643	.541
Trustworthiness of digital financial news message	14.5800	4.8145	.373	.633
Bias of digital financial news message	15.1100	2.523	.670	.516

3.6. Validity and Reliability

Validity in a study using a quantitative method is to maintain the accuracy of measurement of the questions with their original measuring method (Taherdoost, 2016; Edwin, 2019). Field (2005) highlighted that validity and reliability basically describe “measure what is intended to be measured”. Specifically, due to the purpose of this study as a quantitative research, this research understood validity as a guarantee that the operationalization of measurement is closely suitable for the objectives of the research.

In this research, the researcher used the previously established measuring instruments during the operationalization of measurements. According to Punch (2003), if a quantitative survey is conducted by a researcher whose experiences in developing measuring instruments are weak, the application of established measuring instruments either totally or partially will contribute to higher level of validity for the research. The established measuring instruments are the ones which were previously tested and proven which will contribute significantly to the guarantee that the research’s measurement scale be effective in measuring accurately what is initially intended to be measured.

Furthermore, survey method is a popularly used and proven research collection instruments with high level of validity (Lavrakas, 2008; Young, 2015). It is highlighted that the operationalization of the concepts of perceived message credibility and source credibility has high level of internal validity because it was based on two established scales in the literature. In addition to that, the survey questionnaire was designed and distributed online via Google Forms and a third party data collection platform like Qualtrics, which mainly serves the purpose of user experience optimization, will ensure the non-biased data collection procedure in which the external validity as well as generalization of the findings are ensured.

Finally, the analysis section includes the regression analysis model in which the bias from demographic characteristics of respondents will be excluded from the examination of the relationship between dependent and independent variables. Positive results from regression analysis as well as the Cronbach's alpha reliability test have proved the reliability and consistency of the measuring constructs.

CHAPTER IV – RESULTS

4.1. Introduction

In this chapter, the results of data analysis and findings of the research is presented with the purpose of meeting the research's objective of identifying the perception of financial news consumers toward automated journalism in the Netherlands.

4.2. The Response Rate

During the survey questionnaire process, there were 132 respondents completing the survey questionnaire. Nevertheless, there were some copies of the responses which were not completed or some respondents did not pass the filter questions. Those responses were excluded from the research's results in which only 100 responses to be kept for the next data analysis section for hypothesis testing. Thus, the response rate of the research was 75.7% which was relatively fair and representative. According to the recommendation by Mugenda and Mugenda (2003), the response rate of 50% is suitable for the analysis while the response rate of 60% is perceived as good and the response rate of 70% is perceived as very good. Thus, with the response rate of 75.7%, the research has the adequate rate to develop its findings and conclusions.

4.3. Background Information

Within background information, the basic information of respondents consists important demographic specifics. Results of background information analysis are provided in the following sections.

4.3.1. Respondents' Age

Table 4.1. Respondents' Age

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	18	18.0	18.0
	26-35	68	68.0	86.0
	35-45	14	14.0	100.0
	Total	100	100.0	100.0

In table 4.1, it is revealed that most of financial news consumers are at the young ages of less than 35 years. Specifically, 68% of the respondents are 26-35 years old while another 18% of the respondents are at the age-range of 18-35. There are only 14% of the respondents aged 35-45. On the account of this finding, it is reflected that the financial news consumers are mostly younger than 35 years old. There are no financial news readers younger than 18 or older than 45 years old.

Such limited age range (from 18 to 45 years) might highly reflect the news selection behaviours of these respondents.

4.3.2. Educational Level

Table 4.2. Respondents' education level?

	Frequency	Percent	Valid Percent	Cumulative Percent
	32	32.0	32.0	32.0
	29	29.0	29.0	61.0
Valid	21	21.0	21.0	82.0
	18	18.0	18.0	100.0
Total	100	100.0	100.0	

The educational level of respondents is disclosed in table 4.2. It can be seen that the respondents are relatively well educated with the majority of 61% are undergraduate in which 32% are academic undergraduate while 29% are applied science undergraduate. 21% of the respondents have post-graduate educational level, followed by 18% of the respondents who have executive or professional degrees. There are no respondents who have educational level of less than high school or high school graduate. Such high educational level of respondents is understandable because the target respondents are reached from groups on LinkedIn such as VPNN (Vietnamese Professionals Network in the Netherlands, CFA Program Candidates and Software & Technology Professionals: Managers | HR | Recruiters | Blockchain | Investors (BIG)) whose members are mostly financial professionals.

4.3.3. Employment Status

Table 4.3. Respondents' employment status

	Frequency	Percent	Valid Percent	Cumulative Percent
	52	52.0	52.0	52.0
	8	8.0	8.0	60.0
	6	6.0	6.0	66.0
Valid	28	28.0	28.0	94.0
	4	4.0	4.0	98.0
	2	2.0	2.0	100.0
Total	100	100.0	100.0	

Table 4.3 shows that the majority of the respondents (which accounts for more than half of respondents – 52% of population) are full-time employees, followed by 28% of the respondents are students. Only 6% of the respondents are unemployed looking for work and another 8% of the respondents are part-time employees. Thus, it can be concluded that more than half of all respondents participating in the survey have stable employment.

4.3.4. Annual Income

Table 4.4. Respondents’ annual income

	Frequency	Percent	Valid Percent	Cumulative Percent
	Less than €10,000	51	51.0	51.5
	€10,000 - €19,999	10	10.0	61.6
	€20,000 - €29,999	4	4.0	65.7
Valid	€30,000 - €39,999	13	13.0	78.8
	€40,000 - €49,999	12	12.0	90.9
	€50,000 - €59,999	9	9.0	100.0
	Total	99	99.0	100.0
Missing	System	1	1.0	
Total		100	100.0	

Annual income of respondents, however, is at low range with most of the respondents (account for 51% of the population) having the income level of less than €10,000. Only 9.1% of the respondents has the income range from €50,000 to €59,999. There is no respondent whose annual income higher than €60,000 leaving the last 6 options of annual income unselected. The low-income level of the respondents might create bias for the research’s results. The selection of research’s sample population via the LinkedIn group only might exclude the financial news readers who have high income level which somehow affects the validity and reliability of the research.

4.3.5. Respondents’ Base

Table 4.5. Respondents’ home region

	Frequency	Percent	Valid Percent	Cumulative Percent
	Europe	84	84.0	84.0
	Asia Pacific	14	14.0	98.0
Valid	North and/or South America	2	2.0	100.0
	Total	100	100.0	100.0

There are four regions to be taken into consideration of the research when referring to the base of respondents. Nevertheless, European respondents take up the majority of the population

with 84% of the population. Asian Pacific financial news readers accounts for 14% of population while the Americans takes up 2% of the respondents only. There are even no respondent from the Africa.

4.4. Credibility of Automated Financial News

4.4.1. Descriptive Analysis Comparison between Automated and Human-written News' Message Credibility

First of all, for the perceived credibility of automated financial news message, there are five variables to be taken into consideration following the scale developed by Clerwall (2014). The variables of perceived credibility of digital financial news message including (1) inaccurate or accurate, (2) incomplete or complete, (3) unbelievable or believable, (4) can be trusted or cannot be trusted, and (5) biased or not biased.

Table 4.6. Descriptive Statistics of Message Credibility

		Accuracy		Completion		Believability		Trust		Bias	
		Automated	Human-written	Automated	Human-written	Automated	Human-written	Automated	Human-written	Automated	Human-written
N	Valid	100	100	100	100	100	100	100	100	100	100
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		4.02	3.63	3.62	4.23	3.65	4.07	3.82	4.07	3.29	4.04
Mode		4	4	4	4	4	4	4	4	4	4

Among the five variables of the message credibility of automated journalism, the accuracy is proved to be of highest satisfaction with the highest Mean of 4.02 illustrating that the messages generated by automated systems are much more accurate than that of human journalists (the mean of human-written journalism is only 3.63). In fact, the high accuracy level of automated messages has been highlighted in the literature as one of the most typical advantages of automated journalism. According to Arya et al (2019), automated journalism is able to produce daily news in a faster speed at less cost than human journalists.

In addition to that, the contents involved in automated journalism are proved to be free of error. If human journalists are easily to make mistake, the input generated by automated system is usually narrative which bases on existing template algorithms to develop stories automatically (Caswell & Dorr, 2018) which prevents the existence of errors which create high level of

satisfaction for the news readers. The level of accuracy is significant for news readers, especially the ones in the financial sector because even the smallest typing mistakes regarding the numbers or figures could result in wrong decisions which severely affects the investment of the financial news readers. Thus, with high level of accuracy, the messages created by the automated news system are proved to be highly satisfying to financial news readers.

Secondly, the second highest Mean at 3.82 describes the high level of satisfaction towards the trust in the message of financial news coverage, followed by the third highest Mean at 3.65 illustrating the high level of believability of digital news messages. However, those means are much lower than the means of human-written news (both means are at 4.07). This means that news readerships still have higher trust and believability toward the human-written journalism comparing to the automated ones. This disapproves H1, meaning financial news readers' perceived message credibility of automated journalism content lower than that of human-written content.

In financial news, the trust and believability of a news story's messages are of great importance, especially in the emerging market where the flow of information is limited. Literature highlights that the limited flow of information in an emerging industry might make the process of collection and analysis of information costly and difficult for inexperienced investors. The information collected is even heterogeneous, resulting in the lack of belief of some investors in their own information. This contributes to their decision to follow others' behaviours under the motivation created by preference for conformity.

The messages generated by automated news are not only accurate but also quickly updated. This renders both macroeconomic information and firm-specific information available for investors. In the future, it could increase the trust and believability of the financial news readers on automated news' messages after they experience the excellent accuracy and reliability of the automated financial news.

The Mean of completion level of automated journalism is at 3.62 which is quite low in comparison with other constructs of perceived credibility of messages. The Mean value of human-written journalism is very high, at 4.23. Meanwhile, the bias of digital financial news message also receives the low level of Mean value at 3.29.

On the other hand, the bias of human-written news is quite high (4.04). It is commonly argued in the literature that the automated news might potentially contribute to higher quality and objectivity of the news. Specifically, due to the fact that automated news is generated under predefined rules of data converting methods, automated algorithms were argued to be more accurate without bias.

Nevertheless, the low satisfaction level of perceived credibility of automated news messages might be not as optimistic as previous literature (Lazer et al, 2014). It can be explained by the facts that the content (messages) generated by the automated journalisms must also rely on assumptions and data which are subjected to biases. Like human-generated news, it is possible for the algorithms to generate automated financial news to be incomplete and biased due to the incomplete and biased sources of data collected for the automated system. It is highlighted that the automated financial news is generated without critical thinking but solely based on the collected data. Thus, the messages generated might reflect the unconscious biases of the sources of data.

4.4.2. Descriptive Analysis Comparison between Automated and Human-written News' Source Credibility

The perceived credibility of digital financial news source should be also taken into careful consideration in all five aspects which are as same as the five aspects of perceived credibility of messages. Descriptive statistics of perceived credibility of digital financial news sources are provided in the following table.

Table 4.8. Descriptive Statistics of Source Credibility

		Accuracy		Completion		Believability		Trust		Bias	
		Auto	Human	Auto	Human	Auto	Human	Auto	Human	Auto	Human
		mated	-written	mated	-written	mated	-written	mated	-written	mated	-written
N	Valid	100	100	100	100	100	100	100	100	100	100
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		3.19	3.03	3.12	3.90	2.96	3.85	2.93	3.83	2.98	3.88
Mode		3	3	3	4	3	4	3	4	3	4

Among the five variables of source credibility of automated financial news, the most satisfied determinant is the accuracy with the Mean value at 3.19, which is higher than the source accuracy of human-written journalism (3.03). The credibility of source refers to the writer of the article while the credibility of message focuses on the content of the article. Most respondents agreed that comparing with the human-written financial news, the sources of automated financial news are adequately accurate which strongly affect the selection behaviours of financial news readers in the market. High accuracy level of automated financial news source, thus, contributes to high level of news readers' satisfaction.

The second highest Mean at 3.12 belongs to the completion of digital financial news source. However, this value is still much lower than the Mean of human-written news completion

(3.90). The bias of automated financial news source is also proved to be high with the Mean value of 2.98 ranking the third in the range of Mean of the paper.

If the content of the automated journalism is possibly incomplete and biased due to the incompleteness and bias of the data, the perceived completion and bias of the source of digital financial news stays considerable. The source of automated financial news are not influenced by the subjective perspective of human being. Sources of automated news, thus, potentially improve the objectivity of news coverage contributing to higher satisfaction level regarding these two determinants in comparison with the perceived credibility of messages. That is the reason why the bias of source creditability of human-written journalism (Mean = 3.88) is much higher than that of the automated journalism.

Believability of the source of automated news is proved to be of neutral satisfaction only with the Mean value of 2.96. It is highlighted that the perceived believability of the content of certain news sources is one of the most important determinants of credibility of the automated news. Nevertheless, the believability of the automated news source remains neutral.

Trust in automated financial news source, however, is not as high as expected with the Mean value at 2.93 only. It is highlighted that the news readers' behaviours find it challenging to fully comprehend the algorithms of automated news. Thus, the task of evaluating the quality of the algorithms remains taxing. It is highlighted that the redundancy of data reduces the trust of financial news readers in perceiving credibility of automated news source. This finding goes in line with the findings from Winter and Kramer (2014) which also indicated that credibility assessment is not solely responsible for the selection behaviours of users in the market. Instead, user selection is also affected by whether the source is read longer, selected more frequently or previously selected or not in order to increase trust into the source of automated news.

Comparing with the automated news, the believability and trust of readership toward the human-written financial news are much higher, respectively with the Means of 3.85 and 3.83. This inferred that the news readerships do not have high belief in the source creditability of the automated news as the computers might generate the news from distrusted or low trusted sources. As a result, this discredits H2, inferring financial news readers' perceived source credibility of an algorithm author lower than that of a human author.

4.5. Impacts of Automated News's Credibility on Readers' Financial News Selection – Multiple Regression Analysis

To measure the impacts of either perceived credibility of message or perceived credibility of sources on readers' financial news selection, the multiple regression analysis is applied. Specifically, the perceived credibility of message or of sources on readers' financial news selection

play the role of dependent variables while the independent one is readers' financial news selection toward the automated news. Findings of the multiple regression analysis are provided in the following tables.

Table 4.9. Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.255 ^a	.065	.046	.80964

a. Predictors: (Constant), Source, Message

b. Dependent Variable (DV): Readers' financial news selection

Table 4.10. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.414	2	2.207	3.367	.039 ^b
	Residual	63.586	97	.656		
	Total	68.000	99			

a. Dependent Variable: Readers' financial news selection

b. Predictors: (Constant), Source, Message

In the above table, it is indicated that significance F is very small which is 0.039 which indicates high level of compatibility and reliability of the research's results. The very small significance F describes a very small probability that the null hypothesis in the regression model to be rejected. This means there is a substantial likelihood that readers show no preferences of news coverage based on the message' or source' credibility when selecting automated financial news for consumption.

The low value of R-squared indicates that the independent variables analysed in the research model do not have significant roles in predicting or influencing the dependent variable (Frost, 2018a; Minitab Blog, 2014). This means that the DV of the research is explained by many other different independent variables (IVs) that had not been included in the research or the research participants are unpredictable (Nanoman, 2021; Minitab Blog, 2014; Itaoka, 2012, Frost, 2018a). In this case, unfortunately, the likelihood that readers select automated financial news are not explicated with the variables chosen with the hypotheses H3a and H3b.

However, in this research, although R-squared is low, IVs and DV of this research were proved to have a real relationship as the P value was lower than 0.05 (Frost, 2018b; Grace-Martin, 2012). This means that two IVs in this research still have significant influences on the DV but as the DV is decided by many other factors and the prediction of human behaviours is complicated,

the R-squared value remains low.

Table 4.11. Coefficients^a

Model	Unstandardized		Standardized	t	Sig.	
	Coefficients		Coefficients			
	B	Std. Error	Beta			
	(Constant)	4.489	.726		6.186	.000
1	Message Credibility	.474	.189	.252	2.509	.014
	Source Credibility	.151	.128	.119	1.180	.041

a. Dependent Variable: Readers' financial news selection

The relationship between variables being analysed is measured in the form of a mathematical expression of multiple linear regression. In multiple regression analysis, it is assumed that the relationship is linear. The Sig. value of each independent variable determines whether the relationship between independent and dependent variables is significant or not. Specifically, results of multiple regression analysis are provided as follows.

Sig. of Credibility of Financial news Message is 0.014, which is smaller than 0.05, equivalent to the confidence level of 99.986%, proved that there is a significant relationship between Perceived Credibility of Financial news Message and the Readers' Financial News Selection. The unstandardized Beta coefficient of Perceived Credibility of Financial news Message is 0.474 illustrating that if the Perceived Credibility of Financial news Message improves by 1%, the Readers' Financial News Selection toward Automated Journalism improves by 0.474% accordingly. Thus, hypothesis 3a is accepted.

Sig. of Credibility of Financial News Source is 0.041 which is smaller than 0.05 proving that there is a significant relationship between Perceived Credibility of Financial news Sources and the Readers' Financial News Selection. The unstandardized Beta coefficient of Perceived Credibility of Financial News Sources is 0.151 illustrating that if the Perceived Credibility of Financial news Sources improves by 1%, the Readers' Financial News Selection toward Automated Journalism improves by 0.151% accordingly. Thus, hypothesis 3b is accepted.

According to the result of the multiple regression analysis, it is highlighted that with higher unstandardized beta coefficient, the Perceived Credibility of Financial News Message is proved to have higher impacts on the Readers' Financial News Selection toward Automated Journalism in comparison with that of the Perceived Credibility of Financial news Sources.

In fact, literature has concentrated on the relationship between those types of credibility. Specifically, it is highlighted by Roberts (2010) that as long as the credibility of source is high, the message will be also considered as credible. Nevertheless, it is most frequent for the readers to be provided with respective authorships (Graefe et al., 2016) in which the relationship between message and source credibility becomes related. Nevertheless, findings from the research prove a reverse relationship in which the role of message credibility is proved to be even more important than that of source credibility. This finding shares the same idea with Metzger & Flanagin (2015) which avers that the lack of source credibility which is commonplace in online journalism motivates the readers to base on the medium or message cues in order to evaluate the credibility of a news.

CHAPTER V – DISCUSSION AND CONCLUSION

In this chapter, the summary and conclusion of the research will be provided with the purpose of identifying financial news consumers' perception toward automated journalism in Netherlands. After that, recommendations are provided regarding which of the perceived credibility of the automated news contributing to higher possibility of financial news readers to select this type of news for consumption.

5.1. Summary of Findings and Discussions

Targeting at the relationship between automated journalism and reader perception of news credibility, the researcher has analysed collected data with the attempts to answer the research question of “*Do message and source credibility of algorism affect financial news reader's choice of automated news?*”. Firstly, the comparison between the message and source creditability of automated and human-written journalism had been discussed via descriptive statistic testing. Then, the multiple regression test was applied to test whether the Source Credibility and Message Creditability of automated news positively affects the likelihood of financial news readers to select automated journalism articles for consumption.

Regarding the message creditability, it is highlighted in the findings that among the five characteristics of the automated financial news message, accuracy is proved to be of highest satisfaction. This implied that the messages generated by automated systems are much more accurate than that of human journalists. In fact, the high accuracy level of automated messages has been highlighted in the literature as one of the most typical advantages of automated journalism. According to Arya et al (2019), automated journalism is able to produce daily news much quicker and more cost effective than the human journalists.

In addition to that, the contents involved in automated news are free of error. Given the assumption that human journalists are easily to make mistake, the input generated by automated system is usually narrative which bases on template algorithms to automatically churn out stories (Caswell & Dorr, 2018). This prevents errors in automated news reporting which create high level of satisfaction for the news readers.

The level of accuracy is significant for news readers, especially the ones in the finance sector because even the smallest typing mistakes regarding the numbers or figures could result in wrong decisions which severely affects the investment of the financial news readers. Thus, with high level of accuracy, the messages created by the automated news system are highly satisfying for financial news readers.

In addition to that, the trust and believability of automated news messages are also of high level of satisfaction. In financial news, the trust and believability of the messages are of great importance, especially in an emerging market with insufficient information. Literature highlights that the insufficient flow of information in prominent industries added the cost of the process of data collection and analysis, making it difficult for inexperienced investors. The information collected comes in a large volume, resulting in the lack of belief of some investors and challenging their decision-making process while participating in a trading market.

The messages generated by automated news are not only accurate but also quickly updated. Such positive notion presents sufficient information about the overall industry or certain organizations' performance. This, in turn, increases the trust and believability of the financial news readers on the messages conveyed by an automated news story. However, the level of completion and bias of automated news are not as high as expected.

With regard to source creditability, among five variables of perceived credibility of digital financial news sources, the most satisfied determinant is the accuracy of a financial news story's source. The credibility of the source refers to the writer of the article and whether the source of the information was "fact-checked" or verified.

Meanwhile, the credibility of message focuses on how well the content is formulated in an article. This is well-presented in the typical case of a start-up debuting its initial public offering (IPO) in a trading exchange, or a stock launch where the company's shares are offered at a designated price to institutional investors. Krinitz and Neumann (2021) found that however fast business news outlets pick up the announcement, as long as the source of the information is verified by a trusted point of contact, the story is well-read and well-received by financial news readers showing interests in the start-up. The volume of news coverage of a story does not influence user perception and therefore does not impact on IPO performance. Surprisingly, the more uncertain the message appears, the higher the return is on first day of trading in public. This leaves room to financial news researchers in analysing the nuance of message credibility of a financial news story and research the extent of credibility on financial news readers' trading behaviours.

Most respondents agree that the sources of automated financial news are adequately accurate which strongly affect their evaluation and selection of financial news coverage. High accuracy level of automated financial news source, thus, contributes to high level of news readers' satisfaction. In addition to that, if the content of the automated journalism is incomplete and biased due to the incomplete and biased data, the perceived completion and bias of the source of digital financial news stays high. The source of digital financial news are computers which are not

influenced by the subjective perspective of human being. An automated news story's source, thus, potentially improves its objectivity, contributing to higher satisfaction level regarding these two determinants in comparison with the perceived credibility of messages.

Thirdly, it is highlighted by the literature that the perceived believability of the content of certain sources is one of the most important determinants of credibility of automated news. Nevertheless, respondents showed neutral stance on the believability of the automated news source. News reader's does not trust the source of automated financial news source as much as expected. Thus, it is proved challenging to evaluate the quality of the algorithms which determines the quality of the an automated article.

Finally, the findings from the multiple regression analysis highlighted that both Source Credibility and Message Creditability of automated news have positively effects on the likelihood of financial news readers to select automated journalism articles for consumption. This means as long as an automated news story have sufficiently credible source and message, news readers are more likely to choose the less traditional form of news coverage.

Although the value of these two factors in predicting readers' behaviours was not very high (the R-squared value was quite low), they remained significantly influent on respondents' decision of reading automated news. Having higher unstandardized beta coefficient, the Message Credibility of Financial News is proved to have higher impacts on the Selectivity of Financial News Readers toward Automated Journalism in comparison with that of the Source Credibility of Financial News. This agrees with the notion that as long as an automated news story's message is perceived more credible than its source, news readers are more likely to choose automated news coverage for consumption.

In fact, literature has paid attention to the relationship between those types of credibility. Specifically, it is highlighted by Roberts (2010) that as long as the credibility of source is high, the message will be also considered as credible. Furthermore, findings from the research prove a reverse relationship in which the role of message credibility is proved to be even more important than that of source credibility.

The study chose questionnaire survey as a choice of methodology to approach the subject matter in a quantitative way. This ensures the validity and reliability of the study as it preserves the integrity of measurement accuracy (Taherdoost, 2016; Edwin, 2019). Regardless of the results, the study's validity holds the suitability of measurement operationalization. As the researcher's less experienced in developing measuring instruments, choosing survey as a method remain effective in measuring the intended variables of the study (Punch, 2003).

5.2. Conclusions

There are two credibility types of the automated news including the perceived credibility of message and perceived credibility of sources.

First of all, in terms of message credibility of financial news, it is generally argued in the literature that the automated news contributes to higher quality and objectivity of the news. Specifically, because automated news is generated under predefined rules of data altering, literature argues that automated algorithms are more accurate without bias. Nevertheless, unlike the positive connotation in previous research, perceived credibility of automated messages received a less satisfaction level of (Lazer et al, 2014). It can be explained by the facts that the content (messages) generated by the automated journalisms must rely on assumptions and data which are prone to biases.

Due to the incomplete and biased data sources, algorithms potentially carry the incompleteness and biasedness into the news story. It is highlighted that the automated financial news is generated solely based on the collected data. Thus, the messages generated might reflect the unconscious biases of the sources of data. To add, in order to improve the perceived credibility of the financial news, automated news providers are recommended to find ways to improve the completeness and bias of the source of data. This can be achieved with the involvement of journalists in scanning and skimming data sources before the automated news content is published.

Secondly, in terms of sources credibility of financial news, the massive volume of unverified information reduces financial news readers' trust in the perceived credibility of automated news source. This finding goes in line with the findings from Winter and Kramer (2014) which also averred that credibility assessment is not the sole factor determining the selection behaviours of users in the market. Instead, user selection is also affected by whether the source is verified with merits to increase trust into the source of automated news. To be more specific, with the content generated via algorithm, journalists will be provided with necessary information and more time to spend on labour-intensive and higher value tasks contributing to higher effective productivity. For instance, the automated financial stories posted in the AP could be updated and expanded by journalists while only some elements of the articles are automated with the attached description in the article.

5.3. Societal Implication

Answering the key question of the research, the credibility of automated finance journalism is perceived as equal as or even higher than that of human generated journalism. Specifically, automated news potentially contributes to higher quality and objectivity of the news. Findings from the research, thus, advise the future development of automated news in which automated

news would be extensively used in the routine industry like financial, sports and weather forecast journalism in order to reduce the boring and repetitive tasks for journalists. Financial journalists also could utilize the data from automated journalism in order to improve their productivity because they have more room for labour-intensive and more challenging story lines.

5.4. Limitations of the Study

One of the typical limitations of the research is the administration of the questionnaires. In fact, it is difficult for the researcher to create the comfort with the questionnaire in order to ensure the 100% response of the respondents. There were 132 respondents involved in the survey questionnaire. Nevertheless, there were some copies of the responses which were not completed or some respondents did not pass the filter questions. Those responses were excluded from the research's results in which only 100 responses to be kept for the next data analysis section for hypothesis testing, levelling the response rate at 75.7%.

Although the sample size is relatively high (N=100) which satisfies the requirements of statistical methods, a larger sample size is still recommended for further research to be conducted in order to generalize the research findings.

The research failed to garner response from financial news readers with the income bracket of higher than €60,000 and garnered feedback from a modest percentage of 9.1% of the total respondents with €50,000 - €59,999 income bracket. This opens the door to future research studies hypothesizing whether personal income affects one's opinion and attitude against the disruptive introduction of automation in financial news as well as whether there is discrepancies in user perception on automation in news production among those with different annual earnings.

The distribution of the questionnaire was limited to two groups of professionals who lived and/or worked in the Netherlands in the last five years. This calls for future research to narrow down the population sample to only those who was actually staying in their base country of the Netherlands. Another limitation was the significance of bias among respondents as the questionnaire was distributed to employees of automation in industries with disruptive technologies such as cryptocurrency, renewable energy and digital transformation in finance. For further studies in the similar topic, the target audience should hold a variety of opinions towards automation to generate a more nuanced and reflective of the reality among financial news readers in the Netherlands.

More importantly, the research findings focus on the automated financial news and perception of financial news readers only which might result in differences when observing other topics which are not much related to finance. Financial news are characterized by its routine characteristics due to the needs of updating information on a daily basis of readers in which the

use of human-generated news might be much more expensive and slower. Nevertheless, the findings might not be the same as the less “routine” topic which might be advised to be examined by future research in order to spot out the difference if any marking an interesting point of departure for future exploration.

Finally, the research lacks focus on the international perspective and multicultural approach which might have significant impacts on the perception of new readers towards automated financial news. Further studies, thus, are invited to take further scope on the international approach with comparative analysis between different national contexts in order to identify differences in the characterization of automated news readers in different territories if any.

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Automated financial news – A survey

Hello there, fellow financial news reader and/or investor,

First of all, I would like to say thank you for participating in this survey for my Master Thesis project at Erasmus School of History, Culture and Communication, Erasmus University Rotterdam.

The topic I am researching is reader perception to automated financial news in Europe. For the last 6 years, automation in the production of news and journalism has seen remarkable innovative development. My aim is to find out how people perceive financial news when they know it has been written by a bot journalist and whether this impacts their behaviours in trading financial products.

Completing this questionnaire will take around 10 minutes. For the optimal visual experience, it is suggested to complete it on your laptop. Your data will be dealt with anonymously and with complete confidentiality, and will only be used for purposes regarding this research.

Do you agree to the conditions stated above? If yes, please proceed with the next pages.

Q1 What is your age?

18 - 25 (1)

26 - 35 (2)

36 - 45 (3)

Q2 What is your education level?

Undergraduate, academic (1)

Undergraduate, applied science (2)

Post-graduate (3)

Executive/Professional degree (4)

Q3 What is your current employment status?

Employed full time (1)

Employed part time (2)

Unemployed looking for work (3)

Unemployed not looking for work (4)

Retired (5)

Student (6)

Disabled (7)

Freelancer (8)

Entrepreneur (9)

Q4 Where do you come from?

Europe (8)

Asia Pacific (9)

Africa (10)

North and/or South America (11)

Q5 What is your annual income?

Less than €10,000 (1)

€10,000 - €19,999 (2)

€20,000 - €29,999 (3)

€30,000 - €39,999 (4)

€40,000 - €49,999 (5)

€50,000 - €59,999 (6)

€60,000 - €69,999 (7)

€70,000 - €79,999 (8)

€80,000 - €89,999 (9)

€90,000 - €99,999 (10)

€100,000 - €149,999 (11)

More than €150,000 (12)

News readership

The next section is about your digital news reading habit, especially in digital financial news content. Please take no more than 5 seconds for each question.

Q5 How often do you follow the section of financial news on digital news sources?

- Daily (1)
- 4-6 times a week (2)
- 2-3 times a week (3)
- Once a week (4)
- Never (5)

Q6 Please answer the following questions about how you perceive the credibility of digital financial news message.

Source
Credibility
of
Automated
Journalism

Accuracy (1)

Completion (2)

Believability
(3)

Trust (4)

Bias (5)

Source
Credibility
of Human-
written
Journalism

Accuracy (1)

Completion (2)

Believability
(3)

Trust (4)

Bias (5)

Selectivity behaviours

The next section is about your selectivity habits. Please take no more than 5 seconds for each question.

Q8 Please answer the following questions about your selectivity behaviours and external factors that can have an impact on them.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
My selective decisions are influenced, knowing the digital financial news sources were covered by an automated journalist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If you have any questions or suggestions for further investigative opportunities on this subject matter, please do not hesitate to reach out to me via email at 531516nl@student.eur.nl.

My name is Sam Luong and I highly appreciate your input for my survey.