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Adaptability of Inter-Organizational Information Systems Based on Organizational Identity: Some Factors of Partnership for the Goals

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Abstract: Given the current trade friction between the United States of America and the People's Republic of China, the progress of the Sustainable Development Goals (SDG) may slow down in some areas in both countries, and there is a need for organizations to understand more of the factors that affect the adaptability of inter-organization information systems (AIOISs) in order to support the 17th Sustainable Development Goal. This research proposes a new model for the adaptability of IOISs based on organizational identity. The hypotheses for this research were deduced from the literature in order to identify and extract the factors for adaptability and partnership. Subsequently, a conceptual model has been developed and empirically tested using the data from 259 samples. The exploratory and confirmatory analysis showed that organizational learning mechanisms (OLM) and knowledge sharing (KS) have a significant positive effect on the identity of multi-organization alliances (IMOAs), and on the adaptability of IOISs, as well as indirectly affecting the adaptability of IOISs through the mediating role of the identity of the multi-organization alliance. In addition, organizational collaboration (OC), commitment, and trust have a significant positive effect on the identity of a multi-organization alliance, whereas there is no direct relationship between organizational collaboration, commitment, trust, and the adaptability of the IOIS. Lastly, the mediating roles of IMOAs on AIOIS are supported.

Keywords: organizational identity; multi-organization alliance; inter-organizational information system; adaptability; factor analysis

1. Introduction

For more than half a century, the trade balance between the United States of America and other countries has registered persistent deficits. Among several other reasons, this has partly led authorities to argue that trade is unfair, and that most countries take advantage of the “goodness” of the USA [1]. The People's Republic of China is working hard to maintain growth that is inclined towards sustainable development, and all measures are being taken in order to maintain growth, including research papers such as this one [2]. Today, fast-growing organizations continue to create autonomous and decentralized business units to strengthen their competitiveness [3]. In a complex and large organization, it is inevitable that there will be coordination problems among the various departments. We, the authors, have encountered many cases of delayed work processes because of organizational changes or upgrading of the information system (IS). Optimizing business processes is part of the solution to the problems faced by some enterprises, from the perspective of organizational relations. This optimization will reduce the costs of doing business, decrease the research and development (R&D) period, and shorten the production cycle, thereby eventually increasing efficiency and cutting down on waste.

An inter-organization information system (IOIS) is a computer network that supports information exchange across organizational boundaries [4–6]. IOIS supports the integration of information systems for two or more enterprise operations management and business processes [7,8]. As an essential part of operations management, IOIS provides assistance and support for supplier collaboration [4,9]. It has the ability to exchange information at a low cost, which is regarded as the decisive factor for the success of supply chain management [10,11]. Users can exchange rich information through effective IOIS, quickly obtain accurate data, and easily access business partners [12]. From the perspective of transaction costs, their adoption can reduce coordination costs and transaction risks simultaneously [13]. However, in order to exploit the potential of IOIS, information systems need to be integrated into the functions and applications that the organization requires. Choudhury [5] stressed that all IOISs contribute to communication efficiency, but their own integration capabilities and proxy capabilities may vary.

The adaptability of inter-organizational information systems (AIOISs), a comprehensive concept that includes supply chain and dynamic alliance cooperation, is needed now more than ever, in order to further achieve “partnership for the goals” of the Sustainable Development Goals (SDG). While an inter-organizational information system (IOIS) can be described as an integrated data-sharing method based on complex business collaboration between different companies, the development of an IOIS and the role it can play are constrained by the collaborative relationship between the organizations that partake in sustainable development. Fundamentally, an IOIS is an automated information system (IS) shared by two or more organizations to support business process convergence [7,14]. An IOIS spans organizational boundaries through the support of information technology (IT) infrastructures, with the object of sharing and the exchange of information. The technologies utilized are, for example, electronic data interchange (EDI), intranet, extranet, internet, enterprise resource planning (ERP), and electronic transaction standards.

Meanwhile, organizational identity is the degree to which organization members are defined by the attributes of the organization [15]. Although the term organizational identity seems at first glance to be easily understandable, it can be more problematic than it appears. Various definitions of the term “identity” exist and are rooted in different ontological and epistemological assumptions [16]. Organizational identity is best explained by Hatch and Schultz [17], as what individuals consider to be central, sustainable, and distinct within their organization. Other definitions of organizational identity place greater emphasis on the fact that it reflects the distinctive and central attributes of an organization, such as its values, culture, performance modalities, and products; however, this assumes a collective and commonly shared understanding of the values and distinctive features of the organization. Organizational identity is a difficult proposal for decentralized business units or independent profit and non-for-profit centers, because it is, obviously, related to the multi-organizational identity that IS establishes in a multi-organizational context. Addressing the difficulty involved can lead to achieving highly efficient operational results when effectively implemented.

In the literature about organizations, most of the discussions about identity are based on the concept of organizational identity; while in the literature about marketing, it generally focuses on corporate identity. Broadly speaking, organizational identity generally refers to members’ perception, feelings, and thoughts about the organization. It can also be described as a collective, common understanding of the unique values and characteristics of an organization. Albert and Whetten [18,19] proposed an influential definition of organizational identity, namely, the core, persistence, and uniqueness of organizational characteristics.

The difference between corporate image and organizational identity is how much of it can be conceptualized into other concrete management indicators [20]. While both concepts are based on organizational concepts, the close relationship with the company’s vision and strategy underscores the clear role of top management in developing the corporate image [21]. Marketing strategies focus more on the way managers present this key idea to the external personnel (for example, products, communication, behavior, and externalities [22]). Organizational literature, on the other

hand, focuses more on the relationship between the employees and their organizations (for example, studies on organizational commitment and identity [15,23]). Visual identity is a kind of deeper group identification, an explicit sign of internal identity, and a tool to keep being reminded of its role. Olins [22] showed examples of the strategic use of identity symbols by companies such as Shell Oil and Yves Saint Laurent, which strongly and consistently use their company names, logos, and colors to create a single identity for their organizations.

In addition, the adaptability of the IOISs mentioned in this paper refers to the flexibility process of the organization after it adopts the IOIS in its internal daily business processes. The adaptability of the IOISs is closely connected to its business relations [24], and it is difficult to consider the role of the IOIS for companies if they just rely on owning and controlling the technology of the IOIS. In order to gain a competitive advantage from the support of the IOIS, companies must learn to manage the system from the perspective of the organizational relationships that will bring a more impact to the organizational collaboration (OC), business processes, organizational structure, and collaborative relationships [17,25–29]. Thus, studying the relationship between the organizational identity and the adaptability of the IOIS is significant, especially when implementing sustainable development projects.

We regard organizational identity as being embedded in organizational culture, based on its local meaning and organizational symbol. The construction of corporate image is transmitted from senior managers to middle managers, and even to members of organizations, but it is interpreted and formulated by the members of organizations according to their own cultural patterns, work experience, and the social influence of external relations and environment [30]. Thus, organizational identity is a continuous interaction between the influence of the organizational members (including middle managers) and senior management.

There is little research on the sustainability of IOISs, and the study fills this gap in the literature. We analyzed this from a new perspective in order to contribute to the literature in this area. From a practical point of view, the enlightenment drawn from the research conclusions can help enterprise managers to carry out targeted management of the enterprise, and can effectively reduce various costs and improve efficiency without upgrading the hardware technology.

This research aims to solve problems such as discovering the new characteristics of organizational identity in the context of a multi-organizational alliance, compared to a traditional individual–organization; understanding the adaptation process for inter-organizational information systems; describing the adaptation mechanism of inter-organizational information systems based on organizational identity in the context of a multi-organization alliance; enabling IOISs to carry out sustainable R&D; and the upgrading and development of applications in a multi-organizational alliance environment. In addition, we were motivated to undertake this research because, in a complex and large organization, it is inevitable that there will be coordination problems among the various departments. We have encountered many cases of the work process being delayed because of organizational changes or from the upgrading of the information system, and therefore, we have reason to be responsible for analyzing and optimizing the problems faced by some enterprises from the perspective of organizational relations, thereby reducing costs and shortening R&D for enterprises. In doing so, the production cycle and office efficiency can be improved.

2. Theoretical Background

2.1. Inter-Organizational Information System and Partnership

Over the years, the academic community has continued to pay attention to the study of basic issues related to IOISs. One of the earliest research projects is from the 1960s, in which Kaufman [31] believed that the adaptation of the IS across organizational boundaries was the key to an enterprise's ability to develop and maintain competitiveness. Back in the 1980s, Barrett and Konsynsk [32] suggested that an integrated IS across organizational boundaries would have interesting and different characteristics. Now, research on the adaptability of ISs covers the processes and influencing factors of adaptation.

The process of adaptability research considers IS adaptability as a procedure consisting of a series of consecutive stages, while identifying the influencing factors of adaptation research involves identifying the elements affecting adaptation, and analyzing the mechanism of each factor affecting the adaptation of an IS. From the 1980s to the 1990s, many types of research on the implementation of ISs focused on technical factors [33–35]. At that time, research on IOISs was relatively simple, and formed a general understanding that the implementation of an IS was a planned and rational process [36]. Additionally, the study of technological factors was common, which includes the implementation methods and models of ISs [37]. After the 1990s, some researchers focused on the implementation of ISs, with emphasis on “technical–economic” and “social–political” views [38]. This suggested that IT is the result of social actions. The use of ISs is not limited to computer industries; non-IT organizations can also implement IS solutions [34].

Research on the IOIS adaptability problem is often linked with the implementation of the system in the development of the IS. However, Wardhani et al. [39] considered that an OC that emphasizes the standards and values is the key to the successful implementation of a quality management system, whereas Magalhães [40] believed that the system implementation is a process of organizational learning through the use of IS. Both branches have support from numerous research results, and some scholars believe that there is a certain relationship between the two branches. For example, Orlikowski [41] proposed a “technical duality” model that incorporates the two parties’ viewpoints, combining the users’ formation and mastery of shared technical meanings in the design and application processes. Rogers [42] divides the adaptive process into three phases—initiation, acceptance, and fusion. From this, Boland and Hirschheim [43] divided the introduction of IT into six phases—startup, adoption, adaptation, acceptance, use, and integration. Subsequently, Cooper and Zmud [44] extended this model, combining it with the acceptance and integration of IT after adoption by organizations, then a complete six-phase model of IT implementation was proposed.

A partnership based on a management contract can facilitate knowledge sharing that improves the organization’s performance. Lok et al. [45] reviewed the concept of outsourcing in relationships with facility management, which may result in an alliance. This is because joint ventures and franchising alliances may be formed [35]. Yoo and Won [46] proposed the use of a block chain and smart contracts in supply chain management; in the long run, an organization can be run at a reduced cost by sharing information securely through a block chain network. During the sustainable development process, acquiring and applying knowledge is the foundation for innovation and collaboration through the alliances formed [30]. Knowledge sharing can improve production networks, and private organizations may have the knowledge required by the government, and vice versa. This may promote private–public partnerships, and the knowledge shared could boost the economy overall [25]. Jung [47] used organizational learning as a criterion for measuring social sustainability management policy in evaluating third-party logistics providers. There should be a creative atmosphere that promotes new ideas and innovative behavior, while having a dynamic and elastic strategy with tolerance for uncertainty with partners, and flexibility in the organization structure that is open and inventive should be maintained [24]. In addition, the sharing of credit information is part of the criteria for evaluating a business environment [48].

At this juncture, it can be conceptually represented in two dimensions, namely, the time and degree of interaction dimensions. Based on this, the adaptability changes between the organizational relationship before, during, and after implementing IOIS are shown in Figure 1.

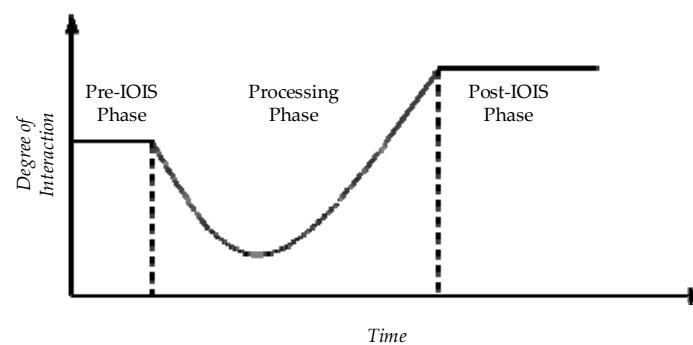


Figure 1. Inter-organizational relationships over time of information system (IS) implementation.

2.2. Research Hypotheses

The research framework, the relevant theory, and the different constructs adopted in the study, alongside the hypothesizing relationships among these variables, are presented.

2.2.1. Relationships among the OC, IMOA, and AIOIS

The natural and business environmental factors of an organization promote knowledge sharing (KS) among organizational members in the R&D process of a multi-organization alliance (MOA), as different R&D teams have different organizational cultures, historical origins, cultural characteristics, and economic development levels. Long [49] believed that the core of effective knowledge management is to form a suitable culture, and organizational collaboration (OC) should support and encourage knowledge-related activities. O'Dell and Grayson [50] pointed out that organizational collaboration should emphasize employee interaction in order to establish relationships and connections between them, so that they can share different perspectives, because the interaction and cooperation of organizational members help to spread knowledge among individuals, thus transforming individual knowledge into organizational knowledge. Yang [51] conducted an empirical study on the Taiwan International Travel Hotel, and found that the collaborative culture of the company had a strong positive correlation with the knowledge sharing effect. Concurrently, the leadership role also has an impact on knowledge sharing. In a multi-organization alliance among R&D teams, the alliance's organizational collaboration can be expressed in the form of the emotional states of the teams, which can have a strong influence on the organization members within the organization's internal environment. The organizational collaboration may strongly infect the members of the organization, and potentially affect the work attitude and efficiency of the organization members, thereby affecting the organization and the individual members of the organization. Consequently, a positive atmosphere may encourage the members of the organization to trust each other and recognize each other, which in turn will promote the sharing of knowledge within the multi-organization alliance. Therefore, this paper proposes Hypothesis 1 (H_1) and Hypothesis 2 (H_2), as follows:

- H_1 : OC has a positive effect on the IMOA.
- H_2 : OC has a positive impact on the AIOIS.

2.2.2. Relationships among the OLM, IMOA, and AIOIS

An organizational learning mechanism (OLM) is considered as the process by which an organization adapts to its political and technological environment [52]. The purpose of organizational learning is to achieve a new understanding of the external environment of the members and organizations through an effective mechanism of formation, dissemination, and sharing. Huber [53] defines organizational learning as the ability or process that an organization uses to maintain and improve its performance. This includes knowledge acquisition, sharing, and utilization. Goh and Richards [54] believe that organizational learning is a concept that promotes continuous adaptation

and improvement. The organizational learning process can be divided into the following four phases: knowledge acquisition, information distribution, information interpretation, and organizational memory. Crossan et al. [55] proposed a framework for analyzing the organizational learning process by combining the individual, group, and organization levels of learning. They showed organization learning as a dynamic process experienced in four stages (intuition, interpretation, integration, and institutionalization) during the learning process. Slater and Narver [56] pointed out that organizational learning is the organization's cultivation and development of knowledge or insights that influence behavior, including the three steps of information—acquisition, transmission, and sharing. Organizational identity and learning mechanisms influence each other. On the one hand, the learning mechanism provides a development platform for organizational identity and partner alliance identity. On the other hand, organizational identity affects the choice of learning mechanisms. Therefore, this paper proposes Hypothesis 3 (H_3) and Hypothesis 4 (H_4), as follows:

- H_3 : OLM has a positive effect on the IMO A.
- H_4 : OLM has a positive impact on the AIOIS.

2.2.3. Relationships among KS, IMO A, and AIOIS

The importance of knowledge sharing has been acknowledged by organizations, and it is an important strategy for developing competitive advantages. However, knowledge sharing behavior in the organization does not necessarily occur because it is human nature to store and protect knowledge. Knowledge sharing is not an easy task, including from a practical point of view, as knowledge sharing behavior cannot be forced, it can only be encouraged and promoted. Hansen and Avital [57] believe that knowledge sharing behavior is the exchange of information with others, and it is voluntary behavior that provides individuals with unique experiences and facts within or outside the organization. Hendriks [58] points out that knowledge sharing is a process of communication, and explained that knowledge is not like commodities that can be freely delivered. When one learns from others to share knowledge, they must also engage in knowledge reconstruction behavior, and must have certain types of knowledge in order to both gain and share knowledge. Therefore, knowledge sharing involves two main bodies—the owner of knowledge and the demand-side for knowledge. Knowledge sharing also includes two processes—the knowledge owners externalize the knowledge, and the knowledge seekers internalize the knowledge. Haas and Hansen [59] suggested that if team members cannot share knowledge, they may worsen the atmosphere of the team. Srivastava et al. [60] studied decentralized leadership, knowledge sharing, and team effectiveness, and showed that members of the team share expertise with each other, which can improve teamwork efficiency. Nahapiet and Ghoshal [61] regarded the recognition of the collective as a source of motivation for the integration and exchange of information. They believe that identity will lead people to be willing to share their knowledge with other members of the organization, so as to enhance their ability to work. Thus, this paper proposes Hypothesis 5 (H_5) and Hypothesis 6 (H_6), as follows:

- H_5 : KS has a positive effect on the IMO A.
- H_6 : KS has a positive impact on the AIOIS.

2.2.4. Relationships among Commitment, IMO A, and AIOIS

Commitment is a key success factor in long-term relationships. Partners are sometimes willing to exchange short-term benefits for the realization of long-term benefits. They are also willing to invest in assets for a specific transaction, in order to prove that they are reliable. Relationship commitment is one of the most important factors in the establishment of a stable and lasting partnership in a multi-organization alliance. Commitment is a tendency to intentionally sacrifice short-term benefits so as to maintain long-term stability [62]. Organizational commitment is a positive psychological feeling [63]. With the increasing research on commitments, some scholars have begun to use relationship commitment specifically to describe the psychological contract of both parties. Moorman et al. [64] believe

that relationship commitment is a valuable relationship that tends to develop into the future. Goodman and Dion [65], and Mentzer and Zacharia [66] also hold similar views and believe that the relationship promises that the partners want to maintain a long-term relationship, and that they are willing to invest resources in order to strengthen the relationship. Thus, this paper proposes Hypothesis 7 (H_7) and Hypothesis 8 (H_8), as follows:

- H_7 : Commitment has a positive effect on the IMOA.
- H_8 : Commitment has a positive impact on the AIOIS.

2.2.5. Relationships among Trust, IMOA, and AIOIS

Trust is a crucial factor in the cooperation between partners [67]. Trust is a party's willingness to accept another party's behavior, based on the expectation that the other party will perform an important action on its own [68]. Trust is defined as the confidence of partners, despite weaknesses and uncertainties; it is a spontaneous reliance on trading partners [64]. It is the expectation that the partner will pursue cooperation, fulfil obligations, and try to maintain the relationship between the other parties [69]. The three factors that influence trust are shared values, communication, and speculation [70]. The IOIS literature has confirmed the importance of trust between trading partners [71]. In general, a trusting relationship is a major influence on success, which emphasizes the importance of having a credible relationship in IOIS implementation. First, trust is considered to be the expectation of the credibility of the partner, which is based on the partner's technology, reliability, or intention. Additionally, trust can be described as the expectation that the partner discloses weaknesses and uncertainties. It is a spontaneous dependence on the confidence of trading partners. The alliance does not rely on a single legal contract as a general business relationship, because even if the two parties cooperate, trust can provide the confidence needed by both parties to promote the effective operation of the alliance. Once there is no trust relationship among companies, it will be difficult for companies to invest in various assets to establish an IOIS and share information, and participate in cooperation activities. Thus, this paper proposes Hypothesis 9 (H_9) and Hypothesis 10 (H_{10}), as follows:

- H_9 : Trust has a positive effect on the IMOA.
- H_{10} : Trust has a positive impact on the AIOIS.

2.2.6. Relationships between IMOA and AIOIS

The purpose of this paper is to study the adaptability factors when implementing IOIS in the organization for a multi-organization alliance, under the background of organizational identity. The variables of OC, OLM, KS, commitment, and trust are based on the concept of organizational identity, and on the identity of the multi-organization alliance. IOIS is an integrated IS based on a complex business collaboration between different organizations. Its development and the role it can play is subject to the collaborative relationship between the organizations [71]. Therefore, this paper proposes Hypothesis 11 (H_{11}), as follows:

- H_{11} : The IMOA has a positive impact on the AIOIS.

2.2.7. Hypotheses of IMOA as a Mediating Variable

Previous literature has shown that the use of IOIS alone will not necessarily achieve the desired results, as many enterprises that have invested heavily in IOIS have not achieved the expected benefits. When cooperative organizations acquire technical, strategic, and cultural compatibility, IOIS adaptability affects alliance capabilities [29]. Li and Williams [72] demonstrated the direct relationship between inter-organizational information system compatibility and organizational alliance activities. However, other researchers found an indirect link between inter-organizational compatibility and multi-organizational communication systems, such as the IOIS [73,74]. The consistency and

compatibility of information systems ensure the smooth flow of information between members of the alliance through information systems, and enhance alliance capabilities [75]. In this study, the identity of multi-organizational alliances is considered as a mediator variable, which links the effects of inter-organizational compatibility (organizational collaboration, organizational learning mechanism, knowledge sharing, commitment, and trust) to the adaptability of IOIS. Therefore, we hypothesize the following:

- H_{12} : IMOA mediates the relationship between OC and AIOIS
- H_{13} : IMOA mediates the relationship between OLM and AIOIS
- H_{14} : IMOA mediates the relationship between KS and AIOIS
- H_{15} : IMOA mediates the relationship between Commitment and AIOIS
- H_{16} : IMOA mediates the relationship between Trust and AIOIS

2.2.8. Company Size as a Control Variable

Company size plays a key role in the adoption, use, and integration of information systems with partners in IOIS and virtual alliance [76,77]. As there may be significant differences between small and large companies in the effectiveness of the implementation as well as in the implementation of alliance activities, the impact of a perceived multi-organizational identity on the IOIS adaptability may vary depending on the size of the company [29]. In the current study, we used the company size as the control variable, using the number of employees and the annual turnover of the organization to measure [78,79]. Combining the above analysis of the various factors affecting the adaptability of IOIS based on organizational identity and the hypotheses (H_1 – H_{11}), a conceptual model is constructed, as shown in Figure 2. Also, Table 1 shows some case studies that conclude some similar variables in this article.

Table 1. Some similar studies. MOA—multi-organization alliance; IOIS—inter-organizational information system.

No.	Variable Names	Variable Types	Case Studies	Variables in This Study
1	Organizational culture [49] organizational collaboration [50]	Independent	Leadership Relationships and connections	Organizational collaboration
2	Organizational learning mechanism [52], organizational learning [53], and organizational learning [54]	Independent	Adaptation and improvement	Organizational learning mechanism
3	Knowledge sharing behavior [57], knowledge sharing [58], share knowledge [59], and knowledge sharing [60]	Independent/Dependent	Relationships and atmosphere Leadership	Knowledge sharing
4	Relationship commitment [64], commitment [62], relationship promises [65,66]	Independent	Long-term partnership	Commitment
5	Trust [67,69] and trust [70,71]	Independent/Dependent	Relationship between partners	Trust
6	Corporate identity [20], organizational identity [21], and identity [22]	Dependent	Exploratory study and Decision-making	Identity of MOA
7	Competitive advantage from the support of the IOIS [29], IS established in the context of multi-organizational alliances [80], and electronic integration [5]	Dependent	Technical optimization and Corporate performance	Adaptability of IOIS

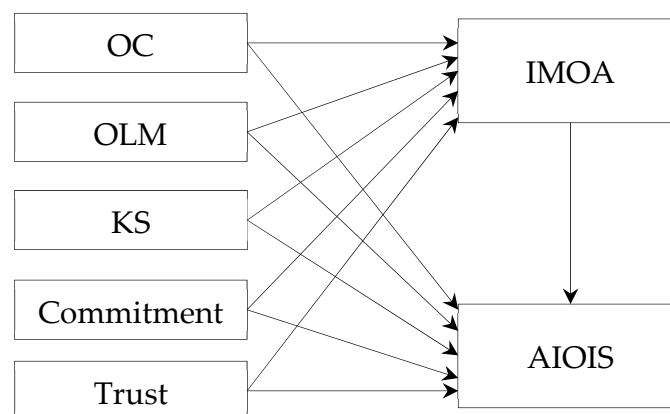


Figure 2. Proposed conceptual model.

In the era of globalization, collaboration across organizational boundaries and even across countries has become the mainstream model of business [80]. Inter-enterprise partnership requires frequent communication, so information systems have become a must-have item. However, in addition to hardware technology, to gain a competitive advantage from IOIS support, companies must learn to manage the IOIS from an organizational relationship perspective. Whether an IS established in the context of multi-organizational alliances can be effectively implemented or not, sustainable R&D upgrades and applications in an inter-organizational environment are closely related to multi-organizational identity [81]. This paper extends what is provided in the literature by presenting a new concept of the identity of a multi-organization alliance and adaptability of the IOIS mechanism that can support the SDG.

3. Methodology

The measurement items for the constructs were adapted from prior literature. The measure items for the organizational learning mechanism were adapted from Popper et al. [82] and Ellis et al. [83], and were modified to suit the study context. The items for knowledge sharing were adapted from Casimir et al. [28] and Ismail et al. [25], and were modified to suit the study context. The items for commitment were adapted from Casimir et al. [28], and were modified to suit the study context. The items for trust were adapted from Casimir et al. [28] and Seppänen et al. [84]. The items for the adaptability of inter-organizational information systems were from Kim et al. [85,86], and those for the identity of the multi-organization alliance were adapted from Ashforth and Corley [26]. The organizational collaboration measures were adapted from Chinese literature and others [25], and were modified to suit the study context.

3.1. Questionnaire Design

This empirical research used a questionnaire survey method. Relevant mature scales were analyzed and compared in-depth, and were screened based on questionnaire designed methods in the literature. After making several draft versions through the consultation of the topic group, the teaching and research department solicited their opinions on the questionnaires, and the questionnaire was pilot tested. A few questionnaires were sent out and were promptly recovered. The SPSS version 17 statistical software was used for this research. The data was analyzed, some measurement items were modified, and poor measurement items were deleted. These steps were carried out in order to check the integrity of the questionnaire structure and the ease of understanding of the designed questions. Finally, a formal questionnaire was created.

The initial questionnaire included two sections—the basic information section consisting of seven questions, and the main body section consisting of 30 questions. The main body section, which focused on research questions, was designed using Likert's five-grade scale method, where 1 = strongly

disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. The questions of the main body section are designed to measure seven variables, namely: organizational collaboration (OC), organizational learning mechanism (OLM), knowledge sharing (KS), commitment, trust, identity of multi-organization alliance (IMOA), and adaptability of inter-organizational information system (AIOIS). There are a total 30 questions as measurement items to measure the seven variables above. The measurement items (Q_1 – Q_{30}) used for the main body section of the questionnaire are shown in Table 2.

Table 2. Questionnaire for related variables. OC—organizational collaboration; OLM—organizational learning mechanism; KS—knowledge sharing; IMOA—identity of multi-organization alliance; AIOIS—adaptability of inter-organizational information system.

Variables	Measurement Items
OC	Q_1 : The alliance has clear and highly systematic procedures
	Q_2 : The alliance emphasizes team awareness
	Q_3 : Member companies of the alliance obey the rules and regulations
	Q_4 : Cooperation opportunities between the member companies do exist
OLM	Q_5 : Employees in the alliance have a wealth of work knowledge and skills
	Q_6 : Member companies can effectively solve conflicts and conflicts
	Q_7 : The organization structure can ensure the alliance's operation effectively
	Q_8 : The organization procedures can ensure the alliance's operation effectively
KS	Q_9 : The alliance attaches importance to the employment of knowledge sharing
	Q_{10} : The alliance information system can help employees sharing information
	Q_{11} : The documents and databases of the alliance can provide employees with the necessary information to complete their work
	Q_{12} : Member companies are able to grasp the workflow of other companies in the alliance
Commitment	Q_{13} : We commit to the fact that the future cooperation will not easily break
	Q_{14} : We hope to continue the cooperation in the alliance
	Q_{15} : We believe the partnership will comply with the commitments
	Q_{16} : As a member of the organization alliance, the company should be loyal to the alliance
Trust	Q_{17} : We have a high degree of trust with our partners
	Q_{18} : We believe the alliance will place the member companies' interests in a vital position
	Q_{19} : Other member companies are willing to make important contributions to the alliance
	Q_{20} : Other member companies can complete the task assigned by the alliance
IMOA	Q_{21} : Our company is indispensable in the alliance
	Q_{22} : Our company is happy to be a member of the alliance
	Q_{23} : Our company is willing to be consistent with the policy of the alliance
	Q_{24} : Our company's performance can be agreed upon and accepted by the alliance
	Q_{25} : At present, our company is suitable to participate in the alliance
AIOIS	Q_{26} : IOIS providers often provide technical upgrades and management training
	Q_{27} : The convergence of business processes among member companies of the alliance has been improved
	Q_{28} : The business cooperation between our company and the partners in the alliance has improved
	Q_{29} : Alliance's workflow is steadily conducted via IOIS connectivity
	Q_{30} : IOIS is routinely used in the alliance

3.2. Data Sampling

The sampling frame was taken from Northwestern Polytechnical University (NWPU). To ensure universality, the study included respondents in the retail, manufacturing, IT, and financial sectors. Senior management, middle management, and R&D personnel were selected as appropriate interviewees, because they are active participants in the inter-organizational decision-making process in the multi-organizational alliance or IOIS management. Key information providers must have worked in these areas for more than a year in order to participate. To identify the most appropriate key information providers, we conducted an exploratory study prior to the survey, which indicated that the appropriate respondents were senior managers with at least one year's experience, who were involved in the adoption of information systems and were involved in decision-making.

To verify the measurement questions, we consulted with three professors who conducted research in the information systems, and five IT managers. Based on the in-depth interview results,

the measurement items were re-edited and modified to meet the requirements of the industry. To begin, the pilot test sample was targeted towards the Master of Business Administration and Executive Master of Business Administration students of our institution (Northwestern Polytechnical University, NWPUP), as a small sampled survey. Fifty printed copies of the questionnaires were issued, and 45 of the copies had responses, for a 90% response rate. Next, the questionnaires that were incompletely answered and those with unattended responses were removed, leaving 41 valid questionnaires, or an effective response rate of 82% for the pilot test analysis. After a small sample of pre-tests, the final valid questionnaire was revised. A total of 350 questionnaires were distributed, including 250 electronic questionnaires and 100 paper questionnaires. Over a period of one and a half months, a total of 301 questionnaires were retrieved. The response rate was 86%. After a review of the questionnaires, the invalid and unqualified questionnaires were removed. Finally, 259 valid questionnaires were retained, including 182 electronic questionnaires and 77 paper questionnaires. The response efficiency was 72.8% and 77%, respectively. The total effective response rate was 74%.

4. Results and Discussion

This research was based on a sample size of 259 respondents. Table 3 provides the profile of the respondents that participated in this study. The respondents were mainly from branches of large companies, and most of the respondents were highly educated and experienced.

Table 3. Sample characteristics. R&D—research and development.

Respondent Profile	Type	Number	Percentage (%)
Gender	Male	137	52.8
	Female	122	47.2
Education level	Undergraduate	101	39.0
	Graduate and above	149	57.5
	Other qualifications	9	3.5
Industry type	Retail	9	3.5
	Manufacturing	37	14.3
	Financial	65	25.1
	IT	73	28.2
	Service	37	14.3
	Others	38	14.6
Position	Senior manager	72	27.8
	Middle management	98	37.8
	R&D personnel	78	30.2
	Ordinary member	11	4.2
Working years	Less than 5	9	3.5
	5–10	45	17.4
	10–15	99	38.2
	Over 15	106	40.9

4.1. Factor Analysis

After the questionnaires were collected, we analyzed and screened them according to the questionnaires filled in. The reliability analysis results showed that the Cronbach's Alpha coefficient of OC was 0.845, OLM was 0.761, KS was 0.748, commitment was 0.847, trust was 0.847, IMO was 0.879, and AIOIS was 0.860; the control variable company size was 0.821; and the overall parameter was 0.960. The Cronbach's Alpha coefficients of all of the variables in this study were greater than the standard threshold of 0.7. Furthermore, four questions (Q_2 , Q_7 , Q_{10} , and Q_{21}) were deleted in the validity analysis in order to improve the factor loadings. Seven components were extracted based on the rotational factor loadings shown in Table 4, using a suppression of 0.5. In other words, the measurement items were grouped into seven factors. Sequentially, from the first component,

the variables were AIOIS, OLM, KS, OC, Trust, Commitment, and IMO. Our official questionnaire only had 26 items (four questions were deleted after the pre-test), so the official serial numbers are from 1 to 26. Then, we deleted three more questions, but kept the original numbering of the questions. Where the initial verification factor analysis of each indicator value was not ideal, we considered deleting the item. According to the observation model adaptability index, the modification indices (MI) value observation was performed again (the corresponding item with an MI value greater than 10 was deleted), and items Q_{12} , Q_{15} , and Q_{23} were deleted in order, until the indicators reached an acceptable level. After deleting items Q_{12} , Q_{15} , and Q_{23} in this study, the value of each factor of the confirmatory factor analysis reached an acceptable level.

Table 4. Rotated factor loading matrix.

Measurement Items	Components						
	1	2	3	4	5	6	7
Q_{27}	0.781						
Q_{28}	0.776						
Q_{29}	0.689						
Q_{26}	0.570						
Q_{30}	0.560						
Q_6		0.876					
Q_5		0.659					
Q_8		0.582					
Q_7		0.533			0.523		
Q_{11}			0.749				
Q_{12}			0.624				
Q_9			0.579				
Q_{10}							
Q_1				0.772			
Q_4				0.670			
Q_3				0.660			
Q_2				0.445			
Q_{18}					0.851		
Q_{17}					0.765		
Q_{20}					0.663		
Q_{19}					0.651		
Q_{13}						0.741	
Q_{16}						0.722	
Q_{14}						0.688	
Q_{15}						0.613	
Q_{21}					0.515	0.567	
Q_{22}							0.761
Q_{23}							0.723
Q_{24}							0.696
Q_{25}							0.660

Note: Q_2 , Q_7 , Q_{10} , Q_{21} are strikethrough questions because of poor loadings.

After the reliability and validity analysis of the empirical data collected by the questionnaire, the conceptual model and hypotheses were tested using AMOS version 17, according to the conceptual model of the influencing factors of the organizational information based on the organizational identity. After the correction of this model, $\chi^2/df = 2.179$, root mean square error of approximation (RMSEA) = 0.077, which is less than 0.08. The goodness of fit index (GFI) value is close to 0.9, meaning that the absolute fitness is good. The normed fit index (NFI) value and relative fit index (RFI) value are close to 0.9, and the incremental fit index (IFI) value, Tucker-Lewis index (TLI) value, and comparative fit index (CFI) values are greater than 0.9. The matching degree is good; the parsimony normed fit index (PNFI) value and the parsimony comparative fit index (PCFI) value of the simple adaptation index are greater than 0.50. The simple fitting degree is good; in the model, the average variance

extracted (AVE) values of the latent variables are 0.651, 0.515, 0.510, 0.561, 0.575, 0.648, and 0.554, respectively, and the AVE value of the control variable company size is 0.707. The values are all greater than 0.5, meeting the requirements, and the composite reliability values are 0.848, 0.758, 0.756, 0.791, 0.802, 0.880, and 0.830, all of which are greater than 0.6, in line with the requirements. Therefore, the model of this study has a good degree of internal structural fit, indicating that the overall fit of the model is good.

We can determine whether each aspect of our study has an acceptable discriminant validity by examining whether the square of the correlation coefficient of a given aspect and other aspects is less than the AVE value of the aspect. As shown in Table 5, the AVE value of each aspect is greater than all of the corresponding squares of the correlation coefficient of the same row of the table, indicating that each aspect has good discriminant validity.

Table 5. Square of correlation among the variables.

Variables	OC	OLM	KS	Commitment	Trust	IMOA	AIOIS
OC	0.651						
OLM	0.167	0.515					
KS	0.176	0.299	0.510				
Commitment	0.079	0.098	0.178	0.561			
Trust	0.081	0.254	0.214	0.189	0.575		
IMOA	0.158	0.240	0.213	0.168	0.167	0.648	
AIOIS	0.130	0.269	0.284	0.105	0.157	0.241	0.554

Note: The numbers on the diagonal (in boldface) are the average variance extracted. The other numbers are the square of correlation.

The empirical results confirmed H_1 , H_3 , H_4 , H_5 , H_6 , H_7 , H_9 , and H_{11} , whereas H_2 , H_8 , and H_{10} were unsupported, based on the path coefficient values given in Table 6. The mediating effect of the identity of a multi-organization alliance on the relationship between the organizational collaboration, organizational learning mechanism, knowledge sharing, commitment, trust, and adaptability of IOIS are shown in Table 7. The mediation effects were tested as suggested by Baron and Kenny [87], Sobel [88], and Hayes [89]. Consequently, an optimal theoretical model that finally met the conclusions was constructed, as shown in Figure 3, which demonstrates that IMOA is a mediating variable.

Table 6. Direct and indirect effect.

Dependent Variable	Independent Variable	Standardized Coefficient			Hypotheses (Direct Effect)
		Direct	Indirect	Total	
IMOA ($R^2 = 0.62$)	OC	0.538 ***	NA	0.538	H_1 : Supported
	OLM	0.154 *	NA	0.154	H_3 : Supported
	KS	0.297 **	NA	0.297	H_5 : Supported
	Commitment	0.474 ***	NA	0.474	H_7 : Supported
	Trust	0.228 *	NA	0.228	H_9 : Supported
	Company size	0.135 **	-	-	-
AIOIS ($R^2 = 0.57$)	IMOA	0.422 ***	NA	0.422	H_{11} : Supported
	OC	0.191	0.407	0.598	H_2 : Not supported
	OLM	0.476 ***	0.245	0.721	H_4 : Supported
	KS	0.327 **	0.201	0.528	H_6 : Supported
	Commitment	0.072	0.196	0.268	H_8 : Not supported
	Trust	0.172	0.214	0.386	H_{10} : Not supported
	Company size	0.097 *	-	-	-

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

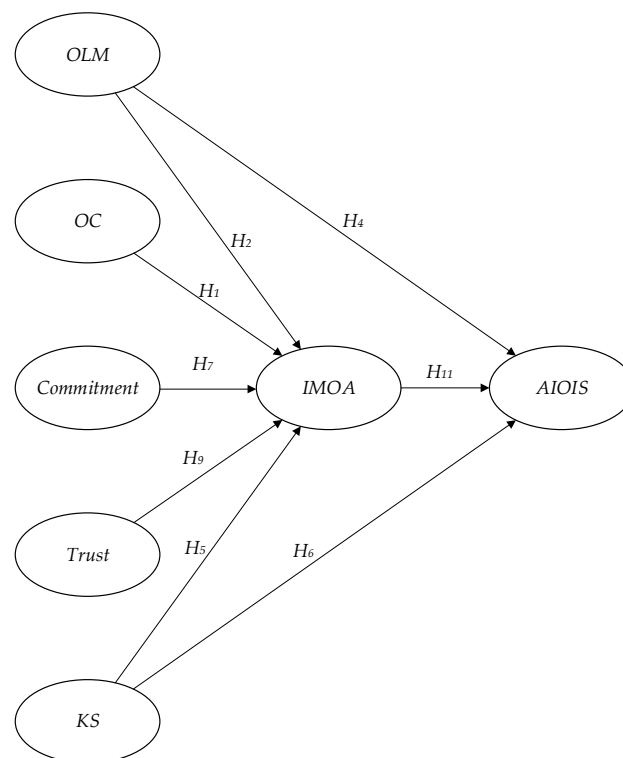


Figure 3. Final theoretical model.

Looking at the results in a multi-organizational context, the following can be inferred:

- (1). The more attention the alliance attaches to the building of OC, the better the ability to obtain the organizational identity of the member of the alliance. The common OC among the member of the organizations in the alliance is important for the IMOA. Whether or not IOIS operates well will not be affected by the OC of the alliance.
- (2). The more compressive the learning mechanism of the alliance is, the better it is to obtain the organizational identity of the alliance members. The more thorough the OLM is, the more IOIS can be applicable and play a better role in its alliance.
- (3). The more important the alliance that attaches to KS, the better the ability to gain an organizational identity from the alliance members. The more important the alliance that attaches to KS, the more IOIS can be relevant and play a better role in its alliance.
- (4). The more alliances are able to make promises and honor them, the better they will be able to gain organizational identity from the alliance members. Regardless of the alliance commitment, it cannot affect the inter-organizational AIOIS.
- (5). The more alliance members trust other members or the alliance, then the more likely it is that the alliance will be able to obtain the organizational identity of the members of the alliance. Whether the member organizations of the alliance trust other member organizations or the alliance itself, it cannot affect the AIOIS among organizations.
- (6). The more organizational identity the alliance can gain, the more IOIS can be more applicable and the better the role it can play in the alliance.

In general, this study enriches the relevant theoretical results of organizational identity and the adaptability of IOISs. In practice, we provide decision-making guidance for existing enterprises that implement an inter-organizational information system. At the same time, it is expected to make up for the deficiencies of the current inter-organizational information systems in dealing with the process of multi-organizational collaboration, and it will help improve the implementation efficiency of inter-organizational information systems.

Table 7. Mediating effect of IMOA.

Hypotheses	Sobel's Statistics	Direct Effect	Remarks
H_{12}	2.973 **	0.191	Supported; full mediation
H_{13}	5.681 *	0.476 ***	Supported; partial mediation
H_{14}	2.831 *	0.327 **	Supported; partial mediation
H_{15}	3.526 ***	0.072	Supported; full mediation
H_{16}	4.418 **	0.172	Supported; full mediation

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

4.2. Recommendations

From the research results, we know that organizational collaboration, commitment, and trust have a significant positive impact on the identity of multi-organization alliances, and the organizational learning mechanism has a direct and significant positive impact on the identity of multi-organization alliances and the adaptability of IOISs. Knowledge sharing also has a direct and significant positive impact on the adaptability of IOISs, and it indirectly affects the adaptability of IOISs through the intermediary role of the identity of multi-organization alliances. From this understanding, we can provide the following management suggestions for SDG partnerships.

4.2.1. Establish an OLM Centered on KS

Enterprises should start from the core of the organizational learning mechanism, and create a good spiritual culture, so that team members can spontaneously contribute their knowledge, without a conflict of interest. For the R&D team, knowledge sharing is only a means, not an end goal, so the pursuit of knowledge sharing should be reflected in the core values of the organization. Building knowledge sharing in an existing value system can enhance the importance of knowledge sharing and make it more natural for team members to engage in. Even team members who still do not trust knowledge sharing can share knowledge, as they accept the value orientation of the organization. Therefore, supporting the construction of knowledge sharing should match the overall style of the development team, and should adapt to the characteristics and style of the team.

The specific measures are as follows: Firstly, to promote knowledge sharing from the top to the bottom. Secondly, the multi-organization alliance needs to establish a specialized organization that is responsible for organizational learning, to assist human resource departments as well as to help employees better achieve goals through learning. Thirdly, to evaluate the organizational learning mechanism to see if it has achieved the expected goals, and if its efficiency has improved, and to then promote positive employee work attitudes, such as those in the organization's R&D department.

4.2.2. Improve KS Channels

We recommend that multi-organization alliance members should establish a set of effective knowledge sharing channels to promote the knowledge sharing behavior of key stakeholders. The sharing channel includes the following:

Firstly, the network sharing channel. Establishing an internal communication platform through the knowledge management system within the organization can eliminate communication barriers between different departments and teams, helping stakeholders to get close to knowledge and direct knowledge, and helping to integrate scattered information and knowledge, and to promote the integration and optimization of the organizational knowledge base, thus expanding the knowledge base of knowledge sharing. In practice, organizations need to use knowledge maps, forums, online videos, and other richer information infrastructures to support knowledge exchange, enabling the key stakeholders to exchange hidden and explicit knowledge, and build mutual trust on the network platform. In this way, the knowledge seekers are connected with the best knowledge source, and the

transfer and sharing of tactical knowledge within the organization can be realized through the interaction among the knowledge demanders and the knowledge owners.

Secondly, the leisure communication channel. The adoption of a leisure communication mechanism can help to establish good interpersonal relationships among stakeholders. Based on this interpersonal relationship, knowledge sharing parties can share knowledge on the principle of non-reciprocity. Specifically, the R&D team can influence people's emotions and behavior according to the human environment improvement of the office environment, such as by using an open office and by setting up a comfortable casual tea room. Therefore, the team should support the establishment of good interpersonal relationships among stakeholders, and increase opportunities for stakeholders to meet and communicate casually.

Thirdly, the sharing communication meeting channel. This channel can have the purpose of solving problems through a certain topic by sharing experiences and opinions. Team stakeholders exchange their skills, methods, experiences, lessons, and so forth, in a sharing communication meeting, and finally come up with a solution to the problem. In the sharing communication meeting, the content expressed by the stakeholders is based on the accumulation of their knowledge, especially the strategic knowledge of the team. Everyone shares their knowledge and learns from others, thereby achieving knowledge sharing.

Lastly, the interest circle channel. A circle of interest is an informal organization that brings together people who are interested in a particular field or aspect. Members of the circle can come from different teams or different departments in the same team. The basis of the circle of interest is the attentiveness of the employee instead of the order of the organization. People are also willing to share knowledge with people who share a common interest, so that knowledge can be shared among different teams and different departments.

5. Conclusions

Companies are strategizing to gain a competitive advantage in order to increase their profit margins, and one approach is to form alliances with other companies that support the exchange of information through ISs, which can improve sustainable development. From a theoretical point of view, the research on the whole process of IS implementation at home and abroad is concentrated on a technical level, and there is room for research on the managerial analysis of ISs, especially the adaptive mechanism of IOISs in enterprise groups, as well as their sustainability. This paper has presented some factors that have been empirically confirmed to affect the "partnership for the goals" of the SDG. From a practical point of view, the enlightenment drawn from the research conclusions can help enterprise managers to carry out a targeted management of the enterprise, and can effectively reduce various costs and improve efficiency, without upgrading the hardware technology.

Although this research has achieved the anticipated goals, one of the limitations of our research is it has not been tested in a multi-national organization. Another is that the research data has been obtained from China, and testing in other countries, such as the USA, is still required before full implementation. The data was only obtained from numerous supply chain enterprises. As there are a range of different industry characteristics, the level of knowledge sharing between different teams may be different, and the mechanism of action of the influencing factors could be different. Therefore, the scope of the research should be broadened, and this particular research is more applicable in the financial, manufacturing, and communications computer industries.

Further research could consider conducting longitudinal studies and comparing different industries in order to verify and improve the research on the internal influence factors of organizational information system adaptability, and promote organizational collaboration, organizational learning mechanism, knowledge sharing, commitment, and trust, as well as their relationships among themselves. The mediating role of IMOA can further be researched, and a hierarchical regression analysis or partial least squares structural equation modelling approaches may be used. Finally, while the external macro-environment factors, such as policies, are not involved in this research,

the background factors of the research objectives, such as the size, geography, and type of company, may not affect the relationship between the main variables, and these aspects need further consideration.

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