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Research on the Path of Digital Hoarding Behavior among Digital Natives Based on the I-PACE Model in China

Nanying Qiao, Shasha Ye*

College of Applied Arts and Sciences, Beijing Union University, Beijing, China
Email: *yq2024buumlis@126.com

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Abstract

Purpose: As a significant group in information behavior in the digital age, digital natives are increasingly exhibiting digital hoarding behaviors as their utilization of digital information deepens, which even hinders the improvement of their information literacy. This paper aims to raise digital natives' awareness of digital resource consumption, focus on high-quality digital preservation, and enhance their data literacy through the study of the paths of digital hoarding behavior. **Methods:** This paper collects interview data from 24 digital natives through open-ended interviews and constructs a digital hoarding behavior path model for digital natives based on the I-PACE model through three-level coding. **Results:** The digital hoarding behavior path model of digital natives is ultimately formed, clarifying the path performance of digital natives' digital hoarding behavior, discussing countermeasures to escape the digital hoarding dilemma, and providing suggestions.

Keywords

Digital Hoarding, Digital Natives, I-PACE Model, Personal Information Management

1. Introduction

In the era of information abundance, facilitated by technologies such as cloud computing and big data, the speed of information acquisition has accelerated, and storage costs have decreased. However, individuals often fail to utilize this vast amount of data, leading to information overload, increased psychological stress and confusion. This phenomenon can manifest as "Digital Hoarding", a psychological condition akin to "physical hoarding" [1]. The fundamental conflict un-

*Corresponding author.

derlying digital hoarding lies in the disparity between the boundless nature of digital information and the limitations of human cognitive capacity [2]. As early as 2019, a commentary in People's Daily emphasized that information accumulation should not be merely a process of transfer but rather the initial processing of knowledge, urging individuals to guard against information "Hoarding Disorder" [3].

Within recent academic investigations, digital hoarding, a novel interdisciplinary concept emerging from information science and psychology, remains relatively under-explored within the domain of library and information science. Current research predominantly concentrates on individual information behaviors within ubiquitous environments or organizational behavioral patterns. A limited number of studies have focused on User-Generated Content (UGC) social media platforms, with limited exploration of influencing factors, particularly concerning digital natives. Investigating the digital hoarding behaviors of digital natives, exemplified by the millennial generation, can contribute to a deeper understanding and identification of individual information management practices at a micro-level. Digital natives, immersed in the digital information age from birth, exhibit characteristics such as rapid information intake, proficiency in multitasking, and an innate aptitude for emerging digital technologies [4]. In the era of exponentially increasing digital intelligence, digital natives are at the forefront of facing the challenges of digital hoarding, which include not only how to satisfy their information needs and avoid low-quality information, but also how to effectively store, manage, and utilize vast digital resources [5].

This study investigates the imbalances in data accumulation, under-utilization, and the challenges of data cleansing currently faced by digital natives. Employing the I-PACE model and content analysis, the research analyzes the digital hoarding behaviors of 24 digital youths born between 1994 and 2004, who were interviewed for this purpose. The objective is to provide scientifically sound and contemporary recommendations to facilitate the efficient use of digital information by the digital generation, thereby preventing digital disarray.

2. Literature Review

2.1. Digital Hoarding

2.1.1. Digital Hoarding

With the proliferation of internet technology, humanity has entered the digital age, leading to an increasing demand for information. Similar to physical hoarding, a growing number of individuals, particularly younger generations closely associated with information, tend to develop an emotional attachment to digital resources. In a case study, Van Bennekom *et al.* explored the negative impacts of information disorganization caused by hoarding on the individual's physical and mental well-being, formally defining this behavior as "Digital Hoarding" [1]. This refers to the accumulation of digital files to the point of impaired judgment, ultimately leading to stress and disarray. Subsequently, the academic community be-

gan to focus on this topic, with many scholars providing definitions from perspectives such as the process, impact, and characteristics of digital hoarding. Sweeten *et al.*, through a qualitative study involving 45 participants, found that digital hoarding exists in both workplace and personal environments, exhibiting key similarities to physical hoarding behaviors in terms of accumulation, difficulty discarding, and emotional distress [6]. Sedera and Lokuge defined digital hoarding as the failure to discard or effectively manage acquired digital content, regardless of its utility, leading to the accumulation of digital clutter [7]. Four years later, Sedera *et al.*, based on attachment theory and hoarding disorder, posited that characteristics such as difficulty discarding digital content, disorganized digital content, and frequent over-acquisition of digital content are all manifestations of digital hoarding disorder [8]. Vitale *et al.* (2018), through interviews, categorized individuals who save digital data into four types, with digital hoarders and digital minimalists representing the two extremes [9]. Zhao, from the perspectives of information resource management and personal information management, argued that an individual's digital hoarding behavior is a form of information processing in response to information overload, often involving the preservation of as much digital information as possible with minimal deletion or discarding [10].

The advent of personal computers enhanced individual information processing capabilities. Lansdale first introduced the term Personal Information Management (PIM), defining it as the methods and pathways individuals use to manage, categorize, and retrieve information daily [11]. Digital hoarding stems from PIM activities, representing a deviation in the information retention aspect of PIM [12]. Individuals in digital accumulation gradually develop irrational judgments, accumulating various irrelevant information in their personal information space without effective processing. This cyclical process has a detrimental impact on individuals, leading to a loss of control and can even extend to social organizations.

In conclusion, this paper posits that digital hoarding results from excessive digital possession, which originates from individuals' indiscriminate collection of excessive and useless digital resources, coupled with a lack of management and unwillingness to discard them. This ultimately leads to chaos and psychological burden after a certain accumulation threshold is reached.

2.1.2. Research on the Motivations behind Digital Hoarding Behavior

Prior to the formal establishment of the concept of digital hoarding, scholars had already begun to investigate the behavioral motivations behind personal archiving and accumulation. Chen posited that personal archiving and accumulation is not an indiscriminate, disordered accumulation, but rather a purposeful collection aimed at achieving current goals [13]. Luxon *et al.* provided experimental support for the view that there is a connection between digital hoarding and physical hoarding, and indicated that the motivations behind digital hoarding behavior are characterized by practical or instrumental needs [14]. Based on previous qualitative research, Neave *et al.* conducted a psychological measurement on digital hoarding behavior, designing the Digital Behaviors Questionnaire (DBQ) to as-

sess two key components of hoarding (accumulation and difficulty discarding) [15]. The results showed that employees who considered themselves to have a "data protection responsibility" exhibited significantly more digital hoarding behavior, suggesting that this behavior may be influenced by work practices. Later, Neave's research, "Digital Hoarding Behavior: Implications for Cybersecurity", demonstrated how digital hoarding behavior can negatively impact organizations, particularly in terms of cybersecurity, emphasizing the emotional motivations behind this behavior [16]. Similarly, Thorpe's research survey revealed that people have a strong emotional attachment to specific types of digital property, especially photos and videos [17]. Some have attributed individuals' emotional motivations to factors such as the need for future use, accumulation for proof, personal habits of laziness/reluctance to organize, attachment issues, and strong storage capacity. The following year, Mckellar, based on the Digital Hoarding Questionnaire, explored information management practices, the reasons for retaining large amounts of digital data, and the difficulties encountered when deleting data in the context of work, identifying four basic dimensions of digital hoarding (anxiety, detachment, compliance, and collection) [18]. Zhang *et al.* summarized the individual's behavioral motivations from a psychological mechanism perspective into three aspects: loss aversion, digital possession, and emotional attachment [2].

Sedera *et al.* observe that the declining costs of data storage have facilitated unprecedented access to, sharing of, and storage of digital content, including emails, images, videos, and documents [8]. This behavior is amplified by the proliferation of smartphones, wearable devices, and other modern technological devices, the rapid adoption of social media and communication applications, and the increasing digitization of commercial and personal interactions. McKellar *et al.*, employing surveys and focus groups in a work context study, highlighted various motivations for data hoarding, including anxieties stemming from a "blame culture," as participants navigated workplace challenges and accountability demands [19].

2.1.3. Research on the Impact of Digital Hoarding

The earliest case studies by Van Bennekom *et al.* initiated the discussion on the negative impacts of information overload caused by hoarding on the physical and mental health of hoarders [1]. They posited that digital hoarding constitutes pathological hoarding when it exceeds the threshold of interfering with other aspects of life. Sweeten *et al.* conducted qualitative research to explore the potential impacts of digital data accumulation, including effects on efficiency and mental health, cybersecurity threats, and intersections with physical hoarding [6]. Schüll examined a series of existential risks associated with digital storage capacity and devices: the anxiety and depletion of digital housekeeping, the disorientation of self-archiving, and the devastating sense of loss when digital control fails [20]. Sillence *et al.* discussed the impacts of personal digital data hoarding on increasing anxiety, cybersecurity vulnerabilities, and sustainable development [21].

Although the current research predominantly views digital hoarding as having negative impacts, a few scholars believe that it also has certain positive effects. For

example, the research results of Vinoi *et al.* found that digital hoarding has a positive effect on alleviating the psychological stress caused by anticipated regret [22].

2.2. Digital Natives

The initial concept of "digital natives" was proposed by Barlow in his "Declaration of the Independence of Cyberspace," although it primarily presented an advocacy without a specific definition [23]. In the same year, Negroponte, in his publication "Being Digital," indicated that the true cultural gap in the digital age would occur between generations, fundamentally altering how people acquire knowledge and experience [24]. Tapscott, in "Educating the Net Generation," categorized students into four generations based on the situations in the United States and Canada: the Mature Generation, Baby Boomers, Generation X, and the Net Generation, born between 1977 and 1997 [25]. Prensky, a prominent American educational game expert, first introduced the concepts of "Digital Natives" and "Digital Immigrants" in his article "Digital Natives, Digital Immigrants" [26]. Building on Tapscott's views, he termed the younger generation (Net Generation), born into and deeply influenced by the information technology environment, as digital natives. This highlighted the differences among digital groups from different eras in their acceptance, adoption, use, and management of new digital technologies and information, influenced by their upbringing and education. He also pointed out that digital natives are "native speakers" of the digital language, accustomed to quickly accessing information, multitasking, preferring graphics, random access, and instant gratification [4]. Subsequently, extensive research and discussions on digital natives began in the West.

The academic community currently debates the conceptual distinction between "digital natives" and "digital immigrants," with three primary perspectives emerging. The first approach directly employs age as the defining criterion. Prensky, drawing on neuroscientific insights, posits that generational cohorts exhibit varying degrees of plasticity due to differing formative environments [4]. Research by Jones and Czerniewicz [27], Hargittai [28], and Kennedy *et al.* [29] supports this view, highlighting a significant correlation between age and digital technology proficiency. Margaryan *et al.* proposes 1985 as the birth year demarcation for digital natives, considering the advent of personal computers and the growth of the gaming industry [30]. A second perspective advocates for a multi-faceted approach, incorporating economic, social, regional development, and educational factors alongside age [31]. The third perspective emphasizes the convergence of the two groups, focusing on information literacy as the key differentiator. Scholars have introduced concepts such as "Digital Fluency" [32], "Digital Navvy" [33], "digital melting pot" [34], and "digital wisdom" [35] to characterize the information literacy of digital natives.

Western scholarship typically dates the emergence of digital natives to the 1980s, coinciding with the widespread adoption of information technology in the United States. The situation in China differs. On April 20, 1994, China gained full

access to the global internet via a 64K international leased line, marking the official integration of the internet into the nation's history [36]. Consequently, this paper defines "digital natives" as the 20-30-year-old cohort, born after China's internet access in 1994, who possess independent digital information usage capabilities.

3. Digital Hoarding Behavior of Digital Natives Based on the I-PACE Model

3.1. I-PACE Model

The I-PACE (Interaction of Person-Affect-Cognition-Execution) model, initially proposed by Brand *et al.*, examines the development, progression, and perpetuation of irrational internet behaviors, such as internet addiction, through a four-dimensional process paradigm: "user characteristics - affective experience - cognitive regulation - behavioral outcome" [37]. As illustrated in **Figure 1**, the primary pathway of the I-PACE model is as follows: User characteristics serve as the initial triggers and predisposing factors for an individual's irrational internet behavior, encompassing biological factors, psychopathological traits, personality traits, social cognition, and usage motivations. These characteristics render individuals more susceptible to subjective experiences, with perceived stress stemming from personal conflicts or abnormal emotions (e.g., depression or anxiety, excitement) influencing cognitive processes, which, in turn, determine the use of the internet to cope with related cognitions and emotions. Over time, this evolves into an irrational internet addiction, leading to negative consequences in daily life.

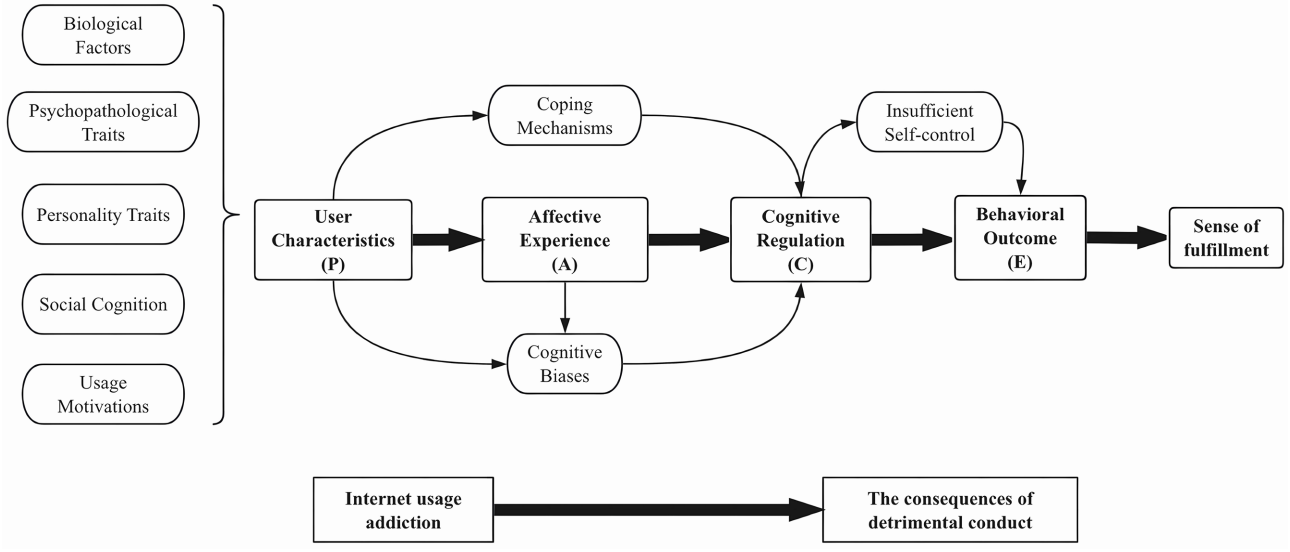

Figure 1. I-PACE Model. (With bold arrows indicating the primary model pathways).

On the secondary pathway, coping mechanisms, cognitive biases, and insufficient self-control play a facilitating role. Individuals more vulnerable to stress (as a susceptibility factor), due to dysfunctional/impulsive coping strategies, may be

more inclined to engage in emotional regulation responses when faced with stress. If an individual (through explicit expectations or implicit associations) anticipates or deludes themselves that using the internet can alleviate stress, or if other internet-related cognitive biases exist, frequent use of an application and experiencing positive outcomes (such as pleasure or escapism) will generate positive (implicit) associations. Coupled with a lack of self-control (a craving for gratification), this may make individuals more likely to reuse the application (reinforcement), thereby increasing the probability of irrational behavior recurrence.

The I-PACE model offers a comprehensive systemic framework for investigating digital hoarding, a prevalent irrational online behavior. This framework encompasses fundamental structural elements, including user characteristics, subjective experiences, and cognitive responses. Digital hoarding represents an alienation within the processes of personal information collection, adoption, organization, and utilization. Deconstructing this phenomenon through the process paradigm of the I-PACE model allows for a deeper understanding of its behavioral mechanisms and the identification of underlying causative factors. Consequently, this paper will analyze the digital hoarding behaviors of digital natives based on the four dimensions of the I-PACE model: "user characteristics - emotional experiences - cognitive regulation - behavioral outcomes".

3.2. Data Acquisition

3.2.1. Interviewees

This study employs content analysis, conducting semi-structured interviews with digital natives aged 20 - 30, born between 1994 and 2004. Considering potential nuances among interviewees of different ages, the interview sample is designed to evenly represent each age group, thereby ensuring the validity of the interviews through sample collection. The interviews were conducted from November 17 to December 31, 2024, with a sample of 24 participants recruited from university students and white-collar workers. The sample comprised 12 university students/postgraduates and 12 employed individuals. The basic information of the interviewees is presented in Table 1.

Table 1. Basic information of respondents.

No.	Gender	Age	Status	Major/Occupation
H1	Male	30	Working	Development Engineer
H2	Female	24	Working	Development Engineer
H3	Male	26	Working	Internet Operation
H4	Female	25	Working	Internet Operation
H5	Female	26	Working	Lawyer
H6	Male	26	Working	Development Engineer
H7	Female	23	Working	Data Analysis
H8	Female	26	Working	Internet Operation

Continued

H9	Female	28	Working	Internet Operation
H10	Male	26	Working	Teacher
H11	Male	27	Working	Lawyer
H12	Male	24	Working	Internet Operation
H13	Male	26	Undergraduate	Computer Science and Technology
H14	Male	22	Undergraduate	Law
H15	Female	26	Postgraduate	Business Administration
H16	Male	22	Postgraduate	Journalism and Communication
H17	Female	24	Postgraduate	Cultural Relics and Museums
H18	Female	25	Postgraduate	Law
H19	Female	25	Postgraduate	Library and Information Science
H20	Male	24	Postgraduate	Computer Science and Technology
H21	Female	21	Undergraduate	Journalism and Communication
H22	Female	21	Undergraduate	Sophomore Electrical Automation
H23	Male	24	Postgraduate	Library and Information Science
H24	Female	25	Postgraduate	Library and Information Science

3.2.2. Interview Outline

To mitigate the potential for the Hawthorne effect and ensure the validity of interview data, the interview setting was deliberately situated in natural environments (e.g., schools, cafes, corporate break rooms) or conducted via online video conferencing. This approach aimed to establish a comfortable and relaxed atmosphere for participants, allowing the utilization of informal conversational language to encourage comprehensive expression.

The interview protocol was structured into three primary sections. Initially, basic demographic information was collected, and the concept of digital hoarding was introduced using illustrative examples to facilitate participants' comprehension. Subsequently, the interview transitioned to an exploration of participants' self-perceived habits, eliciting detailed descriptions of their behavioral patterns to ascertain their characteristics and assess the presence of physical hoarding tendencies. Finally, participants were prompted to recall and describe recent or past instances of digital material hoarding, including storage volume, digital file types, storage media, and organizational strategies. A semi-structured interview format was employed, incorporating supplementary questions to clarify ambiguous or omitted details.

A detailed interview guide is presented in Table 2.

Example 1: Within professional, personal, or academic contexts, the accumulation of extensive digital artifacts, including documents, communication logs (textual, audio-visual), and cached data, leads to diminished device storage capacity with infrequent utilization or maintenance. This results in a state of disorganization and associated psychological distress.

Example 2: Through social media platforms, such as Tiktok, Xiaohongshu, and Bilibili, the acquisition of a substantial volume of content via following and saving, yet with limited comprehensive engagement or application.

Table 2. Interview outline.

Interview Theme	Main Interview Contents
Basic Information of Respondents	1. Age, gender, education level, major/occupation, etc. 2. Do you think you are a planner or a freewheeling type when it comes to making plans and organizing things? 3. Do you usually have the habit of hoarding things (such as stocking up during Double Eleven, hoarding shopping bags at ordinary times, etc.)? Please give recent examples to illustrate.
Specific Behaviors and Formation Process of Digital Hoarding	4. Is the storage space of your electronic devices, such as mobile phones and computers, sufficient at present? Will you be bothered by the insufficient memory of electronic devices? 5. Which contents take up the most memory? (Chat records, photos, screenshots, large files...) 6. Why do you want to save/collect these contents? (Elaborate separately in the contexts of work, study and life.) 7. Will you open the saved/collected contents later? Under what circumstances will you usually use them actively? 8. What impacts has the hoarding of these contents brought to you? Both positive and negative ones are acceptable. 9. Will you clean up the contents that are not frequently used? Why? 10. Do you think it's difficult to practice minimalism on digital contents? Compared with that on physical objects, what's the difference? And why? 11. How do you think your self-control is in terms of information management? And why?

3.2.3. Interview Procedure

The interview process spanned approximately six weeks, with meticulous consideration given to the comprehensiveness of the interview sample. A preliminary psychological assessment was administered prior to the interviews to comprehensively ascertain the personal attributes of the interviewees. This included the Self-Rating Anxiety Scale (SAS) and the Revised Obsessive Compulsive Inventory (OCI-R) to ensure that the psychological states of the participants were within a normal range, thereby mitigating the potential for confounding variables stemming from specific psychological conditions. Subsequently, participants completed the digital hoarding scale, a revised instrument developed by Wu *et al.*, to facilitate their familiarity with the subject matter and to serve as a preliminary assessment. This also allowed for the observation of inter-individual variations in responses to the scale. During the interviews, ample opportunity was provided for participants to reflect and elaborate on their responses. This process culminated in the generation of 20 interview transcripts, with a total recorded duration of approximately 600 minutes. The average interview length per participant was approximately 30 minutes, resulting in a corpus of nearly 80,000 words transcribed from the recordings.

Open coding constitutes the initial phase of the coding process. During this stage, a meticulous line-by-line analysis of the raw interview textual data is undertaken with an open mindset, assigning conceptual labels to meaningful segments.

To mitigate subjective interpretation, these conceptual labels are derived as directly as possible from the data itself, minimizing reliance on pre-existing theoretical frameworks. This process yielded an initial set of 53 concepts, which were subsequently categorized into 31 initial categories, as presented in Table 3.

Table 3. Open coding (Part).

Initial Category	Initial Concepts	Original Typical Statements (Part)
Individual Character	Laziness	I am lazy. Some photos, screenshots of the content of the time are too long, I would not be too lazy to one by one delete those that I do not want to save, would rather let it pile up, do not want to deliberately spend time organizing.
	Perfectionism	Because I don't think I can get something particularly complete and perfect, I simply don't want to do it. Because I know it will take a lot of time to get it perfect, and I don't want it to be a mess, which can be a difficult obstacle.
Individual Habits	Procrastination	I think there is a little bit of procrastination. It's like the mind makes it complicated, but maybe it's not that hard to do. But my brain makes it so complicated that it magnifies the difficulty and keeps me from doing it.
	Long-term Habits	When it comes down to me, I don't seem to have the habit of organizing things right away, and I tend to save things instead of deleting them.
Motivation for Use	Work Requirements	For example, some of my lesson plans, year-end summary templates, some of the materials I use for class preparation, such as student essays and other content that I often use in my work, and must be kept for a long time for work purposes.
	Learning Needs	For example, some very important course-related things: thesis, some course materials issued by the teacher, and graduate student awards and evaluations of the kind of necessary documents, I will definitely be used in the future in the study, I think it is definitely necessary to save.
	Stock of Knowledge	I may also want to build up a knowledge base for myself by saving materials in this way, so that I can make progress.
Compulsive Hoarding	Difficult to Disconnect	I'm a bit obsessive-compulsive in that, if the content of a certain section, if the general category is useful to me, then regardless of whether the specific details of the content is useful or not, I have to save it in its entirety, and if I force to sift through it and take it away, then it will be very difficult to do so.
Upward Social Comparison	Compare with others	I always feel that I should learn more new knowledge and skills, so I keep hoarding a lot of study materials, and I want to take the exams that I see other people taking, such as English, programming software, and so on.
Future Utility	Use Expectations	Feeling useful. For example, during my job search, I will save some job-related interview tips when I see them, or suppose I'm looking up tips on where to go and play, and there are related pictures that I'll save, and then suppose maybe I want to change my WeChat avatar, then I'll save when I see a better-looking one, so I'll pay attention to the utility of some of the content.
	Inspiration	For example, if I want to try something today, I will go through my favorites, which may bring me some ideas, for example, if I turn to a travel guide, I may go to this place recently, or for example, if I turn to a recipe that I want to try, I may go to do it this afternoon. It is going to give me some inspiration.
	Reflection of Personal Ability	For example, a long time from now, I would like to see what I wrote for my undergraduate B. I would like to see how good my thesis is, I feel that that is something I have written and I don't want to delete it so easily, it is a reflection of my own personal ability within a certain period of time.

Continued

	Shopping for Weeds	Maybe I see a life thing, similar to a good shampoo, this kind of thing I will screenshot a lot of pictures, which is equivalent to planting weeds, and then search for it when I want to buy it.
Memory Function	History	I will frequently write a lot of documents in the work, these documents are in fact in the Flying Book documents, in addition, there are some very fragmented things, such as we have to knock some of the sql code, sometimes I will be sent to the Flying Book to do their own chat records in the form of such a record, or take the notepad software to record.
Value Assessment	Economic Value	There are a lot of steam games inside the game will buy some cassette tapes, in fact, may be for example, after I buy it back, I can hang second hand to sell it if I play through the game.
	Scarcity	If this material is particularly scarce, for example, it was originally a material that you have to pay hundreds or thousands of dollars to get, then I will definitely keep it for a long time.
	Long-term Value	Something such as knowledge attributes, especially the basic underlying logic of the content, it will not expire, I will always save.
Information Timeliness	Information Timeliness	Some information is time-sensitive, for example, if I've been looking for a job lately, and there are some notifications that have some positions or timelines in them, I might go back and look at what positions I put in at the time, or how the hiring timeline was actually organized.
Information Digitization	Digital Office	Relative to the physical, it is actually very lightweight as well as anytime and anywhere can see, management and storage are very convenient, the use of physical up to high efficiency, so it is increasingly difficult to get away from these things.
	Paperless Learning	For example, if I study some law-related courses, the material is too much often reaches dozens of pages and hundreds of pages, paperless learning becomes a very efficient way of learning, the teacher often shares resources through the line, and I have to save a lot of electronic documents.
Storage Cost-effective	Large Storage Space	Before my phone is 128G, I think it is not enough, then change a new phone will change 256G, after changing I think 256G now also not enough, so I may now also change a bigger, may also be because the phone memory is large, their heart that threshold is higher, think it does not matter, anyway, my memory is so large, I just download, Then in the end, you will save more and more.
	Low storage costs	I don't think it would cost me more than a few hundred dollars to get a bigger one, but he's going to make it so that I don't have to think about it until the end of the phone's life.
Software Technology	Convenient Software Management	I feel as if information management software has given a little boost to this kind of information hoarding, because it will be easier to make a categorization of what I want to bookmark in it, and it is very convenient for me to make use of it again.
	Incomplete Functions	I feel that, for example, Weibo is not well designed, although it also allows users to make a large number of favorites, but there is no automatic categorization, and sometimes when I click on my favorites, there are close to 800 favorites, which is very confusing, and psychologically it is very uncomfortable.
	Software Cache	I think that software in general seems to get bigger and bigger the more it is updated, it seems to be patched, especially if I play games, it is obvious that every time he updates, he downloads a big patch, and then the game size is getting bigger and bigger. Similar problems occur with residual data from software cleanup, temporary data from downloaded files, etc.
Information Retrieval	AI-assisted Retrieval	AI Large Language Model now have the ability to analyze the state, I just need to give it all my photos, it helps me to identify them, and next time through the retrieval points it gives me, I retrieve the photos can be, and now the phone also has this function, you can according to the face on the photo, all the photos related to this face to build a folder, and we are now aware of the technology do Image recognition has reached a relatively accurate level, and because of this, I have accumulated more and more photos.

Continued

	Enhanced Search Functions	For example, I feel that the classification of the Favorites on B-site is quite clear, and it doesn't give me a very complicated feeling, and it's really quite easy to use, so that I don't have a psychological burden when I save them.
Data Backup	Data Backup	I require electronic copies of vital information, including my identification card, academic credentials, passport photos, and any potentially relevant contracts.
Data Security	Privacy Information	I perceive cloud storage as potentially insecure. My apprehension stems from a prior experience where I was unable to recover my WeChat account. Consequently, I tend to favor local storage solutions.
Satisfaction	Satisfaction	The more items I collect, the better prepared and more confident I become when facing new challenges. Having sufficient resources on hand enables me to tackle difficulties effectively.
Digital Possession	Digital Possession	My desire to understand new knowledge is particularly strong; I feel a certain acquisitiveness, a craving to possess this knowledge.
Sense of Security	Sense of Security	Theoretically, even if the saved data remains unaccessed, the mere potential for future retrieval provides a sense of security.
Perceive Interesting	Hobbies	My interests include documentaries and ASMR audio, which I frequently revisit and am reluctant to delete.
Fond Memories	Fond Memories	Upon rediscovering some intriguing historical records, I found sharing them with my associates to be a gratifying experience. This reinforces my belief in the value of preserving such materials as a cherished aspect of memory.
Mistake Anxiety	High Cost of Mistakes	I might feel a little worried if I mistakenly delete a course file. If I can't find it when I use it in the future, it might cause some distress.
Attachment	Can't Delete	I think because I am more attached to the old, for example, good friends write me letters, emails, greeting cards, I will keep them for a long time, and it has something to do with me being attached to the old.
Self-efficacy	Strong Categorization and Organization	I may have done some coursework, academic activities, I save it inside a folder, and I have a folder for each year from each semester of undergraduate to now three years of graduate school, and just save the appropriate stuff for it. In the case of categorization and organization it's more inclined to save as much as I can without deleting.
	Strong Information Gathering Ability	There's a strength in Gallup called gleaning, and I think the behavior of gleaning it has a lot to do with hoarding itself, for example, I'm in the top ten for gleaning, I'm a better gleaner of information relative to the people around me, and it means that I'm going to be more prone to hoarding the information that I've gleaned.
Endowment Effect	Loss Aversion	In the earliest days, before I formed this relevant habit, I would often get into the situation where I needed the file very badly, but when I went back to search my chat logs or my office computer, I found that it was outdated or had not been saved, and that caused a lot of trouble. So I internally refuse to put myself in that situation again.
	Luckiness	Although I basically never use it, just in case I want to use it someday.
Perceiving External Pressure	Perceiving Technical Pressure	If I can't do this kind of cleaning by very simple, for example, I filter group chats, and I need to check one by one to delete and organize, I will find it troublesome and have no motivation to organize. The cost of learning information management software, including information management software, and the cost of categorization decisions are too high for me.
	External Uncertainty	It has been shown that any file that appears in front of me, as long as it has some relevance to my work, there may be an opportunity to use it later, then there is no way but to save it first, because there are too many external uncertainties.

Continued

Sensing Organizational Stress	Keeping Track of Work	In the workplace, it is important to make sure that I can quantify what I need and what I am not ready to do, and it also helps me to do review and retrospectives to avoid a lot of communication troubles.
	Improvement of work Ability	External pressure at work will be higher, because I feel that work is very different from school, what I am learning now is completely different from what I did in graduate school, so I will feel that some of the knowledge or experience given to me by the outside now must be retained if I can't digest it in the short term.
	Work Responsibility	Now the major platforms of the one-click favorites function is too good to use, sometimes brush the short video on the head, see the need to immerse because the work may be involved in the issue of accountability. For example, the case may have been done for a long time, one day suddenly the customer will find you to a certain litigation procedure documents, you may be the second trial will go to the first trial or arbitration of those materials to go through a year or two years ago, out of the responsibility of the work of the retention is very important.
	Pressure from Superiors	At work, there are often additional requests from supervisors that were not part of the program. Therefore, my electronic documents must be more organized; otherwise, it will take a long time to complete them.
	Knowledge Hiding	Some things I need to use at work, but can't share with other coworkers, I save them in my online disk.
Social Sense	Sharing with Others	For example, if I see something interesting on Taobao, Xiaohongshu, or Tiktok, or if I want to share it with my friends or others, I will take a screenshot and share it.
	Helping Others	There are some files in my work that I think I can help others if they need them after I save them.
Consequences of Behavior		
Digital Information Continues to Accumulate	Device Memory Requirements Continue to Expand	WeChat chat records and photos are constantly migrating as I change to a phone with more memory, and even then, I still don't want to clean it up, so I'll store it for as long as I can.
Difficulty in Deleting Data	Vicious Cycle	The more you store, the more you store, the more you don't want to clean up.
Digital Files are Disorganized	Difficult to Categorize and Search	100 photos are still easy to find, but thousands of photos are impossible to find. Basically, they rely on the simple categorization that comes with the device, and won't do any additional categorization.
Data Loss	Risk of Data Loss	I recently had a device malfunction and one of the memory cards wouldn't open, coincidentally, because it hadn't been used for too long, I couldn't remember what was stored on it, and I was very worried about losing important content, so I spent a lot of time and effort to repair it.

3.2.4. Axial Coding

Following the completion of open coding, axial coding is employed to further investigate the intrinsic relationships among the preliminary categories identified. While ensuring the mutual exclusivity of the initial categories, appropriate superordinate terms are selected to construct relationships. Through the processes of inclusion and categorization of the 31 sub-categories derived from open coding, six primary categories were ultimately established, as presented in **Table 4**.

Table 4. Axial coding.

Main Scope	Scope	Initial Scope (Concept)
Digital Individuals	Individual Traits	Individual Personality, Individual Habits
	Psychological Traits	Compulsive Hoarding
	Social Cognition	Upward Social Comparison
	Motivation to Use	Job Demands, Learning Needs, Knowledge Base
Subjective Feelings	Sense of Satisfaction	Massive information hoarding brings psychological satisfaction to the individual.
	Digital Possession	Satisfying the individual's desire to possess information.
	Sense of Security	False sense of security brought to the individual by the mass storage of electronic documents.
	Perceived Interest	Information content that meets the individual's preferences and brings positive emotional value.
	Fond Memories	Letters, greeting cards, etc. (delivered in the form of WeChat chats, pictures, emails).
	Missed Anxiety	Individuals experience emotions such as anxiety due to fear of adverse consequences of missing information.
	Attachment Emotions	Individuals have trouble letting go of emotions projected on digital content such as photos, chat logs, etc.
Perceived Responses	Self-efficacy	Strong Categorical Organization, Information Gathering
	Endowment Effect	Luckiness, Loss Aversion
	Perceived Extrinsic Stress	Perceived Technological Pressures: Technological Learning Costs, Information Overload, Information Cocooning, Organizing Decision-making Costs; Extrinsic Uncertainty
	Perceived Organizational Stress	Work Retention, Work Responsibility, Sense of Urgency to Improve Work Ability, Pressure from Superiors, Knowledge Hiding
	Perceived Socialization	Sharing with Others, Helping Others
Digital Information	Memory Functions	Historical Records
	Value Assessment	Economic Value, Long-term Value, Scarcity
	Timeliness of Information	Timeliness of Information Value
	Future Utility	Expectation of Use, Demonstration of Personal Competence, Shopping for Ideas, Inspiration
	Digitization of Information	Paperless Learning, Digital Office
Technology Context	Storage Price	Low Storage Cost, Large Storage Space
	Software Technology	Convenient Function Design, Incomplete Software Function, Software Caching Data
	Data Security	Privacy and Security
	Information Backup	Important Data Backup
	Information Retrieval	AI Retrieval
Behavioral Consequences	Potential Consequences	Pathological Hoarding, Increased Costs, Inherent Attrition, Data Security Risks
	Behavioral Manifestations	Continuous Accumulation, Difficult to Delete, Disorganization

3.2.5. Selective Coding

Selective coding constitutes the concluding phase of the coding paradigm, with the objective of deriving a core category from the established categories to construct a theoretical framework. Selective coding centers on the core category, systematically relating other categories to it, and elucidating the logical relationships to explain the phenomenon. The core category serves to govern and integrate other categories. The interrelationships among the core categories are presented in Table 5.

Table 5. Selective coding.

Paths of Action	Relational Structure	Structure Connotation
User Characteristics → Digital Hoarding	Causal Relationship	User characteristics directly motivate digital hoarding behavior.
Subjective Feeling → Digital Hoarding	Causal Relationship	Users' subjective feelings motivate their digital hoarding behavior.
Cognitive Response → Digital Hoarding	Causal Relationship	Cognitive response influences digital hoarding from both internal and external paths.

3.2.6. Theoretical Saturation Testing

To ascertain the theoretical saturation of this study, a theoretical saturation test was conducted on the interview text data from participants 22 - 24 at the conclusion of the interview phase. The analysis of these samples did not yield any new nodes or relationships, indicating that the theoretical saturation met the established criteria.

4. Model Elaboration and Research Analysis

Based on the text analysis coding results and research on relevant models both domestically and internationally, the model presented in this study has been refined. This process culminated in the development of the digital hoarding behavior path model for digital natives, as illustrated in Figure 2.

4.1. Behavioral Manifestations of Digital Hoarding among Digital Natives

The qualitative analysis reveals the behavioral outcomes of digital hoarding: users experience difficulty in deleting vast amounts of information resources, leading to continuous accumulation, either voluntarily or involuntarily, which eventually devolves into a state of disarray due to inadequate management. For instance, within an academic context, students often exhibit a positive emotional response towards digital resources, particularly specialized study materials with high long-term preservation value, driven by the anticipation of future learning needs and influenced by upward social comparison. They perceive the data quality as high and storage costs as low. "I've saved 1GB of English learning materials; although I don't have time to study now, I believe I will need to improve my English skills in the future. Saving these resources now gives me a sense of psychological satisfaction." In a professional setting, employed individuals tend to store electronic

content that has not lost its timeliness due to work demands or limitations of file carriers, and are influenced by perceived organizational pressure. Under anxious and tense emotional states, the hoarding of digital resources provides them with a certain degree of security. "Saving chat records, screenshots, and files helps me avoid many problems in work communication, especially in scenarios where responsibility needs to be assigned".

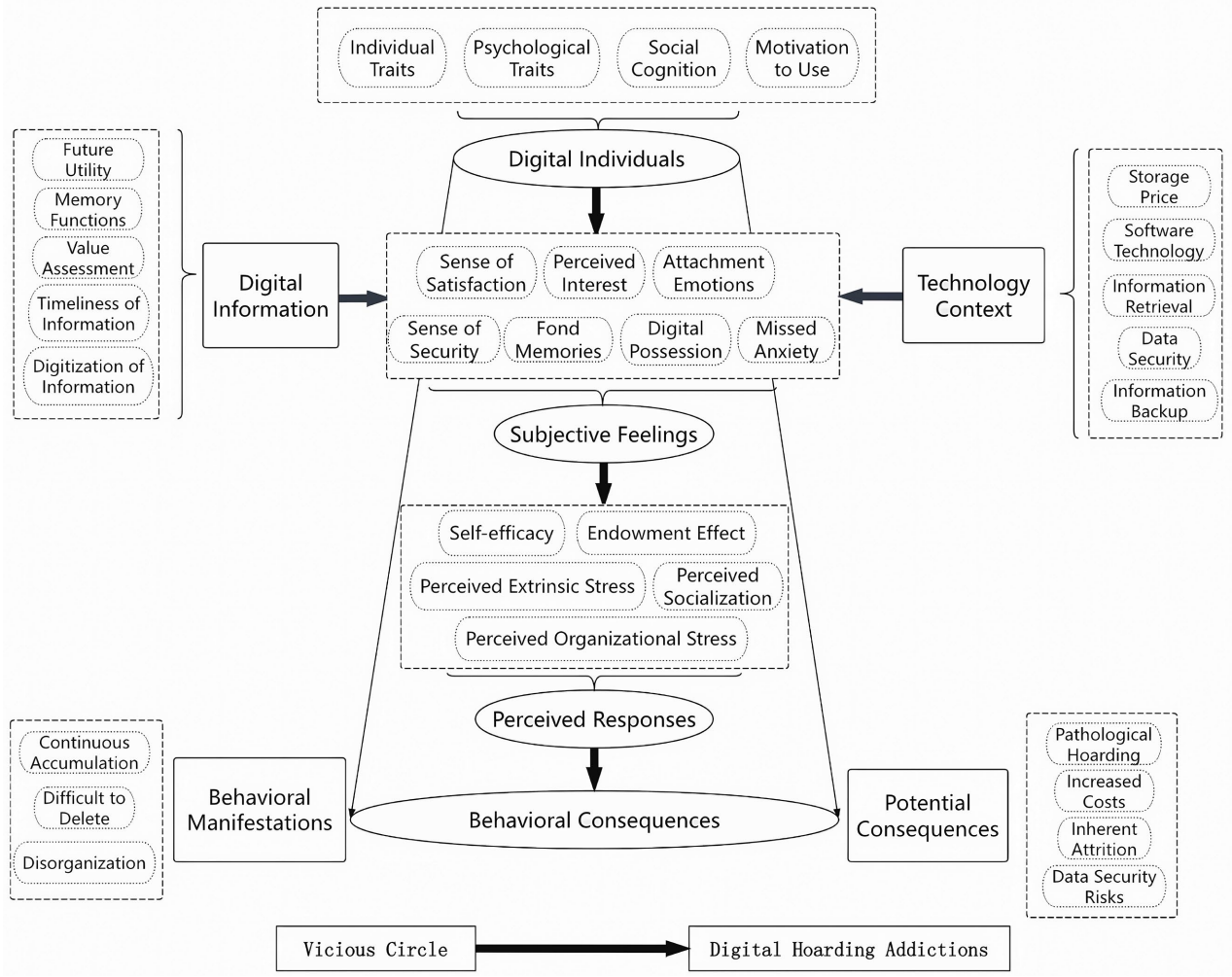

Figure 2. A path model of digital hoarding behavior of digital natives.

The disorganization of digital resources is often closely associated with user characteristics. Research indicates that users exhibiting traits of laziness, procrastination, and a degree of compulsive behavior are more prone to adopt negative coping mechanisms. Furthermore, due to the declining costs of digital storage, the perceived cost of storage is significantly lower than the perceived cost of management. Consequently, users may knowingly tolerate disorganization. For instance, "Although WeChat chat records consume a significant portion of my phone's memory, I typically do not organize them, preferring to upgrade to a device with greater storage capacity when the existing memory becomes insufficient."

4.2. Factor Analysis

4.2.1. Intrinsic Drivers: Digital Users

Digital users' digital hoarding behaviors are intrinsically driven by four aspects: individual traits, psychological characteristics, social cognition, and usage motivations. Individual traits refer to the unique characteristics naturally formed by digital natives in the past, which influence their digital hoarding behaviors. The previous research found that individual traits mainly include two aspects: individual personality and individual habits, specifically manifested as laziness, perfectionism, procrastination, and long-term habits. In terms of attitudes toward processing digital information, digital natives often tend to be polarized: on the one hand, the respondents regard it as a troublesome and low-priority matter, and are lazy to deal with it due to laziness; on the other hand, the respondents demand too high quality in processing digital information, and require themselves to meet perfect standards, but it is difficult to start. From the individual usage habits of digital natives, due to procrastination, respondents often get used to delaying the processing of digital hoarding problems that have already appeared in a mess, thus falling into a vicious cycle; at the same time, some respondents are accustomed to hoarding digital information, and it is difficult to change it over time.

The motivations driving digital natives' digital hoarding behavior are multifaceted, encompassing work requirements, learning needs, and knowledge accumulation. Given the age demographics of digital natives, the interviewees were equally divided between those employed and those yet to graduate, facilitating an examination of behavioral differences in work and learning contexts. The research revealed a significant propensity for digital hoarding across various professions, driven by work-related demands. Notably, professionals in the internet industry, who are most closely associated with digital information, demonstrated superior personal information management skills, and the influence of organizational software facilitated orderly processing of extensive work-related information, thereby mitigating hoarding-related disarray. Conversely, professionals in traditional sectors, such as educators and lawyers, exhibited greater digital hoarding issues due to the stringent requirements for work-related information and traditional management methods, resulting in higher individual information management costs. Regarding learning needs, individuals primarily cited course-related and personal learning requirements, such as "essential course-related papers, materials, and documents necessary for postgraduate awards and evaluations, which will undoubtedly be utilized in future studies; I believe they must be preserved." Digital natives aged 20 - 30, often in their prime for personal development, also displayed a clear inclination towards knowledge accumulation, as evidenced by statements like, "I also aim to establish my own knowledge base for advancement through this method of saving materials."

The psychological characteristic of compulsive hoarding is defined as an addiction to accumulation, exhibiting traits of obsessive-compulsive disorder. "Regardless of the utility of the specific details, I must retain everything in its entirety; any

attempt to filter or discard information causes significant distress." Social cognition encompasses upward social comparison, where individuals assess themselves against those perceived as superior in a specific attribute, often concerning personal capabilities and knowledge levels within this study. "I consistently feel compelled to acquire more knowledge and skills, leading me to amass vast quantities of learning materials. I am inclined to pursue certifications others are undertaking, such as those in English or programming software."

4.2.2. Motivation: Subjective Perceptions

The subjective perceptions of digital natives further instigate digital hoarding behaviors, contingent upon individual trait differences. These perceptions manifest as: a sense of security, satisfaction, perceived interest, cherished memories, fear of missing out (FOMO), and digital ownership. Security refers to the reliance on a sense of safety derived from the digital natives' need to prevent the risk of information loss. Satisfaction, in turn, is a manifestation of spiritual "abundance," akin to a "squirrel hoarding food." Building upon the foundations of security and satisfaction, digital natives develop emotional responses of digital ownership and FOMO. Interviews also revealed that the emotional value embedded within digital information content influences the subjective perceptions of the interviewees. Interviewees perceive certain digital content as interesting or as containing cherished memories. Based on the perception of emotional value, digital natives tend to hoard digital information. Digital natives, in general, construct "digital security fortresses" by hoarding digital resources to alleviate existential anxiety. Simultaneously, they reinforce self-identity symbols, such as "information collectors," through resource accumulation, thereby satisfying their need for competence. Loss aversion and the fear of missing out amplify the fear of information loss, prompting "save all" decision-making to avoid such loss. Emotional attachment transforms digital content, which carries memories, into an "extension of the self", activating the brain's default mode network and reinforcing hoarding inertia. The dopamine reward cycle of "discovery-storage" may trigger addiction-like habits.

4.2.3. Manifestation: Perceptual Response

The cognitive processes of digital natives are influenced by the perceptual stress stemming from various emotions (e.g., security, satisfaction, or anxiety of missing out) derived from subjective experiences, which in turn determine the adoption of digital hoarding behaviors to cope with the associated perceptions and emotions. In this study, perceptual responses are specifically manifested as self-efficacy, the endowment effect, perceived external pressure, perceived organizational pressure, and social perception. Self-efficacy refers to the high confidence of digital natives in their ability to categorize, organize, and gather information. "I am better at collecting information than those around me, which means I am more likely to hoard the information I collect." The endowment effect refers to the tendency of digital natives to overestimate the value of digital information, leading to loss aversion and a reluctance to discard digital assets. "I feel that this file is valu-

able when I save it, and I don't want to delete it even if I don't use it later." Perceived external pressure is specifically manifested as perceived technological pressure and external uncertainty. Influenced by the learning costs of technology, information cocoons, information overload, and the costs of organizing and decision-making, digital natives perceive cost pressures and are therefore reluctant to manage their personal information, eventually entering a vicious cycle of digital disorganization. At the same time, due to the difficulty in grasping the uncertainty of the external environment, such as the information needs of clients, digital natives exhibit a higher tendency to hoard in order to guard against risks. Perceived organizational pressure mainly arises in work situations. Due to the work responsibilities of digital natives, the pressure from superiors and the need to leave a work record both compel individuals to require more digital possession to cope with the pressure from the organization. Social perception manifests as prosocial behaviors, including assistance and information sharing, wherein individuals offer informational support to others driven by their inherent social needs.

4.2.4. Object: Digital Information

Within the digital hoarding behaviors of digital natives, digital information functions as the object of focus. Research into this object relationship encompasses several dimensions: memory function, value assessment, future utility, information timeliness, and information digitization. Digital natives are deeply immersed in an environment characterized by an explosion of digital information, and they exhibit a keen interest in the value and functionality of this information. Memory function refers to the individual's practice of storing information in a digital format on a medium, serving as an "external brain" to aid memory. As one participant noted, "In my work, we often need to write code, and sometimes I record frequently used code in work software for easy recall and use." In this study, respondents frequently considered the future utility of digital information, including anticipated use, inspiration, demonstration of personal capabilities, and product recommendations. For instance, "During my job search, I saved some useful interview guides related to the job, and I would pay more attention to the practicality of some content." Simultaneously, respondents also considered the value assessment of digital information, including long-term value, scarcity, and economic value. "If the information is particularly scarce, such as materials that originally cost hundreds or thousands of dollars, I will definitely save it for the long term." Influenced by the big data environment, digital natives are increasingly accustomed to paperless learning and digital office practices. The trend of information digitization, in turn, encourages individuals to rely more on digital information, leading to increased digital hoarding.

4.2.5. Environment: Technological Context

External technological contexts exert influence on individuals' digital hoarding behaviors, specifically manifested in software technology, storage cost-effectiveness, data security, information retrieval, and information backup. Software tech-

nology presents a dual nature; on the one hand, the convenience of information management software enhances individuals' efficiency in personal information management. On the other hand, the limitations of software functionality and cache occupancy contribute to the disarray of digital hoarding. The current advancements in storage technology offer advantages such as reduced storage costs and increased storage capacity, thereby encouraging digital natives to make hoarding decisions more readily. Simultaneously, the development of cloud storage meets individuals' needs for information backup and data security. The enhancement of information retrieval functions improves individuals' information utilization efficiency and lowers the threshold for storing information. "Even if I do not categorize files when downloading them, the retrieval function can assist me in quickly locating information, so I gradually developed the habit of not organizing."

5. Strategies for Addressing the Digital Hoarding Dilemma

5.1. Technological Strategies

Research employing interview methodologies reveals that digital natives predominantly engage in digital hoarding of large files, including images, chat logs, and audio-visual content. To mitigate the volume of accumulated data, several technological interventions can be considered:

1) Intelligent Identification and Notification of Duplicate Files. Storage locations such as mobile phone photo albums and cloud storage are prone to duplicate files. Implementing more sophisticated identification technologies can extract content with similar metadata, even if the file names and dates differ, and alert users. This approach reduces the burden of data management and enhances users' willingness to manage their information effectively.

2) Implementation of Collection Levels and Enhanced Categorizatio. One potential strategy involves tiered management or time-limited settings for the current "one-click collection" feature, such as options for long-term or temporary storage. This encourages users to manage their data promptly. Furthermore, optimizing intelligent storage categorization can assist users in organizing their digital resources, thereby improving resource utilization efficiency.

5.2. Individual Strategies

1) Cultivating Users' Awareness of Digital "Decluttering"

Through platform-based and software-based prompts, users can be educated on the disadvantages of digital hoarding. It is crucial to develop a clear understanding of one's needs and avoid indiscriminate accumulation. For instance, when downloading digital content, users should consider whether it is genuinely necessary and whether it will be utilized in the future. Regular digital file cleanup is also essential, involving the deletion of unnecessary or redundant information. A monthly cleanup schedule can be established to review stored files and promptly remove those no longer required.

2) Enhancing Information Management Capabilities

Acquiring effective information management methodologies to augment information processing efficiency is paramount. Initially, the establishment of a classification system is crucial for categorizing and storing diverse digital files, encompassing documents, images, and videos. Subsequently, the utilization of metadata tags to describe files facilitates efficient retrieval and management. For instance, incorporating keywords and dates into file descriptions is beneficial. Furthermore, employing data management tools, such as database software, enables centralized management of digital resources, thereby streamlining the processes of locating and updating information.

5.3. Organizational Level

Within work and academic contexts, the perception of external pressures significantly influences digital hoarding behaviors. Organizations can endeavor to modify stringent organizational cultural frameworks. Regarding technological pressures, policies can be implemented to regulate the dissemination of information on online devices, thereby standardizing the timing, content, and format of data interactions. Moreover, leveraging digital nudging technologies to develop multimodal information retrieval systems, equipped with functionalities such as information classification, duplicate file identification, and expiration reminders, can reduce information organization costs and alleviate individual hoarding pressures.

6. Conclusions

As a typical social phenomenon of the digital information age, digital hoarding behavior is subtly integrating into users' daily lives, exerting an increasingly profound impact on digital users. Systematic research on digital hoarding behavior holds significant academic value for understanding contemporary social behavioral patterns. This study employs content analysis, a qualitative research method, and constructs a longitudinal process model based on the I-PACE model framework, encompassing individual characteristics, subjective feelings, perceived responses, and behavioral consequences. Additionally, it establishes a horizontal mechanism analysis framework across three dimensions: digital individuals, digital information, and technological context. Through multi-dimensional segmentation and dynamic correlation analysis, this study systematically reveals the internal logic and external manifestations of digital natives' digital hoarding behavior. In terms of practical value, this research focuses on the digital native group, exploring the impact of digital hoarding on individual information behavior by studying a representative group of information behavior users in the digital age. Through three-level coding and theoretical saturation testing, this study validates the Chinese cultural background and technological context manifestations of digital hoarding behavior, finding that factors such as work pressure and data security significantly influence digital natives' hoarding behavior. These findings en-

rich new observational dimensions for cross-cultural comparative research.

This study has some limitations: Firstly, the sample size (24 interviewees) is relatively small, which may not fully capture the complexity of digital natives' digital hoarding behavior. Although the interviewees considered both undergraduate students and employed individuals, there is a lack of research on the differentiated mechanisms of the two groups in digital hoarding behavior, which can be further explored through comparative studies. Secondly, based on the I-PACE process model, this study provides a clear analysis of short-term behavior, but its cross-sectional nature limits the research on the long-term effects of digital hoarding.

Future research can be expanded in two aspects: Firstly, further focus the perspective of digital hoarding on knowledge hoarding to deeply explore the potential psychological mechanisms of users' hoarding behavior. Secondly, expand the research group to other groups, and consider the influencing factors of different regions and dimensions, to conduct in-depth quantitative research on their digital hoarding behavior, so as to provide more specific and effective suggestions.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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