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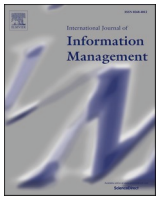

What to post? Understanding engagement cultivation in microblogging with big data-driven theory building

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ABSTRACT

This paper examines how alternative food networks (AFNs) cultivate engagement on a social media platform. Using the method proposed in Kar and Dwivedi (2020) and Berente et al. (2019), we contribute to theory through combining exploratory text analysis with model testing. Using the theoretical lens of relationship cultivation and social media engagement, we collected 55,358 original Weibo posts by 90 farms and other AFN participants in China and used Latent Dirichlet Allocation (LDA) modeling for topic analysis. We then used the literature to map the topics with constructs and developed a theoretical model. To validate the theoretical model, a panel dataset was constructed on Weibo account and year level, with Chinese city-level yearly economic data included as control variables. A fixed effects panel data regression analysis was performed. The empirical results revealed that posts centered on openness/disclosure, sharing of tasks, and knowledge sharing result in positive levels of social media engagement. Posting about irrelevant information and advertising that uses repetitive wording in multiple posts had negative effects on engagement. Our findings suggest that cultivating engagement requires different relationship strategies, and social media platforms should be leveraged according to the context and the purpose of the social cause. Our research is also among the early studies that use both big data analysis of large quantities of textual data and model validation for theoretical insights.

1. Introduction

The use of social media in business is almost ubiquitous; therefore, cultivating social media engagement is essential to fostering successful relationships with customers and ultimately having a successful enterprise (Dessart, 2017). These relationships are even more important in businesses that are closely linked with social movements and civic engagement, such as sustainable food production (Martindale, 2021).

Food is fundamental to human society, and food production has profound impacts on human health and the environment. The United Nations (UN) has set ending worldwide hunger and malnutrition by 2030 as 1 of 17 Sustainable Development Goals to transform our world (FAO, IFAD, UNICEF, WFP & WHO, 2017; United Nations, 2018). The UN goals include doubling the agricultural productivity and incomes of small-scale farmers and ensuring sustainable food production systems by 2030 (United Nations, 2018). Businesses in the context of safe, sustainable food production, such as small-scale farmers and alternative food networks (AFNs), can be especially well positioned to use social media for customer engagement. China, one of the world's largest economies, sees organic food movements arising from concerns about not only food safety, nutrition, and environmental impact but also social justice and social/economic community health (Si et al., 2015). This study examines social media engagement among AFNs and the public in China.

As a vibrant economic power, China is undergoing tremendous change. The rapid economic growth and urbanization process bring many opportunities as well as some inevitable challenges, such as rural decline, food safety and sustainability concerns, loss of cultivated land, and farmers' rights (Gu, Zheng, & Shance, 2007; Ortega, Wang, Olynk, Wu, & Bai, 2011). Suffering from the significant income gap between rural and city areas, loss of land, and degradation of the environment, Chinese farmers leave rural areas and farming to migrate to urban areas for jobs. Thus, the giant gap between the increasing food demand in urban areas and the decreasing arable land is quite hard to fill, causing

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serious problems (Chen, 2007). It also leads to the problem of rural depopulation and rural decline (Li, Westlund, Zheng, & Liu, 2016). In addition, Chinese consumers have concerns regarding the environmental impact of large-scale farming using fertilizers and long-haul transportation methods as well as the safety of food after media reports of tainted milk and milk products (Wang, Si, Ng, & Scott, 2015).

Among the various endeavors to address these complicated societal challenges, organic farming and AFNs can be a possible solution (Shi, Cheng, Lei, Wen, & Merrifield, 2011; Si & Scott, 2016; Si, Schumilas, & Scott, 2015). Organic farming refers to farming methods free from chemical fertilizers and pesticides. Farms that utilize these techniques often are small and economically embedded in the local community, selling primarily to local consumers. AFNs in China include community-supported agriculture (CSA), farmers' markets, and buying clubs (Schumilas, 2014). AFNs are gaining more attention in China, because more Chinese consumers are paying attention to food safety and environmental problems and are willing to pay a premium for organic products (Si et al., 2015).

Yet AFNs are facing the challenges of reaching consumers, gaining their trust, and building long-term relationships (Wang et al., 2015; Zhang, Zhang, & Ren, 2016). Since organic farming products usually require more manpower and are sold at premium compared with conventional farming products, it is challenging for organic farmers to attract consumers and build a consumer community. An additional challenge is for consumers to discern the quality of farming products without some knowledge of the production process. Taking advantage of the widespread usage of mobile phone and social media services in China, AFNs are turning to social media platforms like the microblog Weibo to engage the public in support of organic farming (Martindale, 2021; Zhang et al., 2016). Our research employs a big data–driven approach to investigate how AFNs cultivate engagement with the public through social media usage in the context of the societal problem of building a safe and sustainable food system. Specifically, our research questions (RQs) are:

RQ1: How do relationship cultivation strategies influence engagement in microblogging communities?

RQ2: How does knowledge sharing influence engagement in microblogging communities?

RQ3: How does advertising influence engagement in microblogging communities?

In this study, we followed the suggestions in Kar and Dwivedi (2020) and Berente, Seidel, and Safadi (2019) regarding research methodology. We adopted the theoretical lens of social media engagement and relationship cultivation. The RQs and theoretical lens guided the data acquisition and sampling strategy. We identified Weibo social media accounts related to AFNs. Using the Weibo API, we collected all original posts made since each Weibo account was created through the end of 2017, including contents of the posts as well as likes, comments, and shares/retweets for each post. The resulting rich dataset consists of 55,358 posts from 90 relevant farms and AFN accounts. To analyze the large number of posts, we performed topic modeling using Latent Dirichlet Allocation (LDA),and revisited the literature to map the topics to constructs of relationship cultivation strategies, knowledge sharing, and advertising; then we developed a theoretical model. We specified a fixed effects panel data regression analysis model and performed panel data regression analysis to validate the theoretical model and examine the impacts of the social media messages on engagement. The big data–driven approach allows us to derive insights from a much bigger sample of AFN participants and their actual posts. LDA topic modeling combined with manual sense making helps us uncover the topics of the posts, and panel data regression analysis investigates how the contents of the posts influence actual social media engagement. Findings revealed that openness, sharing of tasks, and sharing of knowledge have positive effects on public social media engagement. Effects of advertising are mixed. Timely and concise advertising attracts more comments, whereas repetitive wording has negative effects on engagement. Irrelevant information also has negative effects on public social media engagement.

This paper is organized as follows. Section 2 provides a review of the research background and related literature. The research method, data acquisition and conversion, topic analysis, and factor identification are described in Section 3. Section 4 is devoted to theoretical model development, and here we revisit the literature, map topics to constructs, and develop hypotheses. The theoretical model validation, regression analysis, and results are introduced in Section 5. We then discuss theoretical and practical implications and limitations of this study in Section 6, followed by our conclusion in Section 7.

2. Related literature

2.1. Food and AFNs

Access to adequate and sustainable food remains a worldwide societal problem. Consequently, agricultural and food production practices have tremendous effects on both the nature and quality of human life. Today, a majority of food is produced through conventional (or global) food systems, where large corporations produce and distribute food on a global scale. Conventional food systems strive to produce the highest yield of crops in large amounts. To do so, this type of production uses significant amounts of energy and synthetic chemicals, which result in negative impacts on the environment, such as greater greenhouse gas emissions, deterioration of water quality, environmental pollutants, and depletion of soil, forest, and water resources (Bene et al., 2019). In addition, conventional food often is produced in one place and distributed widely, so the community where it is consumed does not benefit from the economic impact of the production (Rossi, Johnson, & Hendrickson, 2017). This conventional food production contributes to societal problems, such as inadequate food safety, environmental concerns, weak economic development, and social justice barriers.

Our paper examines an alternative food production source – small organic farmers and AFNs. These alternative sources strengthen society through providing better food safety and security, mitigating the effect of food production on the environment, and enhancing the social fabric of communities. The farming community must elicit public support to achieve success. Engaging the public is important to disseminate information about sustainable food and organic farming, thus acquiring legitimacy.

Chinese AFNs work in a context in which consumers have poor confidence in food labeling and food producers (Martindale, 2021; Si et al., 2015; Zhang & Zhang 2012). Various food safety scandals, such as contaminated melamine baby formula, make the public skeptical about food safety and food quality. AFNs leverage social media as a low-cost tool to reach the public and cultivate engagement and trust by communicating information about how food is produced, allowing consumers to understand safety and quality. This research seeks to understand how posts on a microblogging platform influence social media engagement.

2.2. Microblogging, societal issues, and AFNs

Social media technologies allow users to connect to each other and share content online. The use of social media services, such as Twitter, Facebook, Snapchat, Instagram, Weibo, and WeChat, has exploded over the past decade, in turn spurring scholars to examine questions about how social media can be mobilized for social causes (Selander & Jarvenpaa, 2016). Microblogging is a category of social media applications that allows users to publicly share content that generally is smaller in size than a full-sized blog article (hence, the term, microblogging). The most notable English language microblogs are Twitter and Tumblr, launched to the public in 2006 and 2007, respectively. In China, Sina Weibo was launched in 2009 and has one of the highest market penetration of social media services. It has 573 million monthly active users

as of September 2021 (Weibo, 2021a), and $1.69 billion net revenues in 2020 (Weibo, 2021b). It is a popular social media platform for marketing and advertising in China. Business corporations, organizations of social causes, and AFNs leverage Weibo to engage the public, create awareness, promote products and services, and organize social campaigns. Users post content, and other users can take various actions to react to the content, including liking, sharing, and commenting. Users also can take action in regard to other user accounts, such as following others, ensuring that the user's published content will automatically appear in one's stream or feed of content. Users can also mention other accounts directly by name in the content with special symbols, typically the @ sign. All of these actions form the basis of connections among users.

Social media technologies enable civic participation, knowledge creation and sharing, and relationship cultivation, thus enhancing the impact individuals and small-scale organizations can have on societal issues. In particular, civic microblogging has evolved to allow people to become more engaged with their communities, inform and influence others regarding societal issues, and develop relationships that can support action for societal problems. For example, a grassroots nongovernmental organization leveraged Weibo, the microblogging platform, to engage the public for the Free Lunch for Children charitable program and raised 21 million USD to set up kitchens in rural schools and provide free lunches for approximately 130,000 pupils (Zheng & Yu, 2016).

Social media technologies are also important for AFNs. AFNs use social media platforms to engage the public, improve visibility for themselves and their products, and build trust (Bos & Owen, 2016; Elghannam et al., 2020; Puranen & Jansson, 2017; Zapico & Maja, 2018; Zhang, 2016). Chinese AFNs have been especially active in using social media platforms (Chen & Tan, 2019; Martindale, 2021; Zhang, Zhang & Ren, 2016), and this is in tandem with the growing population of mobile phone users and a growing significance and impact of social media on societal problems in China (Chen, 2014). Martindale (2021) showed how Chinese AFNs try to mitigate the trust pressure from consumers by presenting their food on social media as fresh, thus also projecting the associated notions of good taste and purity. Zhang et al. (2016) examined a leading Chinese AFN's social media posts and noted social media enabled this AFN to reach a larger audience group, demonstrate farmers' expertise, convey benevolence, and address members' concerns. Most scholarly studies in this area adopt qualitative methods, conduct interviews, and perform content analysis of archival data (e.g., websites and social media posts). Table 1 summarizes selected studies on AFNs' social media usage. Prior studies adopting interview methodologies or archival data analysis usually have a limited sample size. For example, Martindale (2021) interviewed in total 20 farmers' market attendees and CSA farm owners. Zhang and Zhang (2012) and Zhang et al. (2016) conducted a single case study, analyzed posts by a specific CSA farm, and proposed how social media platform features influence customer–farmer interaction. These relatively small sample sizes make it challenging to generalize the findings. In this study, to investigate the effects of AFNs' posts on social media engagement, we adopt the big data–driven approach. This approach allows us to have a much bigger sample of AFN participants and their actual posts and to better uncover the patterns of the posts and how the contents of the posts influence actual social media engagement.

Table 1
Brief summary of selected studies on AFNs' social media usage.

Study	Region	Method	Findings
Bos and Owen (2016)	England	Content analysis and interview	Virtual reconnection happens on online spaces. Online spaces are used for promotion and real-time communication.
Elghannam et al. (2020)	Spain	Focus group	Use of social media and electronic word of mouth can be new ways to support the creation of more direct (short) food supply chains.
Martindale (2021)	China	Interview	Chinese AFNs try to mitigate the trust pressure from consumers by presenting their food as fresh, tasty, and pure on social media.
Puranen and Jansson (2017)	Sweden	Interview	AFNs use social media to different extents. They usually use social media to inform and interact with their customers and for promotions. They sometimes use social media for targeted advertising.
Zapico and Maja (2018)	Sweden	Case study	Analysis of social media posts identified three themes: practical communication and feedback from customers, increasing transparency of crop production and values, and marketing and direct sales.
Zhang and Zhang (2012)	China	Case study	Microblog's technical features make it a convenient and accessible platform to foster producer–consumer interaction for AFNs.
Zhang (2016)	Asia, North America, South America	Content analysis	Farmers adopt IT tools and social media platforms to develop public awareness and consumers' trust and to provide social support to farmers.
Zhang, Xu, Oosterveer and Mol (2016)	China	Content analysis	The microblog platform enabled the AFN to reach a larger audience group, demonstrate farmers' expertize, convey benevolence, and address members' concerns.

2.3. Social media engagement

The term, engagement, has various definitions and is a broad concept in scholarly literature (see Appendix 1). In the information systems (IS) literature, engagement often is defined as user connection with a technological resource, such as a website, online app, or computer system (Attfield, Kazai, Lalmas, & Piwowarski, 2011). The utilization of social media and online communities to engage consumers has been the focus of many studies, particularly in the context of brand advertising (e.g., Brodie et al., 2013; Lin, Yang, Ma, & Huang, 2018; Santos, Cheung, Coelho, & Rita, 2022; Shareef, Mukerji, Alryalat, Wright, & Dwivedi, 2018), crowdsourcing (e.g., Nguyen et al., 2015), and e-commerce (e.g., Pagani & Mirabello, 2011). Various measures have been proposed for social media and online user engagement, such as physiological sensors, task performance, and perceived utility (Attfield et al., 2011). Studies also have examined behaviors, such as number of views, number of likes, number of comments, number of online posts, bounce rate, and session duration, to indicate levels of online participation (e.g., Kang, Lu, Guo, & Li, 2021; Nguyen et al., 2015) and have developed models to identify high-engagement discussions, or "buzz," on social media (e.g., Aswani, Ghrera, Kar, & Chandra, 2017; Jain, Batra, Kar, Agrawal, & Tikkiwal, 2021).

Social media engagement can be connected with other types of engagement, such as consumer engagement and civic engagement, depending on the context of the social media posts. Engagement in the consumer context generally is defined as a psychological state resulting from interactive experiences with an object (Dessart, Veloutsou, & Morgan-Thomas, 2015; Lin et al., 2018). Online consumer engagement is important to increase consumer awareness and website traffic and

subsequently purchase probability (Oh, Roumani, Nwankpa, & Hu, 2017). Civic engagement in particular has been defined as citizens addressing and resolving social problems within a community (Warren, Sulaiman, & Jaafar, 2014).

Uses of the term engagement, as discussed in different contexts, share some similarities, such as users' positive reactions, positive experiences, motivations to interact, and relationship building. In the context of this research, we define engagement as the magnitude of online efforts in connecting with and reacting to others in the microblog community. In the case of sustainable food, a high level of online engagement is desirable. Higher levels of engagement indicate more awareness of the societal challenge as well as more support in solutions for the challenge. In the study, we focus on engagement shown through observable behavior in the online social media technology, specifically microblogging.

2.4. Relationship cultivation

In the context of AFNs, farmers and other AFN organizations want to reach the public. Prior literature has discussed organization–public relationship cultivation. Relationship cultivation generally is understood as the ways in which an organization can create and maintain beneficial connections. Ledingham (2003) expands on the notion of cultivation: "effectively managing organization–public relationships around common interests and shared goals, over time, results in mutual understanding and benefit for interacting organizations and publics" (Ledingham, 2003, p. 190). Most studies in the area of organization–-public relationship cultivation are of big corporations and governments (Grunig & Huang, 2000). AFNs as emerging organizations also need to effectively manage organization–public relationships, and they share goals and interests with the public, such as sustainable food, food safety, social justice, and rural revitalization (Si et al., 2015).

Relationship cultivation strategies are defined as "any organizational behavioral efforts that attempt to establish, cultivate, and sustain relationships with strategic publics" (Ki & Hon, 2009, p.5). Hon and Grunig (1999) proposed six cultivation strategies: access, positivity, openness/disclosure, sharing of tasks, networking, and assurances. Ki and Hon (2009) developed survey measurement items for these strategies, covering aspects such as regular communications, annual reports, sharing information, and working with members to develop solutions to problems that benefit members. Although these studies about relationship cultivation strategies are not specified for context of social media, we believe some of the strategies can still be relevant on social media, because they are developed based on interpersonal communications, which also are the basis of social media interactions (Canary & Stafford, 1994; Ki & Hon, 2009).

3. Research methodology

In this study, we contribute to theory through big data–driven research. Theory building with big data–driven research is a relatively new approach (Kar & Dwivedi, 2020), and it allows researchers to generate theoretical insights from big data with the help of computational analysis. Berente et al. (2019) note this research process involves iteratively examining data and theory, and they compare the computational theory discovery approach with traditional qualitative research. Huang, Lehavy, Zang, and Zheng (2018) adopt a big data–driven approach, combining LDA analysis and regression analysis to study financial analyst information discovery.

We followed the methodology in Kar and Dwivedi (2020), and Fig. 1 is drawn based on the process diagram with indicative detailing for theory building in big data–driven research in their paper. This figure presents the process in big data–driven research clearly. As Kar and Dwivedi (2020) suggest, research starts with broad RQs and identification of a theoretical lens, and then RQs and the theoretical lens guide data acquisition and conversion. In our research context, we are

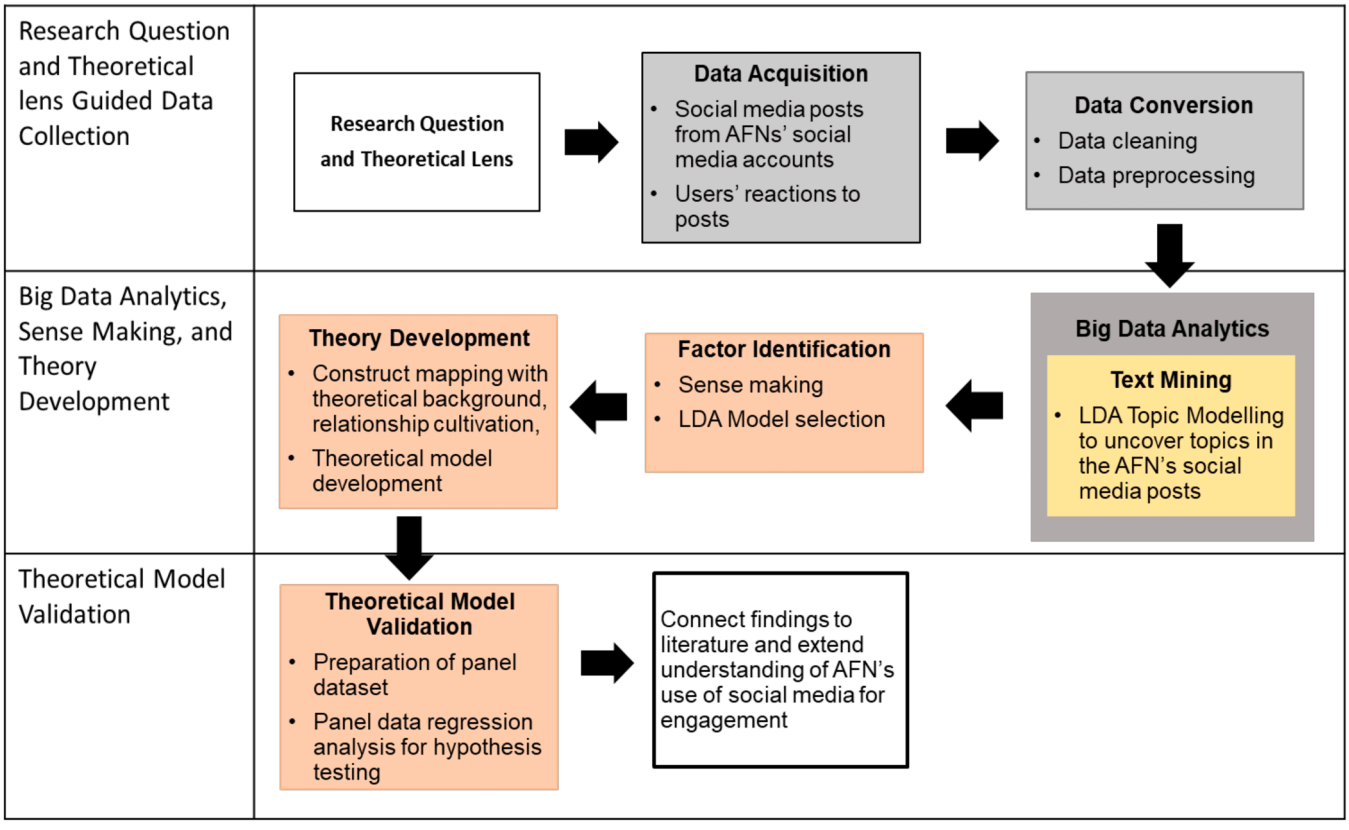

Fig. 1. Research methodology.

interested in examining how AFNs build social media engagement. We collected social media posts by AFNs and also collected the likes, comments, and retweets of the public for the social media posts. The posts were converted and prepared for text mining through LDA topic modeling. LDA topic modeling results revealed topics from the posts, and we then revisited the literature to map the topics with constructs and developed a theoretical model. The theoretical model was validated through a fixed effects panel data regression analysis, and the analysis results are discussed and extended to prior theories.

Note: Adapted from Fig. 2 in Kar and Dwivedi (2020).

3.1. Data acquisition

The use of online social networking has grown rapidly in the last decade, especially with the proliferation of mobile devices. In China, Sina Weibo, launched in 2009, has the highest market penetration of any microblogging service. As of February 2018, Weibo reported 392 million monthly users and 33 million daily active users (Deagon, 2018). Weibo has many of the same features as Twitter, such as the ability to post texts, photos, videos, and links to online articles. Unlike Twitter, Weibo does not limit the length of posts (since January 2016). It is important to note that Weibo accounts are public; thus, information posted is available to all and can be shared broadly throughout the community, both with known others as well as unknown others.

To identify Weibo accounts relevant to the societal issue of sustainable food/farming, we first identified a list of AFN's from a blog post from Shi Yan, a Chinese AFN leader (http://blog.sina.com.cn/s/blog_55a11f8e0102eluk.html). Shi Yan is a co-founder of Little Donkey Citizen Farm (http://www.littledonkeyfarm.com/), and also a co-founder of Sharing Harvest Farm (http://www.fxshcsa.com/). She is the Director General of Chinese CSA association, and Vice President of International CSA association Urgenci's (https://urgenci.net/). The list contains 80 AFN participants, and we searched for Weibo account of every participant in the list, found out that 61 of them had Weibo account. In addition to the list, we searched for the terms "organic farm," "organic farming," and "farmers market" on Weibo. We also identified relevant accounts that followed a CSA association's Weibo account. This produced a list of 91 Weibo accounts. One farmers' market, Zhuhai farmers market (https://weibo.com/zhuhainongfushiji), had no posts and was excluded from the sample. In total, the sample includes 90 Weibo accounts of farms and AFN accounts, such as accounts of farmers' markets. Fig. 2 presents an example Weibo homepage of one organic farm (https://weibo.com/chinacsa).

3.2. Data conversion

After data collection, we prepared the data for LDA topic analysis through data conversion. Our text corpora consisted of all Weibo text messages posted by 90 AFN-related accounts. In total, there are 55,358 messages; messages were written in Chinese.

In the majority of languages based on Latin or Cyrillic alphabets, the space is used as a word divider; other punctuation marks, such as commas and dots, also may be used. However, Chinese language is logographic, and composition of characters into words is established based on the context; sentences cannot be split into words using spaces as in the English language. Chinese text tokenization methods often are

Fig. 2. Weibo homepage of little donkey citizen organic farm.

based on methods such as conditional random fields. We use jieba (https://github.com/fxsjy/jieba), a Python module for Chinese text segmentation implementing multiple algorithms, for splitting sentences into words. Debortoli et al. (2016) suggest performing N-gram tokenization of the sentence before application of LDA; N-grams can be defined when words have clear bounds, as a concatenation of N successive words. To split sentences into words, we used the "full" mode of tokenization in jieba; as a result, we obtained not one possible split of a sentence, but several, which may be seen as being similar to N-grams.

After splitting, we removed 58 uninformative stop words (e.g., 的, "of"; 与, "and"; and 着, an auxiliary word describing an action is in progress) using exact match, filtered Latin characters, URLs, and numbers. We then removed words such as farm names and location names.

3.3. Text mining

In order to find topics discussed in the microblog posts, we used LDA. LDA is a widely used topic modeling algorithm. It is a generative statistical model and imitates how humans compose a document. LDA assumes that D documents are represented as a mixture of K latent topics, where each topic in K is characterized by probability distribution over the list of words specific to that topic (Blei, Ng, & Jordan, 2003; Mehrotra, Sanner, Buntine, & Xie, 2013; Yuan, Li, Liu, Zhai, & Qi, 2021; Zhou, Barnes, McCormick, & Blazquez Cano, 2021). In other words, LDA assumes that (a) the document has its own topic distribution, and (b) each topic has its own word distribution. The LDA algorithm finds the word distribution of each topic and the topic distribution of each document iteratively by inferring the generative model parameters.

LDA offers several advantages over manual coding (Huang et al., 2018). First, LDA can analyze a large quantity of texts, which could be challenging if manually coded. Second, LDA allows topics to emerge from the texts, as no rules, keywords, or taxonomies are assigned to the algorithm. In contrast, manual coding requires rules and descriptions to categorize topics, but it is challenging to determine the rules when there is a large quantity of texts. However, this does not mean LDA is completely "objective" and does not involve researchers' interpretations. The parameters that are set, such as the number of topics in each document and the number of words in each topic, influence the topics that emerge. Evaluation and validation are needed to ensure meaningful topics emerge from the texts. However, LDA results are replicable and reliable in the sense that the same topics emerge with the same parameters. Such an approach requires both computational and manual coding (Berente et al., 2019). Below, we discuss first the computational analysis and then how we validate the topics.

The LDA model involves the following assumptions:

$$\phi_{k=1\ldots K} \sim Dirichlet(\beta) \tag{1}$$

$$\theta_{d=1\ldots D} \sim Dirichlet(\alpha) \tag{2}$$

$$z_{d=1\ldots D,\quad w=1\ldots N_d} \sim Multinomial(\theta_d) \tag{3}$$

$$w_{d=1\ldots D,\quad w=1\ldots N_d} \sim Multinomial(\phi_{z_{dw}}) \tag{4}$$

Here, α and β are hyperparameters of Dirichlet distribution; $\phi_{k=1\ldots K}$ is a distribution of words in topic k; $\theta_{d=1\ldots D}$ is distribution of topics in document d; and $z_{dw}$is the topic index for word w_{dw}. N_d is a number of words in document d.

Given parameter K (number of topics), parameters of the LDA may be inferred from text corpora. Inference amounts to finding $p(\theta, \phi, z \mid w, \alpha, \beta)$ using methods such as variational Bayes inference.

The result is a distribution of topics in each document, a distribution of words in each topic, and topic indices for each word in the given vocabulary, i.e., tokenized text corpora. There are many implementations of LDA parameters learning. In our analysis, we used the gensim package (https://radimrehurek.com/gensim/) available for the Python programming language. We performed the computations on a server having 20 Intel(R) Xeon(R) CPU E5–2640 v4 @ 2.40 GHz cores and 240 GB RAM. Learning parameters of equation (e) allow finding a topic distribution for unseen documents, and this functionality also is provided by gensim.

We performed two types of data preparations for LDA: (a) pooled, where all messages of a single farm were merged and represented as a single document, and (b) non-pooled, where individual tweets were fed into LDA as documents. We ran LDA inference, with the number of topics ranging from 20 to 80; after each round, we performed a manual analysis (by two native Chinese speakers) of the top 40 most probable words for each topic. Involving human experts in determining the topics yields topics with greater semantic meaning (Chang, Boyd-Graber, Gerrish, Wang, & Blei, 2009; DiMaggio, 2015), and this approach is adopted in studies such as DiMaggio, Nag, and Blei (2013), Kaplan and Vakili (2015). Details of the approach to ensure the semantic quality of the LDA analysis is discussed in the following section.

3.4. Factor identification

The evaluation of the results' semantic qualities is based on the guiding questions proposed in Boyd-Graber, Mimno, and Newman (2014), which are recommended in Debortoli, Müller, Junglas, and vom Brocke (2016): (a) Are individual topics meaningful, interpretable, coherent, and useful? and (b) Are assignments of topics to documents meaningful, appropriate, and useful? To make sense of the topics, two native Chinese speakers (bilingual in Chinese and English) read the words in the topics. For each topic, the raters also read posts that loaded high on the topic. They worked on making sense of the topics independently. Evaluation reveals that, when the topic numbers are smaller, such as 20 or 30, the topics contained multiple themes and were mixed and difficult to interpret. When the topic numbers are larger, such as 70 or 80, more topics emerged that had very low loadings of words in the cluster; thus, the corresponding topics are not useful. As a result, we chose K = 50 topics for pooled LDA as the most representative. Table 2 shows the loadings of each topic. Appendix 2 presents the top 10 most probable words/phrases for each of the 50 topics and the topic categorization.

To validate the topics, we followed the fundamental principle of the hermeneutic circle and the principle of contextualization proposed in Klein and Myers (1999). The hermeneutic circle "suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form" (Klein & Myers, 1999). In the validation, we read the topics as well as posts that the topics heavily loaded on. We did this iteratively, to better make sense of the topics. We reflected on the social context in which the AFN participants are embedded, to accurately interpret the topics. We created a word cloud based on the topics that emerged (Fig. 3). Words first were translated from Chinese to English by Google Translate and then revised by a native Chinese speaker, bilingual in Chinese and English.

4. Theory development

To achieve a proper level of abstraction and generalization, we mapped the topics to constructs in prior literature and developed hypotheses. Through iteratively reading the topics and posts, and considering existing literature, the author team identified relevant constructs: openness/disclosure, sharing of tasks, knowledge sharing, and advertising. We invited three native Chinese speakers (bilingual in Chinese and English) to independently perform the mapping. They were not aware of the hypotheses when performing the mapping. They read definitions of the constructs, top ten words in each topic, and posts that heavily loaded on each topic. Among the 50 topics, 14 topics had very low loadings, and were excluded from the construct mapping. One topic is related to GMO, one topic is related to tips about fruits eating, as they are general information that can be shared by non AFN accounts, the

Table 2
Descriptive statistics for the topic loadings.

Variables	Min	Max	Mean	S.D.	Construct mapping
topic_0	0	0.8841104	0.0246808	0.118477	mixed, openness and irrelevant
topic_1	0	0.7676423	0.0263852	0.1123332	irrelevant information
topic_2	0	0.9969037	0.0190868	0.1063833	knowledge sharing
topic_3	0	0	0	0	
topic_4	0	0.9877481	0.0355828	0.1446288	advertising
topic_5	0	0.410529	0.0049951	0.0343627	irrelevant information
topic_6	0	0.9673204	0.1018674	0.1772509	openness/ disclosure
topic_7	0	0.6670835	0.0136966	0.0752887	advertising
topic_8	0	0.847734	0.0237322	0.0959728	advertising
topic_9	0	0.0896454	0.0003303	0.0049535	irrelevant information
topic_10	0	0	0	0	
topic_11	0	0	0	0	
topic_12	0	0.6410564	0.0073239	0.0632454	openness/ disclosure
topic_13	0	0.999624	0.0597265	0.1822591	sharing of tasks
topic_14	0	0	0	0	
topic_15	0	0.9948433	0.0249947	0.1278798	openness/ disclosure
topic_16	0	0.6431895	0.0017337	0.0333927	suggestions about fruits eating
topic_17	0	0.6049929	0.0145301	0.0666581	sharing of tasks
topic_18	0	0	0	0	
topic_19	0	0.3152625	0.0045982	0.0328891	openness/ disclosure
topic_20	0	0.9428816	0.0186474	0.1199458	advertising
topic_21	0	0.9971005	0.175009	0.2600119	openness/ disclosure
topic_22	0	0.6143472	0.0022277	0.0321214	sharing of tasks
topic_23	0	0.9991123	0.0438964	0.1445685	sharing of tasks
topic_24	0	0	0	0	
topic_25	0	0	0	0	
topic_26	0	0.0169155	0.0001102	0.0012439	irrelevant information
topic_27	0	0.8942394	0.0434577	0.1340249	genetically modified organism GMO
topic_28	0	0.9927942	0.0028912	0.0516985	irrelevant information
topic_29	0	0.9995033	0.0172827	0.1270884	irrelevant information
topic_30	0	0.6901861	0.0036248	0.0469611	advertising
topic_31	0	0	0	0	
topic_32	0	0	0	0	
topic_33	0	0	0	0	
topic_34	0	0.9814424	0.0106427	0.0990839	advertising
topic_35	0	0.9938551	0.0294099	0.1149576	advertising
topic_36	0	0	0	0	
topic_37	0	0.8984958	0.008875	0.0698174	advertising
topic_38	0	0.9144719	0.026983	0.1250151	advertising
topic_39	0	0.4170345	0.0021386	0.029126	
topic_40	0	0.8892714	0.1030157	0.207205	openness/ disclosure
topic_41	0	0.9982631	0.0072449	0.0759555	advertising
topic_42	0	0.010303	0.0000278	0.0005349	irrelevant information
topic_43	0	0	0	0	
topic_44	0	0.9991515	0.0482407	0.1725775	advertising
topic_45	0	0.9967333	0.0069495	0.0784366	openness/ disclosure
topic_46	0	0.9999554	0.0144529	0.082874	knowledge sharing
topic_47	0	0.9999744	0.0170659	0.1092264	advertising
topic_48	0	0.831028	0.0393959	0.1221566	advertising
topic_49	0	0	0	0	

Note: Topic loadings are in the range of 0–1.

coders did not map them with the constructs. To measure inter coder reliability, we calculated Krippendorff's alpha with the Kalpha macro prepared by Hayes (Hayes & Krippendorff, 2007; Krippendorff, 2004), and did the calculation in SPSS 17.0. Krippendorff's alpha is considered a good index for inter coder reliability coefficient, and it is applicable for any number of coders (O'Connor & Joffe, 2020). The Krippendorff's alpha value was 0.8411, larger than 0.80, indicating high inter coder reliability. The approach is similar to the approach in Croidieu and Kim (2018), Hannigan et al. (2019). The authors then discussed each construct and develop hypotheses accordingly. Appendix 2 presents the topics and the top 10 words in each topic and constructs mapping; Appendix 3 includes example posts for each construct.

Openness/disclosure and sharing of tasks are from the literature of organization–public relationship cultivation. Knowledge sharing has been widely discussed in online community literature, and advertising has been discussed in marketing literature. It is no surprise that AFNs' social media engagement building has aspects overlapping with organization–public relationship cultivation, because AFNs are organizations that have public aspects, although they are not traditional public organizations, such as governments and large business corporations. AFNs' social media activities also involve aspects similar to those of online communities, and knowledge sharing emerges from this context (Barrett, Oborn, & Orlikowski, 2016; Butler, 2001). Since this context involves selling organic products, advertising is common; prior research about AFNs' usage of social media noted that AFNs use social media for advertising and promotions (Puranen & Jansson, 2017; Zapico & Maja, 2018; Zhang et al., 2016). In addition to these themes, there are topics that contain irrelevant information. Our research context is unique in the sense that it has both consumer engagement in the brand and commerce context and civic engagement in the social organic movement context. The users who support the organic farmers are both consumers of organic products and supporters of social organic movement through consumption. Consumers are interacting with farmers and other users and disseminating information about organic farming, thus also supporting the social movement. Considering the large number of posts, it is natural that there is irrelevant information.

4.1. Openness/disclosure

In public relations, openness, sometimes referred to as disclosure, is defined as "an organization's efforts to provide information about the nature of the organization and what it is doing" (Ki & Hon, 2009). In fact, scholars in public relations introduced the concept of openness from the interpersonal communications literature. Interpersonal communication scholars define openness as "direct discussion about the nature of the relationship and setting aside times for talks about the relationship" (Canary & Stafford, 1994, p.12). Examples of openness in interpersonal relationships include discussing thoughts and feelings and discussing problems in relationships.

In the context of AFNs, openness/disclosure includes introducing life on an organic farm, sharing about the lifestyle, and sharing about the growth of vegetables and fruits. For example, consider the following post which describes the lifestyle on the farm:

> *"# People on the farm# I have been running this farm for several years now. For people on the farm, it is actually creating a relatively stable and sustainable environment for these people. Every month, parents have their own pocket money of 500 yuan. The pocket money makes it easy for them if they want to buy something, want to play mahjong. Second uncle and his wife work part-time on the farm and they have a net income of around 30,000 a year. Elder uncle and younger uncle have a place to live as they get old. Brothers have a platform for growth and entrepreneurship. Brother and sister-in-law have a reunion and warm family. And I, practicing the ideals in my heart and living my own way of life, is what I did at home these years. Let the people on this land enjoy peaceful life [smile]".*

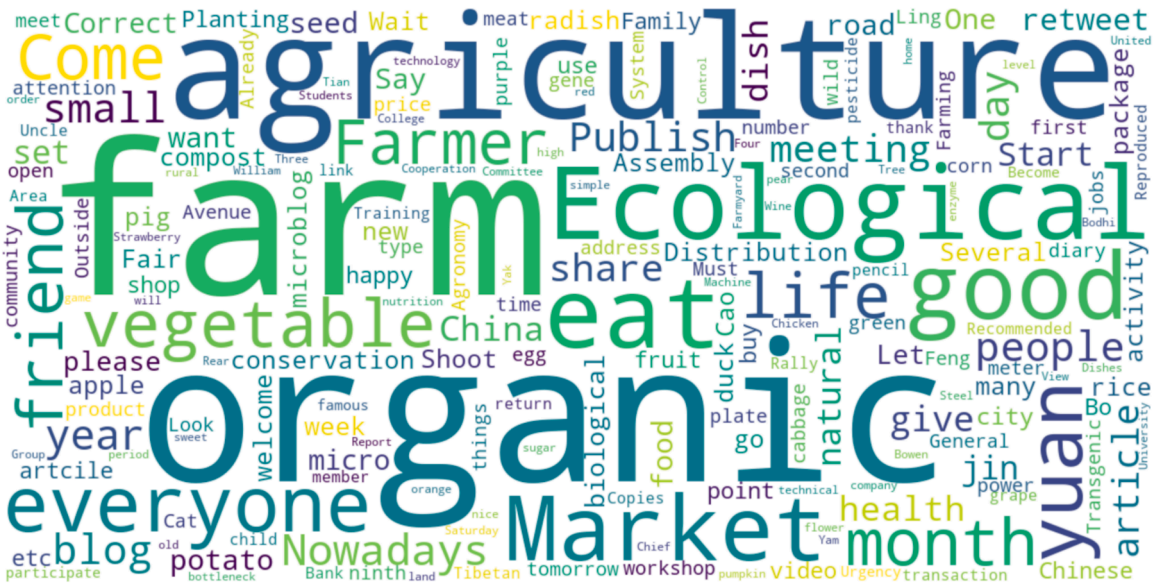

Fig. 3. Word Cloud of Topics.

The post is heavily loaded on topic 6 that is composed of the semantically related words/phrases of "farm, men (们) placed after a noun or a pronoun, to indicate plural), life, friend, do, eat, bit, can/able to, self, and come". Such a topic is about openness/disclosure.

Openness indicates that one is proactive and is willing to cultivate and maintain relationships (Guerrero, Eloy, & Wabnik, 1993). In public relations, openness not only is about discussing thoughts and feelings but also about disclosing behaviors and activities (Waters & Lord, 2009). Examples of openness could be discussing the projects an organization is engaging in and details of the work practices. Prior studies noted that openness is considered an important aspect of trustworthiness (Butler, 1991; Mayer, Davis, & Schoorman, 1995). In the current world, due to the disembedding from time and space, the nature of social life is changing. We are facing increasingly complicated decisions and greater uncertainties (Giddens, 2013). For example, when grocery shopping in supermarkets, consumers are unaware of how the vegetables are grown and what kind of chemicals were used during their growth. We argue that openness can reduce these uncertainties and indicate an AFN's willingness to cultivate relationships with consumers. For example, AFNs that share about the growing situations of the vegetables and the preparation of organic fertilizers indicate openness and can lead to high-quality relationships with the public.

Hypothesis 1. There is a positive relationship between openness and users' social media engagement.

4.2. Sharing of tasks

Sharing of tasks is defined as "organizations' and publics' sharing in solving joint or separate problems" (Hon & Grunig, 1999, p. 15). The core of sharing of tasks is taking joint responsibility. Ki and Hon (2009) discussed sharing of tasks and noted the mutual interest between the organization and its public when both work on projects or solving problems. Publics and organizations may share tasks, such as managing community issues, reducing pollution, and providing employment opportunities (Hon & Grunig, 1999). An organization and the public may have shared interests, and, through task sharing, they also may share values and responsibilities.

In the context of AFNs, sharing of tasks is mainly about inviting people to support farmers through purchasing and introducing who makes the product (e.g., producers can be young people who return to the village to do farming), so people with the same vision can support the young farmers. The following post describes how potential consumers can support the returning to village lifestyle and organic way of production by choosing produce from Xiao Hao and Wang Ning:

> *"# Fertil Soil Workshop Lunch # Look and you can tell this food is Xiao Hao's masterpiece. Let's make a soup base with Korean kimchi fermented by ourselves, and then combine it with the organic carrots produced by Wang Ning, a young guy who returned to his village in Henan Province to do farming. The carrots can be eaten as fruits, and the rice flour made with red rice are enough to make you have good appetite. Just vegetables can taste good ~ On the No. 15 "City and Rural Exchange" Farmer's Market, those of you who have eaten the carrots from us "fertile soil" know (how nice) they are @Ferresar Lee."*

The post is heavily loaded on topic 17 that is composed of the frequent appearance of semantically related words/phrases, "workshop, ecological, small, everyone, use, organic, do, planting, returning home village". Topics 13, 17, 22, and 23 are about sharing of tasks.

In the context of organic farming and food system sustainability, we noted that AFNs' accounts invite the public to support young organic farmers who return to their villages through purchasing their organic products and to support organic farming conferences by volunteering. Sharing of tasks is an effective way to involve the public who have shared values and are willing to share responsibilities, which is useful for cultivating engagement.

Hypothesis 2. There is a positive relationship between sharing of tasks and users' social media engagement.

4.3. Knowledge sharing

We identify topics 2 and 46 as about knowledge sharing. These topics are about sharing farming knowledge. They are different from the topics under openness/disclosure, because farming knowledge posts discuss the details of how to prepare fertilizers, how to deal with pests, or how to use feces for compost. Knowledge is considered an important value creation behavior in various online communities (Barrett et al., 2016; Butler, 2001). Knowledge sharing is found to influence the leadership position of members in online communities (Faraj, Kudaravalli, & Wasko, 2015). In the context of organic farming and AFNs, knowledge farming skills, such as compost preparation and vegetable cultivation, are specific and valuable to the community. Hence, we propose that knowledge sharing positively influences user engagement.

Hypothesis 3. There is a positive relationship between knowledge sharing and users' social media engagement.

4.4. Advertising

As prior literature on AFN social media usage has revealed, AFNs use social media for advertising and promotion purposes (Bos & Owen, 2016; Puranen & Jansson, 2017). Topics 4, 7, 8, 20, 30, 34, 35, 37, 38, 41, 44, 47, and 48 are related to advertising, such as promoting products, broadcasting weekly available vegetables, and introducing sales. Advertising differs from openness/disclosure and sharing of tasks, because advertising posts do not concern producers, the growth history of the products, or the sharing of goals and visions, and the focus is on purchasing instead of cultivating understanding and relationships. We hypothesize that advertising has negative effects on the public's social media engagement with AFNs.

Hypothesis 4. There is a negative relationship between advertising and users' social media engagement.

4.5. Irrelevant information

In addition to openness/disclosure, sharing of tasks, knowledge sharing, and advertising, there are posts with irrelevant information. Topics 1, 5, 9, 26, 28, 29, and 42 contain information that is irrelevant to farming or sustainable food. For example, such topics and posts include posts promoting a game, and when the user plays a game, a post is automatically generated to promote the game. There also are other irrelevant posts about the stock market and social news. We hypothesize that irrelevant posts distract the public and have a negative effect on the public's social media engagement with AFNs.

Hypothesis 5. There is a negative relationship between irrelevant information and users' social media engagement.

Fig. 4. summarizes the theoretical model, and Section 5 discusses validation of the theoretical model.

5. Model validation

In order to validate the theoretical model and examine the hypotheses, we specified a fixed effect panel data analytical model and prepared a panel dataset based on account and year level. The panel dataset comprises three different datasets. Two datasets were from Weibo. The first dataset consisted of 55,358 posts from 90 AFN-relevant accounts from the respective dates of their creation through December 31, 2017. The second dataset was user profile data for all the accounts, including the account location data, account description, and registration date.

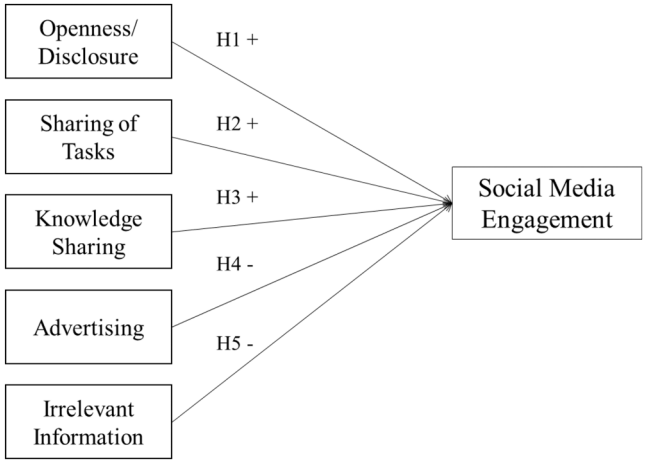

Fig. 4. Theoretical model.

The third dataset was economics data from China City Statistical Yearbooks. We collected Chinese city-level data, including the total population, GDP per capita, Internet users per 10,000 people, and share of agricultural labor of the population. Below we explain how we measure the dependent variables, independent variables, and control variables.

5.1. Measurements

5.1.1. Dependent variables – social media engagement measurements

Engagement has been captured in prior studies using various metrics, such as number of visits, number of clicks, average number of page views per visit (Geva, Reichman, & Somech, 2017; Lehmann, Lalmas, Yom-Tov, & Dupret, 2012), and number of idea submissions and rating others' submissions (Nguyen et al., 2015). In this study, based on the viewpoint of engagement and the technical features of the microblog platform, there can be three different kinds of engagement: liking, commenting, and sharing. We measure each of them.

Number of likes: Likes indicate that users are in favor of the contents of the posts, and each user can like a specific post only once. Liking a post is an engagement that requires a relatively low amount of effort, because it simply needs one click.

Number of shares: Several studies consider sharing a high level of engagement, because sharing a post suggests the user would like to further disseminate the information in the post. When sharing a post, the original poster's ID will also appear on the microblog page of the user who shares the post, and, in this way, the user implicitly connects himself or herself with the original content creator. We measure the number of shares as another aspect of engagement.

Number of comments: The highest level of engagement occurs when a user comments on a post. This requires the most effort, because the user composes a response. When commenting, the poster's ID appears on the microblog page of the AFN account, and the user implicitly connects himself or herself with the original content creator. We measure the number of comments as the final aspect of engagement.

5.1.2. Independent variables

The details of topics and constructs are explained in Section 4. As a summary, topics 6, 12, 15, 19, 21, 40, and 45 are about openness/disclosure. Topics 13, 17, 22, and 23 are about sharing tasks. Topics 2 and 46 are about knowledge sharing. Topics 4, 7, 8, 20, 30, 34, 35, 37, 38, 41, 44, 47, and 48 are about advertising. Topics 1, 5, 9, 26, 28, 29, and 42 contain irrelevant information.

5.1.3. Control variables

We used economics data in our analysis as control variables. These variables included yearly city-level economics data from China City Statistical Yearbooks (2012–2015), which report 2011–2014 statistics. Specific variables included total population, GDP per capita, total number of Internet users, and share of agricultural labor in total population. For the years 2015–2017, we used the statistics in 2014 (Department of Urban & Social Economic Survey, 2015).

5.2. Panel dataset construction

We construct a panel dataset for hypothesis testing. In the panel dataset, each unit of observation is a microblog account and each time period is a year. Because each account was created at a different time, and this results in an unbalanced panel dataset. The dataset has yearly observations for each account, including (a) engagement measures, i.e., the number of likes received, the number of shares received, and the number of comments attracted; (b) the percentages of different topics discussed; (c) the total number of posts the account made; and (d) the yearly city-level economics data of the city in which the account is located, i.e., total population, GDP per capita, total number of Internet users, and share of agricultural sector labor in total population. Table 2 presents the descriptive statistics for the topic loadings, and Table 3

Table 3
Descriptive statistics for the engagement measurements, number of posts, and economics variables.

	Min	Max	Mean	S.D.
Number of likes	0	2757	154.981	352.989
Number of shares	0	2209	119.394	229.147
Number of comments	0	2416	147.297	287.031
Number of posts	1	1073	143.874	174.959
Total population (10,000 persons)	39	3375.2	938.546	503.774
GDP per capita (1000 yuan)	21.383	467.749	91.796	50.730
Share of agriculture sector labor force (percentage)	0.01	4.48	0.439	0.534
Internet users (10,000 persons)	12	5697,300	124,861	718,677.3

presents the descriptive statistics for the engagement measurements, number of posts, and economics variables.

5.3. Panel data regression analysis

Because the engagement measurements variables are count variables (i.e., number of likes, number of shares, and number of comments), we used Poisson specification for panel data analysis (Cameron & Trivedi, 2013). Fixed effects were adopted in the model, and in this way time-invariant, unobservable factors were controlled. In addition, year dummies were included in the model, in order to control effects due to yearly changes. Because social media engagement can be captured by three different dependent variables—number of likes, number of shares, and number of comments—the corresponding regression models are as follows:

5.3.1. Model 1

$$NumofLike_{i,t} = \beta_0 + \beta_1 Topic0_{i,t} + \ldots + \beta_{50} Topic49_{i,t} + \beta_{51} NumofPosts_{i,t} + \beta_{economicvaribles} EconomicVariables_{i,t} + \beta_{yearlydummies} YearlyDummies_t + a_i + u_{i,t}$$

5.3.2. Model 2

$$NumofShare_{i,t} = \beta_0 + \beta_1 Topic0_{i,t} + \ldots + \beta_{50} Topic49_{i,t} + \beta_{51} NumofPosts_{i,t} + \beta_{economicvaribles} EconomicVariables_{i,t} + \beta_{yearlydummies} YearlyDummies_t + a_i + u_{i,t}$$

5.3.3. Model 3

$$NumofComment_{i,t} = \beta_0 + \beta_1 Topic0_{i,t} + \ldots + \beta_{50} Topic49_{i,t} + \beta_{51} NumofPosts_{i,t} + \beta_{economicvaribles} EconomicVariables_{i,t} + \beta_{yearlydummies} YearlyDummies_t + a_i + u_{i,t}$$

Table 4 shows the results for the panel data fixed effects analysis results.

Overall, analysis results support Hypothesis 1. Posts that show openness, such as introducing the situation of the farm or introducing how the vegetables are grown, have positive impacts on engagement, as expressed through the number of comments received. Topics 6, 21, and 40 have positive effects on the number of comments. Topic 12 has a positive effect on the total number of likes, shares, and comments. The effects of topic 45 on likes, shares, and comments are not statistically significant. Topic 15, which is also about openness, shows negative effects on the total number of likes, shares, and comments. A closer examination of topic 15 shows that the contents of the posts in topic 15 differ from other openness posts in the way that the microblog posts include links to external blog articles, such as "blog article published [blog article URL link] …" Readers need to click the link in order to read the blog articles. This extra effort may keep readers from reading the blog article. Similarly, topic 19 also contains sharing of blog articles, and it has negative effects on the number of likes.

Posts that show sharing of tasks, such as inviting the public to purchase products grown by young farmers who return to home villages, to support seed preservation, and to support CSA conferences, have positive impacts on engagement. The results are in general support of Hypothesis 2. Topics 13 and 17 have positive impacts on the total number of likes and total number of comments. Topic 23 has positive impacts on the total number of comments. Topic 22 has positive impacts on the numbers of shares and comments, but interestingly, has a negative effect on the number of likes. Topic 22 is about inviting people to join the seed preservation campaign or to join the CSA conference. The public seems to engage not through clicking "like" but through further disseminating the information about the events.

Posts that share knowledge and skills have positive impacts on engagement, and this supports Hypothesis 3. Topic 2 is about compost making and offering training to others, and it has positive effects on the numbers of likes and comments. Topic 46 is about sharing farming skills, such as irrigation according to seasons and vegetable growth or cultivation techniques for vegetables, and the topic has positive effects on the numbers of likes, shares, and comments.

Results regarding advertising are mixed and worth further examination. Posts that advertise products, such as introducing which vegetables are available in the week and including prices, mostly have negative effects on engagement, although with exceptions. Most advertising-relevant topics have negative effects on engagement, such as topics 8, 20, 34, 35, 37, 38, and 41. Some advertising-relevant topics have positive effects on the number of comments, such as topics 4, 7, and 44. Examining the contents of the posts for each of the topics reveals their differences. Topics that present redundant information in repeated posts, such as topic 41, advertising about pigs, lead to negative impacts on engagement. On the other hand, if the posts contain timely information, e.g. describing vegetables available each week, and are concise, such as topic 4, there are positive effects on the number of comments. These results suggest that the public responds differently to different ways of advertising. They are willing to comment on posts that contain timely information about products available, but they do not engage

Table 4
Panel data fixed effects regression results.

	Model 1	Model 2	Model 3
Variables	Number of likes	Number of shares	Number of comments
Topic_0 openness and other irrelevant posts	1.310	− 3.866***	− 0.383
	(1.095)	(1.030)	(0.910)
Topic_1 mixed, contain irrelevant posts	− 5.239***	− 4.164***	− 1.447
	(0.944)	(1.034)	(0.921)
Topic_2 knowledge sharing – compost making	2.426**	0.115	4.105***
	(0.968)	(1.101)	(0.971)
Topic_4 advertising	0.0314	− 0.259	4.182***
	(0.816)	(0.943)	(0.827)
Topic_5 game playing, irrelevant posts	− 24.81***	− 0.843	6.999***
	(3.834)	(1.458)	(1.165)
Topic_6 openness	-0.213	-0.966	3.914***
	(0.877)	(0.963)	(0.856)
Topic_7 advertising	− 1.559	− 1.802	5.874***
	(1.023)	(1.105)	(0.989)
Topic_8 advertising	− 3.918***	− 3.656***	− 0.228
	(0.905)	(0.970)	(0.877)
Topic_9 mixed, contain irrelevant posts	− 291.3	− 253.7	− 279.8
	(10,258)	(9275)	(18,845)
Topic_12 openness	6.445***	3.184**	10.05***
	(1.104)	(1.428)	(1.367)
Topic_13 sharing of tasks	1.422*	2.120**	5.839***
	(0.823)	(0.910)	(0.805)
Topic_15 openness, sharing external blog links	− 11.77***	− 14.11***	− 11.04***
	(1.180)	(1.215)	(1.155)
Topic_17 sharing of tasks – supporting farmers	− 0.136	3.565***	6.715***
	(0.864)	(1.008)	(0.901)
Topic_19 openness, contain sharing of blog articles	− 6.294***	− 1.196	2.958*
	(1.745)	(1.398)	(1.587)
Topic_20 advertising	− 9.186***	− 7.628***	− 0.412
	(3.465)	(1.832)	(1.880)
Topic_21 openness	− 1.304	− 0.123	2.920***
	(0.820)	(0.907)	(0.823)
Topic_22 sharing of tasks – seed preservation	− 6.000***	6.287***	14.17***
	(1.128)	(1.451)	(1.258)
Topic_23 sharing of tasks	-0.0218	1.381	5.723***
	(0.835)	(0.906)	(0.817)
Topic_26 mixed, contain irrelevant posts	− 53.11***	− 39.84***	− 9.632***
	(5.312)	(4.089)	(3.520)
Topic_27 GMO and other farming problems	0.255	− 1.502	4.370***
	(0.915)	(0.957)	(0.891)
Topic_28 mixed, contain irrelevant posts	− 250.5	− 12.40 *	− 226.3
	(37,178)	(7.494)	(46,401)
Topic_29 advertising and irrelevant posts	− 196.8***	− 213.0***	0.531
	(20.05)	(17.83)	(3.599)
Topic_30 advertising		− 232.6	− 274.7
		(9705)	(27,477)
Topic_34 advertising	− 13.97	− 22.24***	− 12.43***
	(12.03)	(3.412)	(3.379)
Topic_35 advertising	− 3.423***	− 3.834***	0.588
	(0.876)	(0.953)	(0.852)
Topic_37 advertising	− 9.241***	− 18.65***	− 3.955***
	(1.087)	(1.681)	(1.145)
Topic_38 openness and advertising	− 2.701***	− 4.345***	− 0.486
	(0.944)	(1.069)	(0.882)
Topic_39 mixed, openness, and low loading posts			− 432.7
			(203,706)
Topic_40 openness	-0.754	0.110	3.332***
	(0.848)	(0.902)	(0.820)
Topic_41 advertising	− 64.93**	− 2.745***	− 1.734**
	(29.50)	(0.921)	(0.812)
Topic_42 game, and other irrelevant posts	192.5***	− 1421	− 1601
	(71.85)	(56,820)	(102,293)
Topic_44 advertising	− 2.382**	− 0.978	3.088***
	(0.988)	(1.071)	(0.930)
Topic_45 openness	1.135	− 0.276	6.540
	(2.033)	(2.381)	(5.542)
Topic_46 knowledge sharing – farming skills	2.324**	2.677**	5.743***
	(1.066)	(1.068)	(0.912)
Topic_47 advertising repeated posts of similar contents	− 2.407**	− 4.675***	0.361
	(0.967)	(1.115)	(1.155)
Topic_48 advertising	− 1.463*	− 2.349**	2.092**
	(0.835)	(0.928)	(0.845)
Number of posts	0.00259***	0.00334***	0.00336***

(*continued on next page*)

Table 4 (*continued*)

	Model 1	Model 2	Model 3
	(3.43e-05)	(4.57e-05)	(3.84e-05)
Total population (10,000 persons)	− 0.00103	0.000175	− 0.00441***
	(0.00234)	(0.00120)	(0.00120)
GDP per capita (1000 yuan)	0.000646	0.00179***	0.00223***
	(0.000525)	(0.000242)	(0.000297)
Share of agriculture sector labor force (percentage)	− 0.139	0.0764	0.490***
	(0.117)	(0.0675)	(0.0588)
Internet users (10,000 persons)	1.56e-07	− 1.02e-07***	− 5.29e-08*
	(2.87e-07)	(2.58e-08)	(2.85e-08)
2012.year	1.942**	0.129*	0.0151
	(0.883)	(0.0713)	(0.0740)
2013.year	4.794***	0.125*	0.0169
	(0.875)	(0.0701)	(0.0734)
2014.year	5.415***	− 0.490***	− 0.362***
	(0.874)	(0.0741)	(0.0765)
2015.year	5.394***	− 0.848***	− 0.798***
	(0.874)	(0.0757)	(0.0774)
2016.year	5.338***	-0.963*** −	− 0.854***
	(0.874)	(0.0760)	(0.0775)
2017.year	5.143***	− 1.217***	− 1.225***
	(0.874)	(0.0784)	(0.0792)
Observations	350	354	356
Number of ID	81	82	83
Chi-square test	14,119	17,107	20,940
Prob > Chi-square	0	0	0

Note: standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$
*** $p < 0.01$

when the advertising is repeated posting of redundant information.

Posts that are irrelevant to farming topics have negative impacts on engagement. Topics 1 and 29 have negative effects on the numbers of likes and shares; topic 26 has negative effects on the numbers of likes, shares, and comments. The effects of topics 9 and 29 on likes, shares, and comments are not statistically significant. Topic 5 is about game playing and contains other irrelevant posts. Topic 5 has negative effects on the number of likes but has positive effects on the number of comments. Topic 42 has positive effects on the number of likes. After examining the gaming posts, it seems that the poster sometimes interacts with others who also play the game, and this may explain the positive effects on the number of comments for topic 5 and positive effects on the number of likes for topic 42. Overall, irrelevant topics have negative effects on engagement in the current context of sustainable food, and results support Hypothesis 5.

6. Discussion

6.1. Discussion of findings

With the prevalence of social media, various organizations are leveraging social media platforms to engage with the public. This study examines how social media usage by AFNs influences social media engagement through the perspective of relationship cultivation. Prior studies discussed how AFNs may use social media platforms for marketing and sales, increasing transparency for their products, building trust (Bos & Owen, 2016; Elghannam et al., 2020; Puranen & Jansson, 2017; Zhang, 2016; Zapico & Maja, 2018). These studies mainly adopted the methodology of interviews or content analysis of social media posts from one or several cases of AFNs. The actual effects of different types of social media posts by AFNs are yet to be examined, and the relationship cultivation strategies adopted by AFNs need to be better theorized. The present study is designed to understand how relationship cultivation strategies influence engagement in microblogging communities. The study adopts big data-driven theory development methodology, following the suggestions in Kar and Dwivedi (2020) and Berente et al. (2019). The big data-driven approach enables us to generate insights from analysis of a much bigger sample of AFN participants and their actual posts.

The results indicate that AFNs are adopting different types of relationship cultivation strategies in addition to advertising and marketing posts. Prior research discussed how AFNs use social media for promotion, direct sales, communication with customers (e.g., Bos & Owen, 2016; Martindale, 2021; Puranen & Jansson, 2017), and viewed the relationship between AFNs and the public mainly as a seller and consumer relationship. The present study notes that AFNs are cultivating a community that fosters long term partner relationships, and this echoes the findings in Zhang et al. (2016). LDA topic analysis and sense making revealed that there are posts that share about the organic farming lifestyle, and these posts demonstrate openness. Through openness strategies, AFNs share about who they are, what they are doing, and how they are feeling in their everyday life, including reflections on their lifestyle. There are also posts that invite people to support AFNs through purchasing certain products produced by farmers, and the purchasing behaviors are framed as sharing of tasks, taking joint responsibility, and putting visions into practice together with the farmers, such as supporting young farmers returning to villages for rural revitalization.

Based on big data analysis results and related theories, we propose hypotheses about how different relationship cultivation strategies adopted by AFN's have different impacts on public engagement. We integrated, extended, and tested theories of organization public relationship cultivation (Hon & Grunig, 1999; Ki & Hon, 2009; Ledingham, 2003) and theories of social media engagement (Oh et al., 2017; Warren et al., 2014) to understand engagement cultivation in the AFNs microblogging community. Data analysis results show that openness/disclosure has positive effects on engagement (H1). This is in line with the arguments in organization public relationship cultivation by Ki and Hon (2009) and Shin, Pang, and Kim (2015). In particular, AFNs' openness strategies involve sharing about both lifestyle and the producing process of vegetables and fruits, and is relevant to mitigating trust pressure (Martindale, 2021). Results also support that sharing of tasks has positive effects on engagement (H2). Though sharing of tasks is discussed in prior relationship cultivation literature, the actual effects of sharing of tasks is less examined, especially compared with the strategy

of openness. Our study provided empirical evidence that sharing of tasks fosters engagement, and suggests that sharing interests, visions, and joint responsibilities are important when studying relationship cultivation in the context where values are important, such as sustainable food. Knowledge sharing, though widely discussed in online community research (e.g., Faraj, von Krogh, Monteiro, & Lakhani, 2016), is less examined in organization public relationships. We noted knowledge sharing by AFN's foster engagement (H3), and this indicates social media engagement seems to share some commonalities with relationship building in online communities.

Leveraging social media for marketing purposes is common among various organizations (Dwivedi et al., 2021; Misirlis & Vlachopoulou, 2018), including AFN's (Puranen & Jansson, 2017). However, the results of the current study suggest marketing contents have mixed effects on engagement (H4). Most advertising posts have negative effects on engagement. Only advertising posts with timely information and concise wording have positive effects on engagement. Users show willingness to comment on such informative advertising posts.

It is quite common that posts that are not about organic farming, sustainable food, or rural lifestyle appear on AFN's social media accounts. Since AFNs are usually run by small organic farms or SMEs, they usually do not have established organizational strategy and policy regarding what to post and what to avoid. It is worthwhile to examine the effects of such irrelevant posts. Not surprisingly, irrelevant information, such as online games or social news have negative effects on engagement (H5). This finding complements prior literature through specifying what type of content should be avoided on social media in order to sustain engagement. Below we further discuss the theoretical and practical contributions of the study.

6.2. Theoretical contributions

Our study advances scholarly literature in two ways. First, we combine theories of public engagement on social media with theories of relationship cultivation and incorporate the content of social media messages. Thus, we extend scholarly understanding of social media engagement. Second, we use computational analysis together with manual sense making, following the innovative methods of Kar and Dwivedi (2020) and Berente et al. (2019). Thus, our approach of analyzing large quantities of textual data and theory building lends support to new methodologies for scholars who are building theories with big data.

This empirical study contributes to an understanding of cultivating public engagement on social media in the context of sustainable food. We connect the literature in engagement and relationship cultivation in the organization–public context, providing a comprehensive view of how engagement cultivation is accomplished online. This paper conceptualizes engagement in terms of user behaviors on social media, and we capture engagement in the online social media context by operationalizing it as the user behaviors of liking, sharing, and commenting.

The study looks beyond the functional features of the microblogging platform and reveals how the contents of posts are related to social media engagement and relationship cultivation. We examine the semantic and social meanings of the content of the posts and connect the theory of relationship cultivation strategies to social media engagement in the context of AFNs.

Our research highlights that cultivating social media engagement is not straightforward. It is not just about technical features, such as being able to post, to edit posts, and to mention others (Zheng & Yu, 2016). The study provides strong evidence that in order to foster engagement and cultivate relationships, detailed attention must be given to the contents of the topics posted.

The results suggest that user engagement in the context of the societal challenge of sustainable food can be fostered through certain relationship cultivation strategies. In addition to openness and sharing of tasks, which have been discussed in the organization–public relationship literature, we introduce knowledge sharing and also examine advertising-relevant posts in detail. We find knowledge sharing has positive effects on public social media engagement, whereas different types of advertising have different effects on public social media engagement. Timely and concise advertising attracts more comments, while repetitive wording has negative effects on engagement. In addition, we find the negative impacts of irrelevant posts on engagement. Therefore, the study also contributes to the organization–public relationship literature by identifying strategies that may have negative effects on relationship cultivation.

In addition, we also present a way of using computational analysis together with manual sense making to analyze large quantities of textual data and build theory. Our study collects social media usage behaviors of AFNs' accounts, as well as the public's reactions to the posts on the social media platform, i.e., likes, shares, and comments. We perform topic analysis of the posts using an LDA model and interpret the topics, classifying them according to the semantic meanings of the topics and posts and related theoretical concepts. Based on the construct mapping and prior literature, we develop a theoretical model. To test the theoretical model, in addition to the topics data and account- relevant data, we also collect city-level economic data and construct a panel dataset. Such a research method is newly introduced to the IS area (Berente et al., 2019; Kar & Dwivedi, 2020; Kar, 2020), and can be considered innovative in the general management science area. The approach we adopted can be a good example for scholars who intend to do theory building based on a large quantity of textual data.

6.3. Practical contributions

The findings of this study provide AFNs and organizations beyond AFNs that focus on social causes with practical insights. Currently social media is widely adopted for promotional purposes. AFNs naturally may want to advertise products in order to drive sales, but our research shows that most advertising has negative effects, with exceptions for concise, informative, and product-specific content. This suggests that AFNs need to have a deeper level of understanding regarding the subtleties of advertising. They should design advertising posts with detailed attention to what the content conveys. Instead of using repetitive words to promote certain products in consecutive posts, they should provide timely information about products and introduce the background of the products, for example, by sharing background stories about the producers. AFNs may explain how the consumers can have a larger social impact by purchasing the products, and what kinds of impacts the public may have through their consumption activity. For example, posts about purchasing products grown by young people who return to their home villages typically lead to higher consumer engagement with the AFN. Posts about seed conservations also foster engagement. Findings of the study indicate that sharing tasks with consumers and inviting consumers to share joint responsibilities can be an effective way to engage them and develop relationships. This suggestion is in line with suggestions Albanna, Alalwan, and Al-Emran (2022) give to non-profit organizations (NPOs), chiefly that NPOs should engage the public, and help the public be aware that their support can help make a difference in pursuing certain social missions. In order to expand the AFNs space, consumers should be viewed as part of the sustainable food community, as partners that will together bring changes to food production and consumption (Zhang, 2012).

The results also show that AFNs should consider devoting more effort to topics about openness and disclosure. Such posts have a positive impact on engagement, and contribute to the building of trust. Farmers should consider posting information about the situation on the farm, their everyday work and life, and the growth of produce. Other AFNs accounts, such as farmers' markets, should consider sharing about how they procure products and manage relationships with farmers and customers. Such sharing will help AFN's to mitigate trust pressure about produce quality (Martindale, 2021), and cultivate awareness among the

public about the differences in AFNs' work practice and AFNs' participants' lifestyles and values.

AFNs should be careful in posting topics that are irrelevant to their core business, such as social news unrelated to farming, online games they play, and stocks they are interested in. These types of topics have negative impacts on engagement. AFNs should view their social media account as a channel to communicate with customers and supporters, instead of a personal space to share various social news or personal interests. In other words, AFNs need to thoughtfully design strategies not only about what to post, but also about what not to post.

Lastly, we suggest AFNs can be more innovative and data-driven when monitoring the resulting engagement of their posts, in order to better cultivate relationships with consumers, other farmers, and other advocates in the AFN space. Not only AFNs, but also other organizations that have presence on social media and aim to engage the public should consider how to systematically investigate the impacts of their social media posts (Dwivedi et al., 2021). Participants' engagement in social media such as microblogging is fully recorded online and allows for detailed analysis, allowing organizations and individuals to monitor engagement for relationship cultivation. Organizations should make use of such data, and proactively examine the effects of their posts. They can also explore available social media data analytics tools, and develop plans regarding how to better examine the influence of their posts.

6.4. Limitations and future directions

Similar to other studies that adopt empirical investigations, this study has its own limitations. Although this study examines a large number of posts, its geographical compass is restricted to one country (China). Further studies examining AFNs in other cultures facing similar societal challenges, such as sub-Saharan Africa, can foster a cross-cultural comparison of engagement and relationship cultivation and yield other insights.

Future research may consider examining other social media platforms to expand the nature of the sample. For example, WeChat, another online social media platform in China, has achieved tremendous growth in recent years and is viewed as a competitor to Weibo. In the current study, we include yearly dummies in data analysis to control for the time effects and other factors that are relevant to time but not captured in the dataset, such as the emergence of another platform. Future studies can perform analysis by including data from another platform, such as WeChat, in order to mitigate any platform effects.

Future studies also may examine engagement from other perspectives. We use the numbers of likes, shares, and comments to capture engagement. Since we use data from Weibo, if participants communicated outside the platform, the interactions are not captured in this dataset. Scholars who adopt a case study approach and conduct interviews may capture these interactions, but on the other hand, it is challenging for them to reach a large sample of participants as we do in the current study. But different methods can supplement each other and help us understand the nature of relationship and engagement cultivation through usage of social media in addressing the challenges of sustainable food.

7. Conclusions

Social media naturally lends itself to small-scale enterprises and to individuals as a low-cost and relatively easy way to foster relationships with the public. However, it is not always easy to understand what kinds of messages to post that will engage individuals. Our study finds that the topics of the messages are not always obvious and do not always result in a positive effect on all types of engagement. As individuals, organizations, and communities seek ways to address the societal challenge of sustainable food, they need to understand these nuances. In 2012, the United States government launched a campaign to support local and regional food with the slogan, "Know Your Farmer, Know Your Food." It seems that this same message, in the topics posted on Weibo, works in China as well. Although cultures may vary, the public's needs for sustainable food are fundamental and commonly shared. We hope our study of Chinese farmers and the AFN participants' usage of social media platforms in addressing the complicated problems in sustainable food may shed light both on scholars' understanding of social media affordances and of relationship and engagement cultivation and on practitioners' usage of technology tools in their endeavors to solve societal problems.

CRediT authorship contribution statement

All authors contributed to writing paper, designing and analyzing the experiments. All authors reviewed the paper and have no interest conflicts.

Appendix 1. Literature review of engagement definitions in different contexts

Context	Conceptualization	Reference
Civic engagement	"Civic engagement describes how an active citizen participates in the life of a community in order to improve conditions for others or to help shape the community's future."	Adler and Goggin, 2005, p.241
Customer engagement	"customer engagement behaviors go beyond transactions, and may be specifically defined as a customer's behavioral manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers."	Doorn et al., 2010, p.254
Consumer engagement with a website	Consumer engagement with a website is proposed to have two aspects: personal engagement and social-interactive engagement. With personal engagement, "users seek stimulation and inspiration from the site, they want to use the site to facilitate their interactions with other people, they feel the site affirms their self-worth, they get a sense of intrinsic enjoyment in using the site itself, they feel it is useful for achieving goals, and they value input from other users." With social-interactive engagement, "users experience some of the same things in terms of intrinsic enjoyment, utilitarian worth, and valuing the input from the larger community of users but in a way that links to a sense of participating with others and socializing on the site."	Calder et al., 2009, p327
Brand engagement	"an individual difference representing consumers' propensity to include important brands as part of how they view themselves"	Sprott et al., 2009, p92
Media engagement	"the sum of the motivational experiences consumers have with the media product."	Pagani and Mirabello, 2011, p.46
Work engagement, or job engagement	"a positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption"	Schaufeli et al., 2002, p. 74
Student engagement	"the quality of effort students themselves devote to educationally purposeful activities that contribute directly to desired outcomes."	Hu and Kuh, 2002, p.555

Appendix 2. Topics emerged and mapping to constructs

Topic Number	Words in the Topic	Brief Description	Constructs
Topic 0	microblog, being, people, already, lemon, help, view, delete, many	lemon growth, microblog posts being deleted	openness and irrelevant posts
Topic 1	farm, avenue, college, eat, family, "men" a noun to indicate plural, planting, organic, can, meat	farm, eat, and irrelevant topics	mixed, contain irrelevant posts
Topic 2	compost, farm, cultivation, agriculture, China, training, farmers, can/able to, organic, not have	compost making, cultivation, skills and training	knowledge sharing
Topic 3	very low loading of words, < 0.000013865719	very low loading of words	very low loading of words
Topic 4	yuan (unit of Chinese currency), jin (Chinese unit of weight measurements), dish, delivery, radish, share, Chinese cabbage, small, corn, package	vegetables available, delivery	advertising
Topic 5	city, game, start, Jiang (a Chinese family name), fox, raising cats, small, thank, carry out, cat	playing a game online, the game has animal characters	game playing, irrelevant posts
Topic 6	farm, "men" a noun to indicate plural, life, friend, do, eat, bit, can/able to, self, come	life on farm, lifestyle, things farmers are doing	openness
Topic 7	vegetables, delivery, blog article, farm, duck, publish, share/retweet, nature, rice, microblog internal message	vegetables available, delivery	advertising
Topic 8	organic, member, radish, farm, eat, vegetables (cai), vegetables (shu cai), Chinese cabbage, can, small	vegetables available, delivery	advertising
Topic 9	handle, organizing committee, several flowers, Ficus religiosa, female writer, fear, Bodhi, red dust, surplus, Zhang Zhongjing (a Chinese physician, 150–219)	Buddhism-relevant posts, and other irrelevant posts	mixed, contain irrelevant posts
Topic 10	very low loading of words, < 0.000013905609	very low loading of words	very low loading of words
Topic 11	very low loading of words, < 0.000013865719	very low loading of words	very low loading of words
Topic 12	farmer, grape, small, apple, round, heart, photo shooting, date, uncle, crystal sugar	introduce fruits, and introduce farmers who grow the fruits	openness
Topic 13	market (shi ji), market (ji), open, farmer, month, day, ecological, yuan (unit of Chinese currency), community, farm	introduce market, market participants, recruiting volunteers	sharing of tasks
Topic 14	oil company, people, distinguished, slope, more than twenty, bank voucher, bank loan, four meters, profit and loss, reader	irrelevant posts	irrelevant posts
Topic 15	share/retweet, blog article, publish, farm, simple, return, year, day, month, farm	write blog article about the farm and share the link through microblog	openness, sharing external blog links
Topic 16	fruit, orange, January, digestive enzymes, hawthorn, pineapple, eating fruiting, part of the phrase "eating fruits," kiwi, part of the word "kiwi fruits"	eating fruits according to time	suggestions about eating fruits
Topic 17	workshop, ecological, small, everyone, use, organic, do, planting, returning home village	introduce products, introduce farmers who grow the products, the farmers are people who return to their home villages from city	sharing of tasks
Topic 18	very low loading of words, < 0.000014019479	very low loading of words	very low loading of words
Topic 19	diary, details, this week, vegetables, can, today, on, house, what, already	introduce farming work on the farm	openness, contain sharing of blog articles
Topic 20	market, agronomy, month, day, road, today, number, week, afternoon, square	introduce market address and time	advertising
Topic 21	ecological, natural, agriculture, people, life, month, everyone, to, share, health	the growth of fruits, other farming-relevant topics	openness

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(*continued*)

Topic Number	Words in the Topic	Brief Description	Constructs
Topic 22	seed preservation, conference, ecological, agriculture, seed, ecological agriculture, forum, society, part of "society ecological," ninth	CSA (or society ecological agriculture) conference, seed preservation	sharing of tasks
Topic 23	market (shi ji), market (ji), come, farmers, everyone, go to the market, open, "men" a noun to indicate plural, today, good	Introduce product background, who made the products, what are the features of products, the values underlying	sharing of tasks
Topic 24	very low loading of words, < 0.00001376105	very low loading of words	very low loading of words
Topic 25	very low loading of words, < 0.000013908779	very low loading of words	very low loading of words
Topic 26	longevity, room, seedling, move to, according to situation, Dawang Road, clue, The weather is fine, lioness, the home of the White's	mixed topics	mixed, contain irrelevant posts
Topic 27	gene, GMO, agriculture, China, publish, blog article, correct, year, farmers, problem	GMO and other problems related to farmers	GMO and other problems related to farmers
Topic 28	pencil, microblog, package, from, the world, child, find, group purchasing, mountain	social news of a child hurt himself/ herself using a pencil accidentally, group purchasing, and other irrelevant topics	irrelevant posts
Topic 29	blog article, publish, share/retweet, transaction, share, delegate, Sina, pig, micro- (part of microblog)	introduce pig meat, stock trading	mixed, advertising, irrelevant posts
Topic 30	farmer, ecological, go to the market (gan ji hui), market, the first, recommend, go to the market (gan ji), make, attention, recruit	introduce market event	advertising
Topic 31	Cao Cao (a famous historical person), not meet, William, color/quality, immersed the city, means of transaction, Liff (meaning not clear), four styles, encyclopedia, contract	irrelevant posts	irrelevant posts
Topic 32	very low loading of words, < 0.000014008601	very low loading of words	very low loading of words
Topic 33	very low loading of words, < 0.000013898954	very low loading of words	very low loading of words
Topic 34	shop, road, address, wild rice, water chestnut, to, today, avenue, egg, organic chicken	introduce products, shop address	advertising
Topic 35	farm, organic, purple, sweet potato, "men" a noun to indicate plural, yuan (unit of Chinese currency), health, come, eat, can	introduce products	advertising
Topic 36	very low loading of words, < 0.000013883151	very low loading of words	very low loading of words
Topic 37	yak, good, Tibetan, very, grassland, friend, beef, second, sheep, shoot (video or photo)	advertising beef and other products	advertising
Topic 38	shoot (video or photo), eat, duck, video, not, duck, self, does not have, rice, dish	introduce farm work and advertising products, such as rice	openness and advertising
Topic 39	seed, solve, price, part of organic farming, quick temper, bottleneck, group, mention, part of dorbeetle, dorbeetle	vegetable pest biological control, introduce farm, but posts loading low	openness, and other low loading posts
Topic 40	organic, farm (nong yuan), farm (nong chang), share, agriculture, vegetables, "men" a noun to indicate plural, micro- (part of microblog), small, vegetables	introduce situations of the farm	openness
Topic 41	pig, happy, farming, ecological, farmers, say, method, health, correct, radish	advertising products, such as pig	advertising
Topic 42	steel plate, control, in addition to, blood type, perfectionism, jade, Feng Shui Master, qualification, door/way, maggot	mixed, irrelevant posts	irrelevant posts
Topic 43	very low loading of words, < 0.00001400976	very low loading of words	very low loading of words
Topic 44	farm, today, vegetables (shu cai), vegetables (cai), friend, strawberry, delivery, micro- (part of microblog), road, three points	advertising products, such as vegetables, strawberry	advertising

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(*continued*)

Topic Number	Words in the Topic	Brief Description	Constructs
Topic 45	farm, agriculture, let, together, owner, farm owner, pumpkin, delicious food, organic, "men" a noun to indicate plural	introduce farm, and benefits of organic farming	openness
Topic 46	organic, agriculture, vegetables, wait, soil, in/between, grow, produce, after, can	farming skills sharing	knowledge sharing
Topic 47	agriculture, motivation, biological, training, organic, welcome, month, practice, ecological, nature	repeat similar posts about farming problems and advertising of training	repeated posting of similar contents
Topic 48	potato, eat, everyone, ah (interjection to express surprise, praise), good, ba (no specific meaning), come, can, friend, do	advertising products, such as apricots, hens	advertising
Topic 49	very low loading of words, < 0.000013825194	very low loading of words	very low loading of words

Appendix 3. Example posts for constructs

Openness/ disclosure	Introducing life on organic farm, sharing about the lifestyle, sharing about the growth of vegetables and fruits. Topic_6 loading 0.990297:# People on the farm# I have been running this farm for several years now. For people on the farm, it is actually creating a relatively stable and sustainable environment for these people. Every month, parents have their own pocket money of 500 yuan. The pocket money makes it easy for them if they want to buy something, want to play mahjong. Second uncle and his wife work part-time on the farm and they have a net income of around 30,000 a year. Elder uncle and younger uncle have a place to live as they get old. Brothers have a platform for growth and entrepreneurship. Brother and sister-in-law have a reunion and warm family. And I, practicing the ideals in my heart and living my own way of life, is what I did at home these years. Let the people on this land enjoy peaceful life [smile] Helping people getting to know where the fruits grow, the local culture, local people's life Topic_12 loading 0.98393446 # A Box of Xinjiang Brings Home # We have a dream to express the ethos of Xinjiang in a proper way so that more people can get to know and understand the real Xinjiang. Weijidani and @ China National Geographic - Book Cooperation, which mixes @Culbanban Sematian's book "I'm From Xinjiang", Xinjiang's farmers' dried fruit, handicrafts, and table runners and solid wood bowls. Xinjiang New Year gift box." Poke here http:t.cn/RZlGchz
Sharing of tasks	Inviting people to support farmers through purchasing, introducing who make the product (e.g., the producer can be young people who return to the village to do farming) so people who share the same vision can support them. Topic_17 loading 0.8801708 # Fertil Soil Workshop Lunch # Look and you can tell this food is Xiao Hao's masterpiece. Let's make a soup base with Korean kimchi fermented by ourselves, and then combine it with the organic carrots produced by Wang Ning, a young guy who returned to his village in Henan Province to do farming. The carrots can be eaten as fruits, and the rice flour made with red rice are enough to make you have good appetite. Just vegetables can taste good ~ On the No. 15 "City and Rural Exchange" Farmer's Market, those of you who have eaten the carrots from us "fertile soil" know (how nice) they are @Ferresar Lee. Sharing of tasks. Inviting people to participate in seed preservation campaigns Topic_22 loading 0.98284066:# seed preservation#100 facilitators of the Chinese ecological food system, some of them are old and new farmers, some are professors, some are from media or business sectors, some are big stars, some are primary school students, and we together voice out the "seed preservation, seed for cultivation" initiative, hoping to call upon the general public to care about the diversity of our ecological (seed) resources, and pay attention to those old and new farmers who have the courage to engage in ecological agriculture! Welcome more people to join us and you only need to write down your thoughts and slogans on the paper, together with it take a photo, or respond to the theme with video and send it to us. We will be posting your sharing on the @Social Ecology Agriculture CSA Alliance WeChat and Weibo platform. We are looking forward to interacting with you [happy] [happy]
Knowledge sharing	Sharing farming knowledge. Topic_46 loading 0.9883333 #Organic Agriculture # [Organic Vegetables Watering Techniques] When cold-season planting warm-like organic vegetable, watering should be done in sunny mornings and not poured in the afternoon or in rainy and snowy days. Can water under the cover, small water pouring enough, not small water pouring frequently. Hot and cold season planted cold-like organic vegetables, watering should be selected "day cool, land cool, water cool," watering, that is, morning and evening pouring. After the summer rainfall, well water is poured to avoid the appearance of rotten roots. @ World Expo - Organic Exhibition
Advertising	Introducing products available and how to order, delivery. Topic_7 loading 0.9865753 Tuesday 12.03 home delivery 80 yuan / share, including: pumpkin winter melon carrot small green onion lettuce spinach canola snow cabbage Chinese cabbage yellow cabbage sweet potato white radish; some vegetables are randomly allocated. No pesticides, no fertilizers, no hormones, no genetically modified, no herbicides; general look, but rich in odor, energy, nutritional balance. First time order message me your name, phone number, and address for delivery. Can order or preorder sweet potatoes, corn glutinous rice flour, flour (70 white, 80 powder, whole wheat flour is darker). Introducing products, but using similar wording in multiple posts. One example of the posts: Topic_41 loading 0.98515147 To @GlobalShoe official microblogging: people like you who look for quality life, who look for success, the first choice for new year purchasing is: Nanma Village "Happy Pig" - feeding by traditional style, feeding only corn, original ecological crops such as bran, cabbage, and high-vitamin radish, meat is delicate and tender. They are the best choices for the New Year and gifts for relatives and friends. Welcome to pay attention to the "Happy Pig" series of reports.
Irrelevant	Irrelevant social news. Topic_28 loading 0.98280704 Seven-year-old girl doing homework at home, holding a pencil running from the living room to the bedroom, accidentally fell, the pencil actually inserted from the bottom of her left eye under the skin more than 10 cm. Under pain, the child pulled out the pencil herself, but found that the eraser and aluminum skin on the end of the pencil remained inside. The hospital examination revealed that the eraser and aluminum skin had been inserted into the child's brain.

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