Multidimensional information disseminated on stock exchange websites: An exploratory study

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Abstract

Based on an exploratory study, the objective of this article is to determine the characteristics of information disseminated on stock exchange websites. Based on our findings, we put forward that the information is characterised by three dimensions – its nature, the support and the source – that have an influence on the behaviour and choices of cyber-investors. This study thus presents a framework for managing stock market information.

Keywords

Multidimensional information, stock market sites, exploratory study, cyber-investors

Introduction

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Today's world is driven by information; it is omnipresent in traditional media (newspapers, television, radio, social networks) and via the Internet. Information is therefore an integral part of our lives. Referring to the Larousse encyclopaedia, information is defined as ‘any event, any fact, any judgement brought to the knowledge of a more or less large public, in the form of images, texts, speeches, sounds’. Based on this definition, we deduce the rich character of information, which can include events, communications and judgments in various forms such as images, texts, speeches, sounds, graphics, etc.

Prior research suggests that information can affect judgment and decision making (Tversky & Kahneman, 1974). For example, investments made on stock markets depend on timely and credible information being made available to investors (Evans, Owda, Crockett, Vilas, 2021). A favourable information signal improves investors’ perceptions and results in more positive decisions (Frederickson & Miller, 2004). Other studies suggest that the presentation format (DeStefano & LeFevre, 2007) and content of information (Hodge, 2001) available in the internet may influence investors’ decision making. This influence may affect professional and even non-professional investors decision-making processes. Elliott, Hodge and Jackson (2008) argue that non-professional investors use more financial information disclosures other than the audited financial statements.

Based on an exploratory study, we analyse the information environment of stock exchange websites, and highlight the characteristics of the information disseminated on these sites. According to our analyses, cyber-investors attach greater importance to certain criteria at the expense of others. The ease of access, the ergonomics of the site, the quality, source, abundance of data and many other criteria of the provided information give a multidimensional aspect to the information and contribute to influencing the choices of cyber-investors.

This study provides guidance for investors or financial analysts by making it easier to consult stock market websites and to target relevant information that is likely to provide a better understanding of the evolution of financial assets. It also develops ways of improving information management for designers of investment sites. Proper structuring and better availability of information make it possible to achieve a sound match between the characteristics of stock market information and the informational needs of cyber-investors.

In the first part of this article, we describe the notion of multidimensional information found in the literature – acknowledging a gap in the theoretical underpinning that defines this notion. Next, we present the results of a qualitative exploratory study. In the third section, we analyse our key findings and in the fourth section, we discuss our analysis.

1. **Concept of multidimensional information**

In the first model dedicated to communication, Shannon and Weaver (1949) explain that any communication system is a persuasive system that can be represented by the following diagram:
In this diagram, the information source will select a message to be transmitted. This message can only be forwarded if it is transformed into a transmissible form. The sender should convert the message into code and then choose a communication channel. The channel can be a telephone wire, the press, the Internet, etc. In turn, the received signal is decoded into messages (voice or images on a screen) by the receiver. It can happen, however, that the transmitted signal does not coincide with the received signal. This occurs when an interfering source of information adds other signals to the channel.

Based on this model, we suggest that information is multidimensional in the sense that it is characterised by three dimensions: its nature that reveals the visual aspect and content of the information, a support being the channel of diffusion and a source as the origin of the information. The model of Shannon and Weaver (1949) has been used as a reference in communication in a number of other studies. For example, Nwagabara and Reid (2013) examine how this model adjusts corporate social responsibility communication for shareholders. These authors argue that new media can be used to advance CSR communication. Using Shannon and Weaver's model, Holm (2006) attempted to identify the obstacles that hinder the development of ‘integrated marketing communication’.

The following section presents the literature related to the three predefined dimensions of information: nature, support and source.

1.1 Nature of the information

The nature of the information describes mainly the form in which this information is presented. Consumer choice is influenced by the design of a website (Kini and Choobineh, 1998), ease-of-use and perceptions of privacy (Bulter and Peppard, 1998), as well as user expectations (Căpățînă, Kachour, Lichy Micu, Micu and Codignola, 2020). Graphics, visual appearance and editorial quality also play a positive role in driving online transactions (Ladwein, 2001). Some studies highlight the relationship between the conceptual quality of the site and the pleasure experienced by users (Li, Daugherty and Biocca, 2001). Moreover, Shankar, Smith and Rangaswamy (2003) argue that the quality of the information content and the ease of obtaining relevant information will positively influence overall customer satisfaction. In the context of stock exchange sites, a cyber-investor is presented with a set of tables and graphs in different shapes and colours.

Taking inspiration from Guisquet (2006), a cyber-investor consults stock market websites for:

- Stock market prices that represent the value of each share listed on the stock exchange,
- Graphs that show trends for a stock over a specific period of time,
- Financial news disseminated by specialised financial press agencies,
- Consensus in the form of recommendations from members and analysts,
- Discussion forums.

With social technologies such as Facebook and Twitter, information is more readily available and useful (Căpăţînă, Kachour, Lichy Micu, Micu and Codignola, 2020). Wang, Tong, and Chin (2014) examined technologies designed to improve the efficiency and accuracy with which feelings inferred via Twitter are classified. Zou, Tang, Xie, and Liu (2016) analysed the syntactic characteristics of sentences to generate a more accurate solution for classifying user feelings. In behavioural financial theory, investor sentiment and mood are important indicators that can determine stock market behaviour. Investors often buy or sell based on mood inferences about market securities (Aldridge and Krawciw, 2017). The characteristics of a stock market website can influence these inferences.

1.2 The information support

According to the Médiamétrie Internet Usage Observatory\(^3\), 40.5 million Internet users made online purchases during the third quarter of 2019. There are now 1.7 million more cyber-buyers than a year ago; the number of individual investors buying shares in French companies increased fourfold in March 2020, according to a recent AMF report\(^4\). A significant proportion of share buyers over this period came from new customers or customers who had been very inactive in the recent period: over 150,000 new investors bought shares in the SBF 120 index in March 2020, taking into account that the total number of individual investors in France is between 3 and 4 million. The new investors are 10 to 15 years younger than the regular investors – but have invested smaller amounts than regular investors.

One of the advantages of websites, as an information support, is the scope for broadening the amount of data available and reducing consumer search costs. The ease of access to a large volume of information is often highlighted by investors. Internet users use less effort and are more efficient on the investment task than users of paper-based information (Kelton and Robin, 2012). Nel, Smit and Brummer (2019) find that effective voluntary communication via websites enriches the investor base, decreases the cost of equity capital and improves the value of the company. For Levy (2004), excess information causes the Internet user to develop unconscious protection mechanisms called cognitive bias. These biases are intended to simplify the complexity of reality and avoid information overload in order to ensure the mental health of the user. In the context of online investment, overconfidence is one of the most important protection mechanisms. It can be defined in two different yet complementary ways first, it implies that the investor mistakenly believes he/she has all the information needed and therefore overestimates his/her own knowledge (Daniel, Hirshleifer, and Subrahmanyam, 1998) – a process known as 'miscalibration'. The second definition involves the investor overestimating his/her own skills (Langer, 1975) – a process known as the 'better-than-average effect' (Camerer and Lovallo, 1999).

1.3 Sources of information

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\(^3\) Rapport Médiamétrie du 21/11/2019
Information disseminated on the stock exchange sites comes from various sources, which can be either professional, such as rating agencies and the financial press, or non-professional, such as discussion forums. The credibility of the source is a determining factor in the decision-making process of the individual investor. The credibility dimension refers to the authenticity and competence of the source, the communicator, the presenter, the message, the brand, the company and the media. It reflects the positive versus negative evaluation by the consumer. Credibility is not an attribute of the source, but a subjective perception of its image based on information and experience (Hass 1981; O'Keefe, 1990). The expertise of the source may thus be considered an effective means of reducing the perceived risk associated with the decision, use or consumption of the product/service.

After reviewing the literature, we first of all question the characteristics of the information disseminated on the stock exchange sites. Next, we examine how these characteristics can influence the cyber-investors who consult these sites. Finally, it is important to know what improvements can be made to provide useful and attractive information for these cyber-investors.

2. Methodology

We now outline our exploratory study, which aims to highlight key concepts or variables adapted to the field of analysis of the stock market investor's information environment. Thus, a qualitative study allows us to enrich the literature relating to multidimensional information (MI) disseminated on certain French stock exchange sites.

2.1. Method of analysis

Semi-structured interviews were conducted in this exploratory study. The interview is the preferred tool of the exploratory phase. The interview technique reveals the richness of information that is lacking in other more quantitative techniques. During an interview, the interviewees are put into situations in front of stock exchange sites so that they can interact and express themselves with ease on the themes of our interview guide which relate to: buying on the Internet, information disseminated on stock exchange sites, online trust and decision making/information processing. The objective of this step is to better understand the concept of "multidimensional" information, which means identifying the elements relating to the three predefined dimensions of information: nature, support and source.

2.2 Sample

The interviews were conducted with 20 people, lasting on average 45 minutes each. From the 20th interview onwards, there was a repetition of previous verbatim and no further enrichment of existing verbal material. Thus, we assumed that our sample had reached saturation criterion. This criterion has been defined by Mucchielli (1991, p 114) as "the phenomenon which appears after a certain time in qualitative research when the data collected are no longer new". Our sample escapes the rule of representativeness in the statistical sense of the term (Evrard, Pras and Roux, 2003). The aim was not to extrapolate or generalise the results but rather to capture particular situations or contexts.

Table 1 describes the interviewees' profile. We used a convenience sample composed of young investors with genuine securities portfolios, as well as students in Master's programmes in
Banking and Stock Exchange or Asset Management who take part in the stock market challenges at Lyon III University. The sample interviewed is predominantly male.

According to the annual AMF survey in 2019 on investor attitudes and opinions about financial products, investors can be divided into four categories:

- Concerned: an older target group that is highly preoccupied and has difficulty saving;
- Disinterested: a modest, detached target that is very uninvolved in the financial sector;
- Expert helpers: an engaged target that diversifies the sources of information used and is particularly interested in equity investments;
- Dynamic optimisers: a young, committed target group that is interested in savings products and equity investments.

Table 1 shows that the longest experience in stock exchanges is 9 years. Thus, our sample falls within the category of dynamic optimisers. In this context, an over-confidence bias and a search for thrills could take place among young investors, particularly following an immediate stock exchange success.

### Table 1. Interviewee profiles

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Stock exchange experience</td>
<td>5 years/3000€</td>
<td>3 years virtually</td>
<td>2 years virtually</td>
<td>9 years/7000€</td>
<td>4 years/7000€</td>
<td>3 years virtually</td>
<td>2 years virtually</td>
<td>4 years/5000€</td>
<td>3 years/2500€</td>
<td>4 years virtually</td>
</tr>
</tbody>
</table>

NB: this table shows the interviewee profiles. It indicates the gender, duration of the virtual or real experience in stock exchange investment and average amount invested in the case of real experience.

### 2.3 Processing the analysis

The verbal content collected was thematically analysed using QSR NVIVO 8 combined with a lexicographical analysis and a contingency (or co-occurrence) analysis in WordMapper 7.5. Content analysis involves dividing the text into basic units of analysis, grouping them into homogeneous, exhaustive and exclusive categories, and then counting how often they appear. The objective was to determine how the various themes were addressed by the interviewees. Lexicographical analysis consists of detecting the relative weight of the components of discourse, which is measured by the frequency of occurrence in the corpus. This analysis detects the significant words of the interviewees. Finally, we carry out a contingency analysis which complements the earlier analyses since it detects associations between units of recording.

By means of the interview guide, we projected each respondent into a given situation in which his/her personal opinion is brought to the fore on concepts whose definitions found in the literature remain unclear and mixed (Evrard, Pras and Roux, 2003). This simulation of questions put to the interviewee enables the interviewee to answer and stimulate his/her...
thoughts with ease. Next, we recorded and transcribed the 20 interviews in order to proceed with repeated and ‘fuzzy’ readings of the whole discussion.

For this study, we opted for open coding and classified the data into sets and subsets according to a thematic grid created using NVivo software. This grid is based on the themes and sub-themes identified a priori from the literature before coding, and a posteriori during the actual coding process of the interviews conducted. The method used to determine the categories is similar to the method of systematic comparison used by Glaser and Strauss (1967). Finally, with reference to the language of the software, the themes are designated as nodes and the sub-themes are represented by sub-nodes. In order to ensure the reliability of our coding, we calculated Cohen's (1960) kappa convergence index, derived from Kruskal's K. The value of this index, which is 0.90, reflects high coding reliability. Specifically, double coding was carried out to check the clarity of the definitions to be coded and the classification of the units into categories. To do this, the collected data are analysed by 3 coders (3 PhD candidates) using the same thematic analysis grid.

3. Results of the analysis

Below we present the results of the analysis. First of all, we assume that information is multidimensional insofar as it is composed of three dimensions, namely its nature (textual data, statistics and graphics), its support (stock exchange sites) and its source (professional or non-professional sources). According to our respondents, the information on the stock exchange sites consulted is diverse and varied. It is composed of almost the same headings – i.e., News, Courses, Graphics, Advice, Consensus, Forum, Awards, Companies, Agenda and Order Book. Information presented under these headings is composed of textual, graphical and statistical data.

3.1. The nature of multidimensional information

The information on the stock exchange sites may include textual, statistical and graphical data.

3.1.1 Text data

Text data is any information presented in typescript form. On stock exchange websites, this form of information is present in the following sections News, Agenda, Advice, Consensus and Discussion Forum. The lexicographical analysis in Table 2 explains that the ‘News’ section is the most consulted by the investors interviewed regarding textual data, with an occurrence of 81 times (24.3%) outpacing the ‘Agenda’ section. This result clearly shows the importance of financial news for the individual investor. Investors' passion for certain securities motivates them to consult the news. "Some companies fascinate me more than others, in which case I will look more closely at the news section concerning these companies, while in others I look over the information more quickly" (Interviewee 15). News help the investor to access information in real time. For example, Interviewee 8 states that he is “interested in stocks that are in the news”. The ‘Agenda’ is also textual data that gives the publication dates of the results. For interviewee 6, the agenda is an important element that should be consulted before the other headings; thus, "The first thing I look at is the diary to see when they published their half-yearly or annual reports, the reports of the firms that give their assessment of a company ... I find it important to look at the diary ... financial information is extremely important". The advice,
consensus and discussion forum sections are strongly linked to the source of information. That is why we will develop them further".

3.1.2 Statistical data
Some stock exchange information is quantified to be more intelligible and credible. Statistical information is presented in the sections: Order Book, Price, Ranking and Company. The order book is a table showing the quantities of buy and sell orders on the stock exchange; it provides a convenient and instant tool for investors. Being instantaneous, "I look at the order book a lot, especially since I stay on this bank because it's an instantly updated order book – allowing you to have a dashboard of bullish and bearish values" (Interviewee 11). And also, "I come here, so I already know the bullish and bearish values right away. That's what I like" (Interviewee 14). The order book gives better overview of market trends, "The best way to find out what's going on in the market is to look at the order book in real time" (Interviewee 4).

### Table 2. Lexicographical analysis regarding the nature of the information

<table>
<thead>
<tr>
<th>Nature of the information</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>News</td>
<td>81</td>
<td>24,3</td>
</tr>
<tr>
<td>Agenda</td>
<td>1</td>
<td>0,3</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>24,6</td>
</tr>
<tr>
<td><strong>Statistical data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share price</td>
<td>77</td>
<td>23,1</td>
</tr>
<tr>
<td>Order book</td>
<td>13</td>
<td>3,9</td>
</tr>
<tr>
<td>Awards</td>
<td>14</td>
<td>4,2</td>
</tr>
<tr>
<td>Companies</td>
<td>21</td>
<td>6,3</td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td>37,5</td>
</tr>
<tr>
<td><strong>Graphical data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fundamental (informational) analysis</td>
<td>56</td>
<td>16,8</td>
</tr>
<tr>
<td>Technical analysis</td>
<td>70</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>37,9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>333</td>
<td>100</td>
</tr>
</tbody>
</table>

NB: this table details the lexicographical analysis regarding the nature of the information. It indicates the frequency and percentage of terms related to the textual, statistical and graphic data provided by the stock exchange sites.

The share price represents the value of a share at market opening, during transactions and at market closing. It is the most consulted information by cyber-investors and accounts for 23.1% of the statistical data. The share price shows the company's future growth potential, which "makes it easier to find a share that is likely to evolve well in the future depending on its quotation" (Interviewee 7).

The "Company" section presents the quarterly, half-yearly and annual results of listed companies. It is a reliable performance indicator for companies. In this section financial data, the names of shareholders and directors, the company's activity and analysts' forecasts are presented. It is also a major source of information for the investor, taking second place in the figures – thus, "the Company section allows investors to see what the company is doing, which makes it possible to see its activity and its geographical location, whether it is in mature markets, developed, secure sectors, and so on" (Interviewee 10).
The ranking presents the bullish and bearish values of the day, showing a performance indicator for the shares. It is the third most important indicator of the data consulted. Investors try to understand the rise or fall of a share in order to anticipate its future, thus "... secondly I look at the Rising and Declining Rankings and try to find the reason for the rise or fall in value" (Interviewee 13). There are some people who analyse the ranking according to the colour code and simplicity, as indicated by interviewee 3: "I look at a table like this, it suits me very, very well and I understand it very well. There are colours: red for bad and green for good!"

3.1.3 Graphic data

Graphic or schematic information is a tool that allows the individual to understand the data and thus facilitates decision-making. The graphic section is one of the most visited sections by our investors. Technical analysis and fundamental analysis have almost the same frequency in our verbal data with occurrences of 16.8% and 21% respectively. Technical analysis consists of the study of price charts and various indicators deduced from prices in order to anticipate market developments (Murphy, 2003). Chart 1 clearly shows a strong link between the words ‘Analysis’ and ‘Technical’. The word ‘analysis’, cited 110 times, presents an important frequency of association 87, with the word ‘technical’ cited 47 times.

**Chart 1. Link between ‘Analysis’ & ‘Technical’**

After reviewing the data from the interviews, two groups of investors are identified: the first group includes investors who adhere to the graphical/technical analyses, and the second group who do not. According to interviewee 10, graphical analysis is more meaningful than other methods of analysis. "For me, the chart is more important than fundamental analysis and it has a leading edge too! I remember when the CAC 40 market index went down to 2700 points; by the way, only graphical analysis could have anticipated that!". Graphs sometimes replace informational analysis when the latter is not complete or relevant. According to interviewee 4, the graph is a key to success on the stock market: "I need a good graph; the key element is the graph because in real time you can see the tensions and the advantages of the market".

Some investors fail to see the value of technical analysis, as it does not take into account the wealth of information available in the news. "I don't see the point of technical analysis"
"But once again, the basis of technical analysis is to analyse past prices to determine future prices! And for me on the stock market, you can't take the past into account to determine the future" (Interviewee 1).

3.2 The support of multidimensional information

Stock exchange financial information is disseminated on stock exchange websites. At present, there is an abundance of online stock exchange sites that change over time. We therefore selected four sites found on several platforms that compare French stock exchange sites, namely Boursorama, AbcBourse, ZoneBourse and boursier.com. The following section analyses investor reactions to the ergonomics, quality and quantity of the information disseminated on these stock market sites.

3.2.1 Ergonomics of the stock exchange site

Ergonomics of Boursorama: Table 3 shows the lexicographical analysis of the information support. It turns out that Boursorama is the most cited support in the verbal data in terms of ergonomics, quality of information and quantity available on the four stock exchange sites.

"It's a site that's simple, easy to use and rather clear and pleasant to consult" (Interviewee 12). Moreover, "I think it's fairly user-friendly, you know where you're going with different sections. It's easy to find your way around, shares, warrants, prices, and so on … there’s good visibility throughout the site" (Interviewee 13). The ergonomics are also relative to the colour codes "The graph is better presented, it's quicker to download. The graphics are interesting, they remain sober" (Interviewee 2). I like the drop-down menus, it's really super hierarchical" (Interviewee 3). There is nevertheless a minority of investors (in our sample) who find that the Boursorama site is poorly designed "Boursorama no, I've never enjoyed consulting it. The first page is so complicated..." (Interviewee 14).

Chart 2 in WordMapper shows a link between the words ‘information’ and ‘Boursorama’. The word ‘information’ is cited 412 times in the verbal corpus ‘Boursorama’ is cited 124 times.
These two words have a high frequency of association of 134, which suggests a significant link between ‘information’ and ‘Boursorama’.

**Ergonomics of Abcbourse:** "Abcbourse is sombre and that's why I didn't go there. It's a question of feeling with some sites" (Interviewee12). In this case, the ergonomics of the site is judged by the background colour of the site. If the colour does not please the investor, he/she will not consult the stock exchange site a priori.

**Ergonomics of Zonebourse:** Zonebourse is a site that brings together the essentials whilst satisfying the needs of unsophisticated investors. "But for the people who are a somewhat well-informed, it is Zonebourse, Abcbourse" (Interviewee 1). The colour comes back again to influence the decision to visit the stock exchange site or not. "It's more than sober! I'm not used to it, it's so different, the structure of the graph, etc." (Interviewee 2).

**Ergonomics of Boursier.com:** Boursier.com is an easy-to-access site, targeting the daily needs of investors from the home page and throughout, as it provides direct access to the stock charts and the evolution of the CAC. "It's easy to find my way around: I can see the list of all the stocks I'm interested in right from the front page" (Interviewee 7).

<table>
<thead>
<tr>
<th>Table 3. Lexicographical analysis of the information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website ergonomics</td>
</tr>
<tr>
<td>Boursorama</td>
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<tr>
<td>Zonebourse</td>
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<tr>
<td>Abcbourse</td>
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<tr>
<td>Boursier.com</td>
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<tr>
<td>Information quality</td>
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<tr>
<td>Zonebourse</td>
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<tr>
<td>Abcbourse</td>
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<tr>
<td>Boursier.com</td>
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<tr>
<td>Quantity of information</td>
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<tr>
<td>Zonebourse</td>
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<tr>
<td>Abcbourse</td>
</tr>
<tr>
<td>Boursier.com</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

NB: this table details the lexicographical analysis of the information, indicating the frequency and percentage of terms related to the ergonomics of the site, the quality and quantity of information according to the stock exchange site.

3.2.2 *Quality of information*

The quality of information in an online stock exchange depends on its accessibility, clarity, simplicity and relevance in decision-making.

**Quality of the information issued on Boursorama:** the quality of the information disseminated on Boursorama is characterised by the clarity of the information and its presence in real time: "Boursorama is clear, easy to use and allows you to follow the evolution of the stock market
in real time" (Interviewee 12). In addition, "what I expect from a stock market site is that it provides me with the real price, then any other information is a plus to have at hand" (Interviewee 20).

The quality of the information on this site can also be measured by its availability: "The information is within everyone's reach. I don't see anything very complicated, besides what interests me most is the value side" (Interviewee 13). Nevertheless, some stock market players criticise Boursorama for providing inaccurate and trivial information: "On Boursorama there is a lot of news, some of which is not very important" (Interviewee 9).

Quality of the information issued on Abcbourse: "the information on Abcbourse is very simple. And considering my needs, you could say it's enough for me" (Interviewee 19). "On Abcbourse, the information is published daily, updated, but not in detail" (Interviewee 3). Thus, we can deduce that Abcbourse is a basic, instructive and preferred stock exchange site for beginners and learners.

Quality of the information issued on Zonebourse. Zonebourse has headings and analyses of information that are relatively clear and understandable. "I find Zonebourse well designed, there are a few analyses but it's straightforward I think" (Interviewee 10).

Quality of the information published on Boursier.com. Users of boursier.com find advantages in the tracking system – i.e., the information is immediately available. "Boursier.com is simple: I can find my way around… from the first page I already have the list of results I'm interested in, with the news at the bottom. What I'm looking for appears directly before my eyes: the CAC for the day" (Interviewee 7).

### 3.2.3 Amount of information

The amount of information on a stock exchange site is measured in terms of the volume of information.

Quantity of information available on Boursorama. Boursorama appears to be a straightforward site that guides users to the essentials. "The point of sites like Boursorama is that it is not too cumbersome so that you can easily get to what you want" (Interviewee 10). According to other investors, however, Boursorama has too much information and the user gets lost in the intricacies; thus, "I don't find Boursorama very attractive. What I don't like is that there are too many indicators for me" (Interviewee 14), and "There is so much information on Boursorama that it’s difficult to identify what’s useful" (Interviewee 9). We can explain this difference in the appraisal of information between investors by the cognitive capacity of each individual to process a set of information. Thus, the same information could be complicated for one person while it is more accessible for another.

Amount of information available on Abcbourse. "On Abcbourse the information I find it very basic. Given my strategies, we'll say that it was almost enough for me and I just had a small problem with certain things and that's why I went to the feedback" (Interviewee 19). "On Abcbourse, the information is daily but it is lacking in detail" (Interviewee 3). Thus, it seems that Abcbourse contains essential information in terms of stock exchange initiation but is rather limited in volume.
3.3 The source of multidimensional information

The source of information is a very significant element in stock exchange sites that can influence trust and decision-making. This source can be either professional, such as rating agencies and the financial press, or non-professional, such as discussion forums. Table 4 shows the frequency and percentage of terms related to professional and non-professional sources of information. The discussion forums are positioned as the first source with 1008 citations in the verbal data. The "advice" section presents opinions of analysts and stock market experts on the evolution of a share.

3.3.1 Professional sources of information

The "advice" section presents the opinions of analysts and stock exchange experts regarding the development of a share. Table 5 shows the interpretations of the "advice" section. According to the investors interviewed, the advice can be seen as a determining factor in the choice and decision "What really counts and what can change our choice is the opinion of certain analysts or rating agencies" (Interviewee 12). However, the advice seems to be perceived sometimes as noise. "I don't often look at the advice, but sometimes like on Hermès they asked to sell, so on the day they took 8%, so it's contradictory!" (Interviewee 18).

The "consensus" section represents the opinions of financial analysts regarding the purchase, sale and/or retention of financial securities. Consensus is similar to advice since it helps to make the right decision. According to Table 6, consensus can also mean different things to investors. "I use consensus more in relation to the number of analysts, if there are a lot of people advising me to buy I think it's so much better that I buy at the beginning of the day everyone will keep buying" (Interviewee 19).

3.4.3.2 Non-professional sources of information

Non-professional sources can be found in a discussion forum and in members' recommendations. In this respect, the term "non-professional" refers to any person who gives his/her opinion but who does not work within stock exchange circles.

A discussion forum: a space for sharing knowledge and opinions between members. The discussion forum accounts for more than half (57.5%) of the items consulted by cyber-investors. However, some investors have a negative perception of the discussion forum, describing it as non-objective and over-emotional, thus, "I've never visited a forum before in my life because it's just people who know nothing and who judge value based on their emotions. (Interviewee 18). Some investors have a positive opinion of the forum. The forum can be a space for sharing opinions and ideas. The forum is a collection of information that has no jurisdiction or expertise. "I think my opinion doesn't interest anyone! ... the opinions of the other members, unless they are great specialists, I'm not interested in them, they're members who don't necessarily know more about financial information than I do" (Interviewee 13). Some investors have a positive opinion of the forum. It can be a space for sharing opinions and ideas. "It's good to see a friendly space to share all this. It's a space for debate to try to see who is in the right and who is in the wrong"
(Interviewee 17). The forum is also a good indicator of the evolution of small capitalisations. "It can be interesting for the very small company" (Interviewee 9).

Table 4. Lexicographical analysis regarding the source of the information

<table>
<thead>
<tr>
<th>Information source</th>
<th>Frequency</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advice</td>
<td>71</td>
<td>4</td>
</tr>
<tr>
<td>Consensus</td>
<td>68</td>
<td>3,9</td>
</tr>
<tr>
<td>Non-professional source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussion Forums</td>
<td>1008</td>
<td>57,5</td>
</tr>
<tr>
<td>Recommendations from members</td>
<td>606</td>
<td>34,6</td>
</tr>
<tr>
<td>Total</td>
<td>1753</td>
<td>100</td>
</tr>
</tbody>
</table>

NB: this table details the lexicographical analysis relating to the information; indicating the frequency and percentage of terms related to professional and non-professional sources of information.

Members' recommendations: the recommendations of the members of a stock exchange site reflect the consensus of those members to buy, sell, and/or hold a share. This is the opinion of individual stock market enthusiasts. This source is nevertheless used to a lesser extent than forums with no more than 35% of the verbal data. “I don't take into account members' recommendations; it's not something that can be trusted!” (Interviewee 20).

Finally, it transpires that the type of investor can influence the attitude to stock exchange trading on the Internet. Interviewees 3 and 14, who are female investors, focus more on the ergonomics and colour coding of the stock exchange site and prefer to have precise and brief information instead of more detailed information.

Table 5. Typology of advice as a professional source

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Verbatim data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advice as a determining factor in our choice and decision</td>
<td>« What really counts and what can change our decision is the opinion of certain analysts or rating agencies&quot; (Interviewee 12).&lt;br&gt;« I don't look at the opinions of others except for the major analysis firms such as BNP, I'm curious, why they lower their prices or change the value?&quot; (Interviewee 13).</td>
</tr>
</tbody>
</table>
Advice as a comforting factor in our choice

« The opinion of the analysts is interesting to confirm our position, but in itself it doesn't allow us to do what needs to be done!" (Interviewee 13).
« Seeing the advice is reassuring, but it is not the element that determines 100% of the purchase" (Interviewee 18).
« When there's a positive piece of advice, we will read it, because the advice follows our opinion" (Interviewee 1).

Advice as noise

« I don't often look at the advice, but sometimes, like on Hermès, they would ask to sell, so on the day they gained 8%, that is contradictory! »  (Interviewee 18).

Table 6. Typology of consensus as a professional source

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Verbatim data</th>
</tr>
</thead>
</table>
| Consensus as a decision-making factor | «Consensus provides a basis for discussion. It's true, it can be useful because several analysts give their opinions" (Interviewee 12).  
« I'd simply look at the consensus. If the trend is to buy, then I'd go based on a purchase. It's only to comfort myself. I never look at the names of the analysts, I just look at the consensus in general and I don't go into detail" (Interviewee 12).  
« Every time there is an announcement of results I refer to the consensus, I then say we have 44% of turnover, consensus said 43%, ok it's better than the consensus, so it must increase" (Interviewee 13).  
"I use the consensus more than the number of analysts, it's like the horoscope if there are many who advise me to buy I tell myself that it's so much better that I buy at the beginning of the day everyone will continue to buy, but if the consensus changes it will make me change my mind" (Interviewee 19).  
« Regarding the consensus, I go there more out of idleness than in search of precise information. Consensus is more interesting and more visual" (Interviewee 20). |

4. Discussion and recommendations

Our exploratory study analyses the information available on four stock exchange sites: Boursorama, Zonebourse, Abcbourse and Boursier.com. The study assists investors and financial analysts in that it facilitates the consultation of stock exchange sites and enables targeting of relevant information that is likely to provide a more accurate assessment of the evolution of financial assets. Based on our analysis, it appears that investors are more interested in certain criteria at the expense of others. For example, the "News" section is consulted more often than other sections. The order book provides greater visibility on market trends.
However, non-professional sources such as members' recommendations are not considered a sufficiently relevant source of information. From our investigation, investors place great importance on the "news" section for textual data, the "prices" section for statistical data and the "charts" and "curves" section for graphical data. These findings suggest that managers of listed companies should pay more attention to the sound use of these data in their reporting. Improved management of these data will help to provide clear, simple and instantaneous information. In practice, brief and accurate information with a clear graphical explanation will inspire the confidence of individual investors. Moreover, this information must be sufficiently relevant and of sufficient quality to catch the attention of the individual investor and encourage him/her to invest.

Scholarly studies show that investors are subject to behavioural biases that are likely to influence their preferences and decisions. Thus, the rationality of investors is often questioned (Broihanne and Capelle-Blancard (2018)). We believe that a better understanding of the handling of information emerging from stock exchange sites would facilitate the analysis of data, while limiting certain behavioural biases that affect decision-making.

Within the scope of this study, we were able to compare the information conceptualised in four stock exchange sites. This comparison focused on the quality of the information, its richness, as well as the effect of these elements on Internet user trust. Boursorama appears to be the preferred site among French private investors. For the majority of respondents, a simple, clear site is easy to understand and navigate. Zonebourse seems to be a site that brings together all the essentials and meets the needs of less sophisticated investors. Boursier.com is a site that is easy to access and it targets the daily needs of investors, straight from the home page since it provides direct access to the stock charts and the evolution of the CAC. Finally, Abcbourse is a more educational site that makes it easier to learn the rules of stock exchange trading.

Our study identifies potential areas where improvements can be made by designers of stock exchange sites and asset management platforms, particularly life insurance sites. Based on our results and in order to have a successful and attractive site for cyber-investors, designers must pay close attention to the layout of the site, its navigability, structure, colours and general ergonomics. A good match between these elements and the needs of potential investors will improve the conditions for finding relevant information on stock market sites. Furthermore, ease of access to information contributes to greater satisfaction and loyalty, hence the need for managers and experts in the field of stock exchange information to identify an adequate level of information and to create a site that provides access to a particular type of information, in the form chosen by the Internet user. Such information should lead the designers of stock exchange sites to offer their clients personalised data. In this way, clients can create an interface that can be customised according to their own needs in terms of textual, graphical and statistical data. Thus, the ergonomics and design accomplished by the designers must be close enough to their communication strategies. For example, a stock exchange site like Abcbourse is perceived by investors as an educational site. Therefore, it seems more advisable to have a site with simple colours that is easy enough to navigate for finding information. Boursorama, on the other hand, is perceived as a site for stock exchange enthusiasts. In this site, we recommend that experts provide more advanced tools for technical analysis and provide instantaneous, rather detailed and complete information.

5. Conclusion
In this study, we focus on the information available on stock exchange websites. It transpires that this multi-dimensional information has different facets. On the one hand, its nature is characterised by textual data in the form of news or diaries, statistical data in the form of order books, quotes, rankings and companies, and graphical data in the form of figures and plots. On the other hand, the information is transmitted through a support, i.e. the stock exchange site, which is evaluated in terms of ergonomics, the quality and the quantity of the information disseminated. Finally, information is transmitted by a source that may be either professional, such as the advice and consensus of confirmed analysts, or non-professional, such as the recommendations of the members of a stock market site or their opinions on discussion forums.

This study shows the relative importance of certain criteria such as news, ergonomics, quality and source of information on stock exchange sites.

Finally, we provide various recommendations to investors and analysts who use stock exchange sites, as well as to the designers of stock exchange investment sites. Thus, this study is a blueprint for the design of an individual investor's information environment on the online stock exchange. It remains an interesting avenue to be explored in greater depth as it is still relatively under-explored. We thus assume that sound management of the information disseminated on stock exchange sites could contribute to greater transparency of corporate communication and consequently reduce the informational asymmetry between the various stakeholders. Future work could pursue this line of research.

References


EVRARD Y., PRAS B. & ROUX E. (2003), Market, études et recherches en marketing, 3ème édition.


