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The intersection of source, message, and recipient characteristics on information-exchange activity via Twitter

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Abstract. The purpose of the research is to explain how Twitter supports real-time information exchange in popular domains, and examine the influence of source, message, and recipient characteristics on information exchange. University students were surveyed using a structured questionnaire. A model was developed and statistically tested to examine the influence of characteristics on information exchange via Twitter. Different characteristics were demonstrated to be significant predictors of information exchange. For source characteristics, authoritative knowledge, social connections, and attractiveness have a positive influence, while for recipient characteristics, prior knowledge, community engagement, and demographics influence information exchange. For message characteristics, information usefulness and information quality are effective. Overall, influences vary based on the domain. The results help Twitter operators and users to understand the most important source, message, and recipient characteristics for information exchange. This study informs sources about the characteristics that make tweets more informative, and more likely to be exchanged by recipients. It assists Twitter operators to understand what characteristics are important in future system designs.

Keywords: source characteristics; message characteristics; recipient characteristics; microblogging; information seeking; information sharing; information exchange

1 Introduction

The recent development of social networking sites (SNSs) has transformed the World Wide Web into a social and participatory place in which users create, broadcast, modify, and share information and knowledge [1]. [2] stated that “online communities, including discussion forums, blogs, social networking sites, and microblogs, appear to be the most active places where users’ information sharing behavior takes place” (p. 604).

Twitter, a social networking and microblogging service, is now used widely for broadcasting and exchanging messages, including information in various domains [3]. Twitter is a valuable source of user-generated content, with users able to send and receive messages (“tweets”) freely. Therefore, Twitter use potentially differs from other means of communication because of its timeliness and convenience within a context of reduced control and direct access to personal thoughts and opinions [4]. According to statistics from Statistic Brain Research Institute, in March 2015 Twitter had 645 million Twitter users, posting an average of 58 million tweets per day.

This raises the question of what type of information is exchanged via Twitter and what are the most efficient characteristics that influence this activity. One of Twitter's key advantages is that users can interact with others and exchange information and knowledge. According to [5], users engage in information exchange by seeking and sharing information with each other within a communication medium. Users may aim to exchange information to discover more about topics of interest, evaluate particular information, and benefit others by sharing information. Thus, users typically inspect information that they exchange and determine what is valuable and what is not.

In recent years, Twitter has emerged as a popular research topic [4], [6,7,8,9]. Studies have identified several motivations, gratifications, and drawbacks affecting Twitter usage, and have generally concluded that Twitter is an important platform for information seeking and sharing during real-time events. Research has examined the factors affecting information adoption, credibility, diffusion, and exchange via social media, focusing on a particular domain or event [2], [8], [10], [12,13,14].

Although research has shown the importance of Twitter in information exchange, little is known about the effect of source, message, and recipient characteristics on the success of information exchange when users share and seek information and in particular domains. Previous studies suffer from conflicting conclusions, restrictions in the factors considered, and limitations of subjects or events. This study examines how Twitter supports information exchange in various domains, and comparatively examines the influence of source, message, and recipient characteristics on the most popular information-exchange domains.

2 Literature review

2.1 Information exchange and social media

Studies of collaborative information use in electronic environments have indicated that users are amenable to information exchange in terms of sharing experiences and recommendations, and connect with others who have similar concerns via social networks [15,16]. A number of studies discussed the use of social media as a communication and information-sharing and -seeking resource in the context of different events and subjects [12], [10], [17]. According to [18,19,20], people seek and share information for comfort, support, empowerment of the knowledge they have, or simply to learn. Some information can simply be stored and recalled, while in other cases, it can be passed to others to make decisions and/or affect attitudes and behaviors.

Theories such as uses and gratifications, diffusion of innovation, and technology acceptance model promote an understanding of the use and acceptance of SNSs and identify determinants that influence SNS usage. Among several factors, the motivation for information exchange has played a sufficient role in SNSs general usage [21], features [22,23], and usage types [7], [10]. In the context of health, [10] investigated the factors that influence cancer patients and their companions in using blogs for health information. They found that blogging activity is most helpful for information sharing, and this is affected by perceived credibility and posting comments on others' blogs. [7] examined which motivational and constraint factors impact sport Twitter consumption with regard to athletics. Information motivations were found to guide sport organizations and

practitioners in utilizing social media as an information source. Most, if not all, studies, explain that the need for information is an essential motivation to use SNSs.

Information exchange is a sufficient and necessary condition for knowledge creation and collaboration [24]. Because of the importance of information exchange in knowledge creation and construction, substantial research has investigated a wide variety of factors for information diffusion via SNSs [2], [17], [25]. [17] classified the motivations for information exchange into four types: environmental, personal, interpersonal, and socio-cultural. They identified motivational factors for participation in information exchange that are different from the motivations for hindering contribution. While previous studies focused on the use of SNSs for information exchange, these still suffer from a lack of theoretical framework in understanding information-exchange activity via SNSs.

2.2 Information exchange and Twitter

Twitter has recently developed rapidly because of its sufficient characteristics in relation to information pervasiveness [3]. Because of its timeliness, convenience and large number of users, Twitter has been widely adopted by the public to publish/share information on different topics, such as marketing, sport, politics, health, and education. Unlike traditional media and other SNSs, Twitter provides real-time information and status updates in these domains. [6] investigated the effect of collective intelligence from Twitter information on predicting events in the stock market. [26] studied Twitter as a platform for online word-of-mouth branding, suggesting that Twitter could play an important role in marketing. Twitter information was also used in predicting trends in health [10], as well as airline products and services [8] and enterprise collaboration [27].

Understanding information-exchange activity and its determinants on Twitter can help in the design of information systems and in assisting users to gain influence. A growing body of research explores factors that contribute to the process of information diffusion via Twitter [13], [28,29,30,31]. [31] analyzed 1.6 million tweets to identify their attributes and relative influence for disseminating information. [13] focused on the features of Twitter, including the features of tweets and retweets, that affect information diffusion and exchange. Overall, the research on information exchange via Twitter is still restricted to some determinants, and conducting research on other factors is highly recommended.

2.3 Twitter use in Arabic cultures

In developing countries, particularly the Arab region, Twitter has grown strongly in terms of the number of Arabic users and the amount of content posted in Arabic, indicating that Twitter is being adopted by broad segments of society. A growing body of work has started to identify the effect of national culture on information/knowledge sharing, diffusion, and adoption [2], [17]. Many studies have focused on cultures in the Far East, Europe, or North America. However, and despite the substantial increase in Twitter use in the Arab world to disseminate information and raise awareness of local and global events, to our knowledge, no research has explored in detail the domains of Twitter usage and the determinants that influence information exchange via Twitter in Middle Eastern cultures.

3 Research model and hypotheses development

In order to build knowledge via social media, information exchange is a necessary condition that needs to be investigated [32]. Social media makes it very convenient for users to share and seek information. Users log on to different social media sites to gather information to support their knowledge, and to make decisions. Our work extends existing research in two ways. First, we investigate the type of information that users share and seek via Twitter. Second, we investigate several characteristics to identify which are most related to information-exchange activity on Twitter.

Several theories have been applied to interpret how people are influenced by receiving information, such as Yale's model (exposure, attention, comprehension, acceptance, retention, and action) [33], [34] dual-process theory of normative and informational influences, the elaboration likelihood model (ELM) [35], and the heuristics systematic model (HSM) [36]. These four theories concentrate on three major factors: source, message, and recipient. Yale's model posits that three factors—message, source, and audience—influence people's attention, comprehension, and acceptance of a message, which could later affect their opinions, perceptions, and actions. Dual-process theory of human information processing considers how different types of influences (normative and informational factors) affect processing information, establishing its validity assessments, and ultimately form decision outcomes. ELM and HSM are the most prevalent dual-process models in information-processing research. ELM posits that attitudes and behaviors are influenced by a message both centrally and peripherally. The former entails high-cognitive efforts to observe information, while the latter uses the environmental cues of the message to form judgments. HSM also posits that there are two types of information processing: heuristic and systematic. Heuristic processing uses cognitive heuristic or learned knowledge structure to assess a message, whereas systematic processing examines all relevant pieces of a message to form a decision.

Other categorizations have also been used. [17] classified the motivations for information exchange in social information spaces into environmental, personal, interpersonal, and socio-cultural. [37] examined trust in bloggers of marketer and non-marketer sources using three categorizations of characteristics, namely bloggers, blog, and blog-reading outcomes. [13] proposed a conceptual model based on HSM to investigate the determinants of information retweeting during emergency events, while [30] investigated a number of features that might affect information diffusion via retweeting based on content features and context features.

We propose a theoretical framework with three categories of characteristics—source, message, and recipient—to comparatively identify the factors determining information-exchange activity in different domains on Twitter. We have formulated a number of hypotheses focusing on these categorizations (Figure. 1).

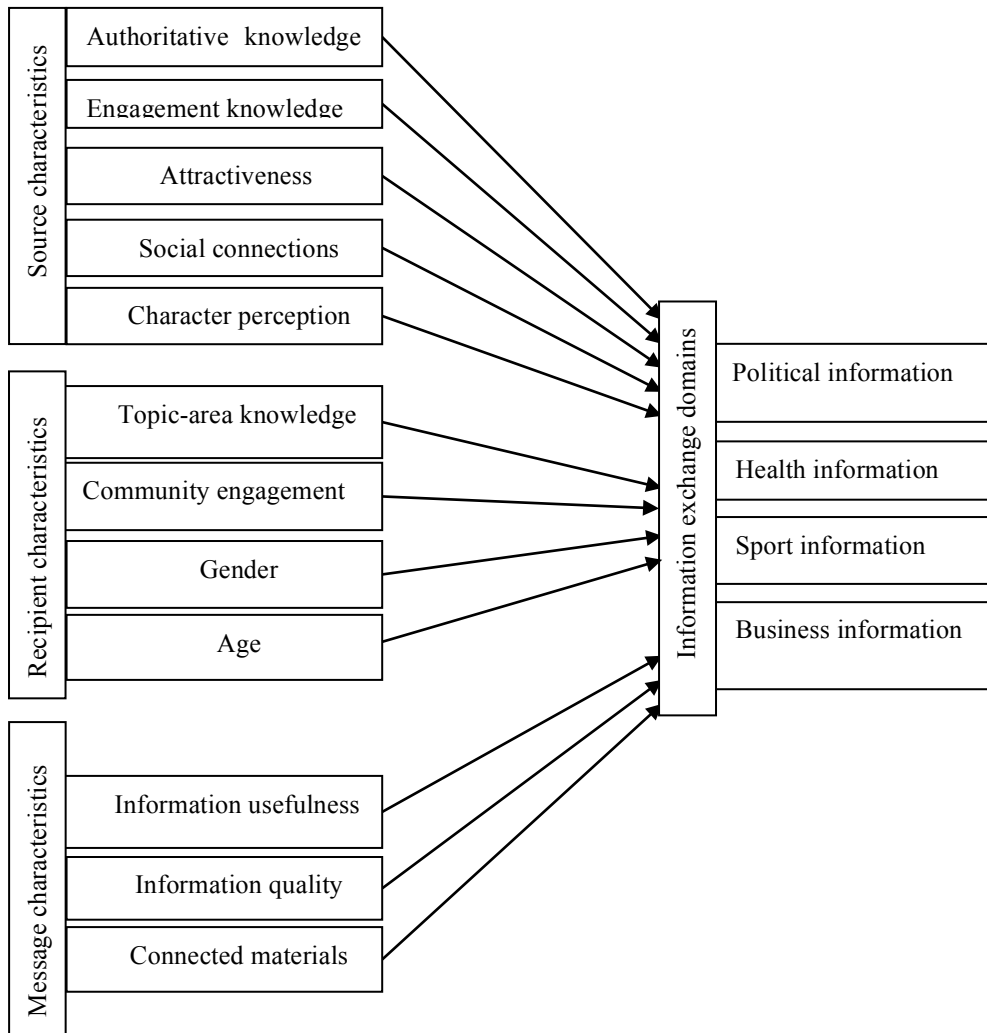


Figure 1. Research model representing the hypotheses of the study

3.1 Source characteristics

Source characteristics refer to the extent to which the tweet’s writer is perceived by recipients to be capable of providing high-quality information. [13], [38] investigated the influence of source trustworthiness, expertise, and attractiveness on information retweeting in emergency events. [37] identified several blog authors’ characteristics in the trust domain, including authoritative

knowledge, engagement knowledge, character of the author, author's character claims, and author's social connections. Liu et al.'s and Doyle et al.'s characteristics, with some modifications, are detailed enough to represent the source characteristics in this study.

Sources are judged as credible based on perceived knowledge, competence, and expertise [39]. The knowledge of an information communicator depends on factors such as personal work, social experience, and personal background. Perceived knowledge can be assessed based on authoritative knowledge and engagement knowledge [37]. Authoritative knowledge is the extent to which the source is perceived to be capable of making accurate assertions in a particular topic area; it accrues over time, depending on factors such as personal work and personal background. [40] discussed the essential role of the positivist tradition, academicians, and portable knower-independent knowledge on authoritative knowledge. The accuracy of authoritative knowledge is supported by formal credentials, for example university degrees, and signs of accomplishment, such as awards.

Engagement knowledge refers to the extent to which tweets' sources are perceived to be capable of providing information, on a longitudinal basis, from personal efforts and social interaction. Unlike authoritative knowledge, which develops primarily through detached inquiry of the topic area, engagement knowledge develops through involvement "within" the topic area [40]. Engagement knowledge depends on topic-area passion, involvement, and wide-ranging experience. Participating in a topic-area Twitter community, for example, by posting strong comments on other tweets and retweets, requires Twitter users to read as much topic-area content as possible. Thus, engagement knowledge is mostly consistent with the tasks of experience in other studies. [13] explored the positive effect of source experience on information retweeting. [37] found that engagement knowledge has more influence than authoritative knowledge on trust formation in the blogosphere.

Source attractiveness—the extent to which writers are preferred by others in social media—can be measured through profile features, namely number of followers and followees, age of the account, number of favorited tweets, and frequency of tweets. [13], [38] identified the importance of source attractiveness on information retweeting.

Source characteristics are also assessed through social connections deriving from social capital. Social capital is the resources available through the structure, relational, and cognitive characteristics of interpersonal connections [41,42]. Individuals with a large, diverse network of contacts allow users to exchange information with others, who willingly share information about their activities, actions, and experiences [43]. Although research has underlined the necessary role of social capital in receiving and accruing information [44,45], indicators of its role in information exchange via social media do not exist. [37] investigated the effect of bloggers' social connections on trust intention and blog-reading outcomes, but neither trust intention nor blog-reading were predicted by bloggers' social connections.

The character of sources revolves around the totality of their personal integrity and benevolence toward readers. Perceived integrity is the extent to which a source is seen as honest, based on neutrality and commitment to moral and ethical conduct, whereas perceived benevolence is a source's caring and motivation toward members' needs and inquiries [46,47]. Research in the context of the blogosphere has found that character has a significant influence on both trust intentions and blog-reading outcomes [37]. Thus, we hypothesize the following:

H1: Source characteristics (authoritative knowledge, engagement knowledge, attractiveness, social connection, and character claims) influence information exchange in topic areas ((a) politics, (b) health, (c) sport, (d) business).

3.2 Message characteristics

[48] reviewed the literature on credibility of information and stated that “obviously, the message itself is critical for information credibility” (p. 140). Content, relevance, currency, accuracy, and usability have been identified as strongly influencing information credibility in electronic media.

Twitter messages cannot exceed 140 characters, so tweets typically consist of short phrases and comments. Despite this limit, governments, institutions, enterprises, and organizations have adopted Twitter to facilitate formal and informal communication, to share information and to discover topics of interest. In their study of airline users’ tweets, [8] identified the main themes of information exchange, such as gathering information, sharing compliments, seeking and sharing information, providing community support, collaborating and helping with each other’s problems, and reporting daily routines. Thus, Twitter users obviously perceive sources’ tweets to be useful. This paper investigates the constructs of information usefulness and information quality. Information usefulness is the extent to which recipients find the information of messages useful for topic-area knowledge; information quality is the accuracy, comprehensiveness, and timeliness of information provided by messages.

Twitter users can mitigate the information volume deficiency using three mechanisms: URLs, mentioning, and multimedia. The short URL allows a link to be inserted into a message, through which users can access further information. Mentioning allows other users to be referenced in a tweet using the “@” symbol. To some extent, [13] realized the analogy between URLs and “mentioning” roles in providing a higher volume of information. Multimedia enables Twitter users to attach videos, images, and audios to tweets, creating richness, which relates to a message’s depth, intensity, and vividness of information. Recent studies indicated that these mechanisms positively influence the action of information retweeting [14], [38] and partly influence retweeting in emergency events [13], but the efficiency of these attempts in the form of information exchange need to be explored within various domains. Thus, we hypothesized the following:

H2: Message characteristics (information usefulness, information quality, and connected materials) influence the information exchange in topic areas ((a) politics, (b) health, (c) sport, (d) business).

3.3 Recipient characteristics

This refers to both stable factors, such as demographics, and variable personal characteristics. Understanding the information described in SNSs is a sufficient way to exchange information and build knowledge [37]. Twitter users introduce information from different domains, so information on Twitter comes from users with different knowledge. Using SNSs as an information-exchange

strategy places the responsibility on recipients to share and find information that needs to be compared with the knowledge they hold, and measure the outcomes [49]. Thus, the importance of information exchange via Twitter might be determined by recipients' knowledge.

According to the motivational models, community engagement is an important determinant for adopting social media. [1] studied the importance of social relations on the expressive usage (social usage) and instrumental usage (information-sharing and -seeking usage) of social media. They identified the importance of community relations in expressive usage, but not in instrumental usage. In the community of practice, [17] underlined the importance of social-culture factors for increasing information exchange; their findings support the assumptions of the social influence model of technology use [50].

The influence of gender and age has been directly and indirectly explored in the context of SNSs [1], [22], [51,52,53], though not in relation to information exchange across different domains via Twitter. Some studies found that younger users are more likely to use SNSs frequently and have more SNS friends than older users [54, 55]. Regarding gender, the Arab Social Media Report found that about 64% of male respondents used Twitter, while the percentage for female respondents was 34% [56](Salem et al., 2014). Men have been found to use SNSs for developing new contacts, whereas women use SNSs for maintain existing relationships [57]. Men use SNSs more for task-oriented and less for interpersonal reasons [58]. In measuring the effect of age and gender differences on the information value of SNSs, [49] found no notable effects on respondents' perceived usefulness of the acquired everyday information in meeting their daily needs. Based on this background, we infer that recipients' characteristics bolster information-exchange activity via Twitter. Thus, we assume the following:

H3: Recipient characteristics (topic-area knowledge, community engagement, gender, and age) influence information exchange in topic areas ((a) politics, (b) health, (c) sport, (d) business).

4 Research methodology

4.1 Questionnaire design

One of the most efficient means of data collection when the researcher knows what data is required to answer the research questions and measure the research variables is the questionnaire [59]. Participants were directed to answer questions on information-exchange activities in four domains (sport, health, politics, and business) using five-point Likert scales (5 = "always"; 1 = "never"). We selected these domains for three reasons. First, they are the most frequently identified domains in social media research [1], [8], [60]. Second, an Ipsos study in Kuwait identified these as the most popular domains for Twitter users [61]. Finally, these are the top domains for information seeking for graduate and undergraduate students [49], [62].

This study measures the influence of source, message, and recipient characteristics on the domains mentioned. Source characteristics comprise engagement knowledge, authoritative knowledge, attractiveness, social connections, and character claims; message characteristics comprise information quality, information usefulness, and connected materials; and recipient characteristics comprise topic-area knowledge, community engagement, age, and gender.

4.2 Sample and data collection

We collected data from Twitter users from Kuwait. A pilot study was used to validate the questionnaire after it was translated into Arabic and double-checked by specialists to ensure the accuracy of the translation. Based on feedback, a few minor changes were made to the wording. For convenience sampling, paper versions of the questionnaire were distributed to 900 undergraduates at a Kuwaiti university, within classes that all students are required to take. We described the purpose of the study and how the questionnaires should be completed via an oral presentation by the principle investigators. All students were informed that their answers would be anonymous and would be used for academic purposes. We collected 872 responses, and after discarding incomplete questionnaires, the number of effective responses was 820.

4.3 Data analysis

We used a series of multiple regression analyses to test the hypothesized relationships among the theoretical model presented in Figure 1. In order to screen potential multicollinearity problems, an exploratory factor analysis (EFA) and the correlation matrix were computed for the variables.

Because several items were loaded at 0.3 and 0.4 in previous studies, and further items were suggested for some constructs, EFA was used to identify relationships among items using the maximum likelihood analysis extraction in SPSS. The factor loadings presented in Table 1 demonstrate that the items were well grouped with acceptable and high loadings. Since the results indicated that all factor loadings are $\geq .5$, it can be said that the instruments are reliable and valid. The correlation matrix of all predictor variables was calculated to assess the possible correlation between factors. No high correlation between the variables was found. Table 2 shows the factor correlation of the variables.

Table 1. Results of constructs' descriptive statistics, reliability and validity

Variables	Alpha	Factor loadings	Mean	SD
<i>Authoritative knowledge</i>	0.69			
Has written a book about the topic		.791	3.54	0.98
Teaches courses on the topic		.501	3.71	0.86
Organizes events on the topic area		.524	3.81	0.89
<i>Engagement knowledge</i>	0.82			
Has extensive experience in the topic area		.630	4.26	0.76
Has resources that others do not have		.686	4.13	0.86
Is heavily involved in the area		.772	4.12	0.82
Is passionate about the topic		.714	4.09	0.84
Is interested in topic-area improvements		.568	3.93	0.77

<i>Attractiveness</i>	0.88			
Has a high number of followers		.842	3.67	1.12
Has a high number of followees		.832	3.52	1.08
Has a high frequency of tweets		.830	3.61	1.08
Has a high number of favorited tweets		.815	3.68	1.07
<i>Social connections</i>	0.73			
Attends major events on the topic area		.647	3.82	0.90
Has contact with other topic experts		.615	3.75	0.75
<i>Character claims</i>	0.72			
Says their information is trustworthy		.648	4.07	0.84
Says they are accurate, fair and unbiased		.759	3.77	0.98
Says they are trustworthy		.535	3.96	0.99
<i>Information usefulness</i>	0.70			
Improves outcomes of topic-area decisions		.636	4.26	0.67
Improves topic-area value that people receive		.723	4.16	0.67
Increases topic-area knowledge effectively		.524	4.20	0.75
<i>Information quality</i>	0.76			
Is well written		.500	4.10	0.81
Is accurate		.612	4.15	0.88
Is up-to-date and immediate		.831	4.28	0.80
Is easy to understand		.700	4.25	0.77
<i>Connected materials</i>	0.77			
Has URL links		.778	3.68	0.93
Has a number of mentions		.800	3.65	0.94
Has multimedia materials		.574	3.93	1.00
<i>Topic-area knowledge</i>	0.81			
I am satisfied with the topic-area tweets I read		.672	4.10	0.75
My previous information on the topic has been re- reinforced		.924	4.02	0.84
My appreciation of the topic has increased		.525	3.99	0.89
<i>Community engagement</i>	0.64			
I can relate to the others in the community		.750	3.99	0.86
I feel I am a part of the community		.551	3.81	1.10

Note: -, Negatively significant influence.

Table 2. Correlation between constructs

	M	SD	1	2	3	4	5	6	7	8	9	10
Attractiveness	3.62	.94	1.00									
Engagement knowledge	4.10	.62	.401	1.00								
Information quality	4.19	.62	.359	.543	1.00							
Topic-area knowledge	4.03	.71	.278	.404	.542	1.00						
Connected materials	3.75	.79	.346	.100	.311	.193	1.00					
Authoritative knowledge	3.69	.72	.147	.420	.239	.288	.125	1.00				
Information usefulness	4.21	.55	.310	.478	.566	.418	.296	.315	1.00			
Character claims	3.93	.75	.494	.521	.414	.366	.369	.256	.425	1.00		
Community engagement	3.90	.85	.156	.309	.270	.480	.229	.305	.308	.207	1.00	
Social connections	3.78	.82	.255	.354	.118	.098	.204	.477	.194	.304	.206	1.00

5 Results

5.1 Sample characteristics

The respondents' demographic information is shown in Table 3. Women accounted for 66.3% and men 33.7% of responses. One explanation is that the proportion of women in the population is larger than the proportion of men, and the sample reflects this. Most respondents (84.1%) were aged 18–24 years.

Table 3. Demographic information of respondents ($N=820$)

Demographics	Value	Frequency	Percentage
Gender	Male	276	33.7
	Female	544	66.3
Age	18–24 years	690	84.1
	25–34 years	110	13.4
	35 and over	20	2.4

5.2 Information-exchange domains

Information-exchange activity in the four domains identified was measured by identifying respondents' level of interest in information sharing and seeking through Twitter (Table 4). The results indicate that Twitter users exchange health information (M. 3.15) more than political (M. 2.53), sport (M. 2.33), and business (M. 2.09) information. However, users are generally more interested in seeking information (M. 2.70) than sharing information (M. 2.35) in the four domains.

Table 4. Activity rates for information sharing and information seeking through Twitter

Activity ^a	Mean	SD
I share political information via Twitter with others	2.15(2.53)	1.19(1.11)
I actively seek information about politics via Twitter	2.91	1.36
I share sport information via Twitter with others	2.25(2.33)	1.41(1.38)
I actively seek information about sport via Twitter	2.41	1.48
I share business and economic information via Twitter with others	2.01(2.09)	1.15(1.12)
I actively seek information about business via Twitter	2.18	1.22
I share health information via Twitter with others	3.00(3.15)	1.26(1.17)
I actively seek information about health via Twitter	3.30	1.23
Activity in all information-sharing domains	2.35	.81
Activity in all information-seeking domains	2.70	.80

Notes: Parentheses contain the means and SD of information-sharing and information-seeking activities for each domain.

^a Five-point Likert-type scale, 1=never, 5=always

5.3 Hypotheses testing and results

Multiple regression analysis was used to examine the effect of a combination of two or more predictor variables on a criterion variable [63]. The results of the four multiple linear regressions are presented in Table 5. It is worth noting that the R² for sport information exchange (38.3%) was much higher than it was for politics (11%), health (6.4%), and business (4.3%).

Politics

With regard to source characteristics (H1.a), authoritative knowledge ($\beta = .153$, $p < 0.001$) and social connections ($\beta = .090$, $p < 0.05$) were positively significant, while engagement knowledge ($\beta = -.125$, $p < 0.01$) had a negative influence. Sources who attend major political events and have social connections with other experts positively influenced political information exchange. Character claims and attractiveness ($p > 0.05$) were insignificant in this domain. Message characteristics were also assessed (H2.a), with none of the characteristics found to have a positive influence. However, connected materials ($\beta = -.154$, $p < 0.001$) negatively influenced political information exchange. With regard to recipient characteristics (H3.a), topic knowledge ($\beta = .226$, $p < 0.001$) was statistically very significant. The age hypothesis ($\beta = .111$, $p < 0.01$) was also confirmed: the

youngest in our sample are less likely than the oldest to use Twitter for political information exchange. Gender was negatively significant ($\beta = -.168$, $p < 0.001$), with women less interested than men in political information exchange. Community engagement was insignificant.

Sport

In terms of the effect of source characteristics (H1.b), social connections ($\beta = .127$, $p < 0.001$) were positively significant, while authoritative knowledge ($\beta = -.066$, $p < 0.05$) and engagement knowledge ($\beta = -.096$, $p < 0.05$) were negatively significant. However, when sources have higher social connections, their tweets are considered significant by users. Two of the message characteristics were also supported (H2.b). Information usefulness ($\beta = .034$, $p < 0.01$) and connected materials ($\beta = -.080$, $p < 0.05$) were statistically significant. Connected materials negatively contributed to sport information exchange. Regarding recipient characteristics (H3.b), topic-area knowledge ($\beta = .123$, $p < 0.01$) and community engagement ($\beta = .079$, $p < 0.05$) positively affected sport information exchange. However, gender ($\beta = -.630$, $p < 0.001$) negatively contributed in the model, with women less likely than men to exchange sport information.

Business

The effect of source characteristics on business information exchange (H1.c) was influenced by the characteristics of attractiveness ($\beta = .126$, $p < 0.01$) and character claims ($\beta = -.104$, $p < 0.05$). However, character claims negatively contributed to business information exchange. Interestingly, none of the message characteristics (H2.c) were significant in business information exchange. Regarding recipient characteristics (H3.c), topic-area knowledge ($\beta = .106$, $p < 0.05$) was the only characteristic that was positively statistically significant. As in the political and sport domains, gender contributed negatively to business information exchange: women were less likely than men to use Twitter for business information exchange. Community engagement and age characteristics were insignificant.

Health

Source characteristics (H1.d) were significant through sources' authoritative knowledge ($\beta = .107$, $p < 0.01$) and attractiveness ($\beta = .155$, $p < 0.001$); the other source characteristics were insignificant. With regard message characteristics (H2.d), only information quality ($\beta = .196$, $p < 0.001$) was significant. No recipient characteristics (H3.d) were significant.

Table 5. Results of the regression analysis on the hypotheses

	Politics information exchange		Sport information exchange		Business information exchange		Health information exchange	
	B(SE)	$\beta(t\text{-value})$	B(SE)	$\beta(t\text{-value})$	B(SE)	$\beta(t\text{-value})$	B(SE)	$\beta(t\text{-value})$
Constant	1.34(.355)	(3.78)***	3.99(.366)	(10.91)***	2.11(.371)	(5.69)***	1.13(.383)	(2.96)***

<i>Source characteristics</i>								
Authoritative knowledge	.237(.062)	.153(3.824)***	-.126(.064)	-.066(-1.975)*	.055(.065)	.035(.847)	.174(.067)	.107(2.606)**
Engagement knowledge	-.222(.081)	-.125(-2.753)**	-.212(.083)	-.096(-2.549)**	-.100(.084)	-.055(-1.179)	-.031(.087)	-.017(-.357)
Social connections	.122(.058)	.090(2.096)*	.212(.060)	.127(3.537)**	-.033(.061)	-.024(-.540)	-.074(.063)	-.052(-1.187)
Character claims	.032(.062)	.022(.510)	-.028(.064)	-.015(-.431)	-.153(.065)	-.104(-2.353)*	-.085(.067)	-.055(-1.265)
Attractiveness	.008(.046)	.007(.168)	-.034(.047)	-.023(-.719)	.151(.048)	.126(3.144)**	.193(.049)	.155(3.914)***
<i>Message characteristics</i>								
Information quality	.016(.083)	.008(.195)	.259(.086)	.105(3.026)*	.158(.087)	.078(1.821)	.354(.089)	.169(3.953)***
Information usefulness	.025(.075)	.014(.340)	.075(.077)	.034(.971)**	-.016(.078)	-.009(-.199)	.036(.081)	.019(.442)
Connected materials	-.216(.052)	-.154(-4.114)***	-.139(.054)	-.080(-2.560)*	-.059(.055)	-.042(-1.070)	-.043(.057)	-.029(-.757)
<i>Recipient characteristics</i>								
Topic-area knowledge	.353(.068)	.226(5.170)***	.238(.071)	.123(3.378)**	.168(.072)	.106(2.348)*	-.049(.074)	-.030(-.660)
Community engagement	.040(.051)	.030(.779)	.129(.053)	.079(2.442)**	-.078(.053)	-.059(-1.454)	.045(.055)	.033(.811)
Gender	-.395(.087)	-.168(-4.527)***	-1.840(.090)	-.630(-20.418)***	-.279(.091)	-.117(-3.053)***	-.089(.094)	-.036(-.945)
Age	.276(.085)	.111(3.252)**	-.160(.088)	-.052(-1.819)*	.067(.089)	.027(.755)	.096(.092)	.036(1.046)
<i>F</i> value		8.30***		41.70***		3.30***		4.57***
<i>R</i> ²		.110		.383		.043		.064
Adjusted <i>R</i> ²		.097		.374		.029		.050

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Gender: Dummy-coded with male = 0 and female = 1.

Age: Dummy-coded with 18–24 years = 0, 25–34 years = 1, and 35 and over = 2.

Table 6. Summary of the results of hypotheses test

Hypotheses	Information exchange activity			
	Politics	Sport	Business	Health
<i>Source characteristics</i>				
Authoritative knowledge	✓	–✓		✓
Engagement knowledge	–✓	–✓		
Social connections	✓	✓		
Character claims			–✓	
Attractiveness			✓	✓
<i>Message characteristics</i>				
Information quality				✓
Information usefulness		✓		
Connected materials	–✓	–✓		
<i>Recipient characteristics</i>				
Topic-area knowledge	✓	✓	✓	
Community engagement		✓		
Gender	–✓	–✓	–✓	
Age	✓			

Note: – Negatively significant influence.

6 Discussion and conclusions

Health information was found to be the most prominent of the four domains for information exchange on Twitter. This indicates that Twitter is an important resource for finding more than for sharing health information. Twitter allows users to seek and share information on sensitive health topics, such as drug use, sexual health, or depression. Political information exchange is the next most popular domain, but the results show a remarkable gap between information seeking and information sharing. Twitter users prefer to seek rather than share political information. This might relate to recent legislation and judicial rulings that restrict the freedom to participate in political issues. Sport is the third most active domain for information exchange. Consistent with the other domains, users seek rather than share sport information. Thus, the top priority for users is to find sport news, results, or upcoming events rather than share such information. Business information is the domain with the lowest rate of information exchange, with a small difference in information-seeking and information-sharing activities. Because most of the respondents are young students, business information is not a priority for them. To our knowledge, there is no directly comparable research on the importance ratings of the information-exchange activity for this population. Therefore, comparisons are made with literature that has a slightly different focus. While not a study of SNSs, [62] surveyed over 8,000 American undergraduates and identified news or current events, product and purchasing information, and health and wellness information as the top three everyday information needs. [49] surveyed international students in the USA and found the top five information needs among SNSs to be finance, health, news of one's home country, housing, and entertainment. [61] showed the greater importance of Twitter for political issues than for health, sport, or business issues. It is remarkable that the top five domains are similar in nature, with a slight difference in ranking. Extending the domains is encouraged to test whether different samples would yield similar results to this study.

With regard to the factors that influence information-exchange activity, regression analysis showed that source characteristics partially correlated with information exchange for the four domains. The traditional knowledge sources, authoritative knowledge and engagement knowledge, do not efficiently drive all information-exchange topics. Political and health tweets posted by sources who have academic degrees and awards and conduct accomplishments are most likely to be sought and shared by Twitter users. However, these characteristics significantly detract from sport tweets in information exchange. Twitter users were dubious of the activities of engagement knowledge in information exchange, especially for political and sport tweets. Many Twitter accounts that tweet sensitive information use pseudonyms, but users may not trust and interact with information from such accounts. [13] identified the role of source expertise on information re-tweeting, which is consistent with our findings in political and health information exchange. Inconsistently, [37] found that trust formation is predicted by engagement knowledge of a blogger. It is also interesting that social network connections have more of a role in political and sport information exchange than in business and health information exchange. Therefore, a source with personal, professional, or institutional connections with political and sport experts and events provides information that is likely to be sought and shared by Twitter users. Character claims do not correlate with information-exchange activity, and actually detract from information exchange, especially in business tweets. This suggests that Twitter users consider sources' claims unnes-

sary in information exchange. It can be asserted that character claims do not influence information diffusion via SNSs, the blogosphere [37], and Twitter in particular. Source attractiveness affects business and health information exchange. Sources whose accounts have high numbers of followers, followees, tweets, and favorited tweets are of interest to Twitter users. Active sources in business and health on Twitter should have higher numbers of followers, followees, tweets, and favorited tweets. A source's credibility might be influenced by the number of followees, followers, tweets and favorited tweets in some subjects. These findings are in line with research on information retweeting on emergency events [13]. Generally, if sources are qualified with authoritative knowledge, are active in terms of social connections, and have accounts with high numbers of followers, followees, tweets, and favorited tweets, recipients seek out and share their tweets.

Message characteristics partially influence information-exchange activity. Information quality was important in health and sport information exchange, suggesting that Twitter users are highly motivated to seek and share health and sport information if tweets contain high-quality information. Because health information is necessary and sensitive for everyone [48], it must be accurate, up to date, and easily understood. Information quality acts as a trust signal for information acquirement and communications [64], but the findings suggest that it is not related to knowledge acquirement on all topics [37]. The nature of the sample generation is sensitive due to the rapidly changing actions and behaviors in general. Therefore, using social media as a credible main source of information might be vital for their future health and decisions. This requires special efforts by information specialists and health professionals to develop a mechanism to monitor information flow on one side and publish high-quality information through Twitter on the other side. Information usefulness impacts only sport information exchange. It may be normal for sport to be the most useful domain for gaining information for our sample. This suggests that the length limitation of tweets might be efficient for sport information, but weak for political, health, and business information. Some topics might need additional content length to attract Twitter users' interest and encourage them to seek and share. Although previous research found that information usefulness is highly correlated with information adoption and electronic word-of-mouth communication [65,66], our findings suggest that information usefulness influence varies between domains. Contrary to expectations, none of the connected materials were found to be useful in information exchange, particularly for politics and sport. This suggests that users prefer tweets without URLs, mentions, or multimedia materials. This is in line with [13] findings, particularly for URLs and mentions, but completely contrasts with studies by [38] and [14] regarding information retweeting. Future studies should consider particular situations within each domain and compare the characteristics of the current study on certain phenomena belong to different domains.

Information-exchange activity in politics, business, and sport appears to be driven primarily by recipient interaction to gain knowledge. Although Twitter users realize the limited usefulness of tweets in general, they are still determining the impacts of the tweets in supporting their current knowledge, except in health information exchange. Thus, the source must provide contents that facilitate goal attainment for recipients [37]. Community engagement was found to facilitate information-exchange activity only in the sport domain. It is interesting that sport information exchange connects Twitter users with their communities more than those who exchange political, business, and health information. Gender is a significant, but negative, characteristic of information exchange, except in health information exchange. Women are less likely than men to be interested in politics, business, and sport information exchange via Twitter. It seems that women

do not interact with short contents as much as men do, so they may prefer other SNSs that do not limit message length. Also, the topics of the study might be more relevant to men than women. Research on the expressive and instrumental usages of Web 2.0 did not find gender differences [1].

Age is also important, though only in political information exchange. Older participants were more interested than younger ones in political information exchange, suggesting that older users engage more with in-depth topics.

6.1 Implications

This study uniquely investigated the influence of source, message, and recipient characteristics on information-exchange activity via Twitter. Unlike previous research, this study comparatively investigated the determinants of the most popular domains of information exchange. Previous studies examined the factors affecting information retweeting or information exchange on a particular subject or situation [13], [17], while this study aimed to explain the cognitive process underlying information-exchange activity and enhance the understanding of information seeking and sharing via Twitter. Thus, the findings extend the literature on information diffusion, and information exchange in particular, in various domains on Twitter.

This study facilitates an in-depth understanding of the key characteristics of information exchange based on source, message, and recipient characteristics. Information-exchange activity is influenced not only by the various characteristics, but also by the domains of information exchange. Not all subjects of information exchange might be influenced in the same way by the same characteristics. We also identify which tweets need to include URLs, mentions, or multimedia.

In this paper, sources' knowledge was distinguished between two human-capital ability resources: authoritative knowledge and engagement knowledge. As both contributed as predictors in this study and in [37] research, further research should consider the contribution of human-capital resources across populations, contexts, and social media applications.

These findings have practical implications for Twitter users. To increase information-exchange activity, sources should have particular characteristics, and these vary according to the specific domain. Although message characteristics had limited influence on information exchange, such characteristics still suggest some guidelines for posting tweets. Again, this varies according to the domain.

In terms of system design, Twitter needs to be an effective system not only for seeking and sharing information but also for categorizing tweet subjects. The length limit of tweets needs to be reviewed, especially for particular domains, to assist sources to provide more information. Some tweet contents should be excluded from the length limit, such as hyperlinks and character claims. Number of followers, followees, tweets, and favorited tweets are likely to attract users, and setting additional profile characteristics would increase information exchange and diffusion.

6.2 Limitations

The limitations of this study represent opportunities for future research. First, data were collected from a convenience sample of undergraduates. Although students are heavy users of social

media, a convenience sample limits the validity of findings. Respondents might not represent the whole population because most SNS users are young people [67, 68]. Also, the favorite Twitter domains of the sample might restrict the influence of characteristics and the generalizability of the study to other groups. Future research should use samples across different generations and communities.

Second, this study focused on general information rather than a particular situation or event in each domain. Future research should comparatively investigate the influence of the current research's characteristics on information-exchange activity in particular situations, such as financial or political events.

Third, the findings found low variance within the models in terms of information-exchange activity. Further characteristics need to be investigated to increase the R2 value of our models. Finally, only gender and age were examined as antecedents in information-exchange activity. Other demographic factors should be examined as antecedents and moderators in future studies.

6.3 Conclusion

This research contributes to information-diffusion literature in general, and research on information exchange via Twitter in particular, by understanding the comparative influence of source, message, and recipient characteristics on exchanging information within four popular domains on Twitter. Source and recipient characteristics play a more important role than message characteristics in information-exchange activity. In source characteristics, authoritative knowledge, social connections, and attractiveness have a positive influence on information exchange, while in recipient characteristics, recipients' prior knowledge, community engagement, and demographics influence information exchange. In messages characteristics, information usefulness and information quality were demonstrated to be effective. However, overall the influences vary based on the domain of information exchange. This avenue of research will not only extend the scope of information diffusion and SNSs research; it will also facilitate the effective design and use of SNSs for different users and domains.

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