Towards Agile Operation for Small Teams in Knowledge Intensive Organizations: A Collaboration Framework

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Abstract. Knowledge Intensive Organizations (KIOs) are of growing importance worldwide. But comparing to other kinds of enterprises, they are challenged by more uncertainty and complex situations. In the context of a KIO, various small teams can be dynamically organized to collaboratively pursue knowledge creation initiatives. As these small teams, which bred from KIOs, often involve activities that cannot be fully predetermined, they need to be supported by related resources and services in a more agile way during their operation and evolution stages. This paper presents a new three-layer collaboration framework for agile operation of small teams on the basis of existing models from the paradigm of Collaborative Networks, with a set of roles and mechanisms proposed in each layer. Considering the framework, related digital platforms and artificial intelligence applications can be developed, giving effective support to small teams' knowledge creation processes. A case study has been developed for a research group to illustrate the proposed framework.

Keywords: Knowledge Intensive Organizations, Agile Operation, Collaborative Networks, Digital Platforms

1 Introduction

As the rise of the knowledge economy is having a profound impact in society, Knowledge Intensive Organizations (KIOs) have drawn much attention worldwide during the past years [1]. KIOs were initially defined as "organizations whose primary value-added activities consist of the accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service" [2]. Although an agreement on their definition and typology is unavailable [3], KIOs have common characteristics and face similar challenges. Activities in KIOs are often interdependent and cannot be fully predetermined, as they often entail innovation on the part of the individual and involve further complex tasks [4]. To deal with

uncertainty and complexity, effective collaboration among individuals inside KIOs are of growing importance.

The paradigm of Collaborative Networks (CNs) has been applied to a great variety of domains, including manufacturing and other industries [5]. As the theoretical models of CNs show good potential to also deal with inner-organization affairs [6], this paper explores their application in KIOs. Collaborative Networks address structuring organizations into two high levels of Collaborative Networked Organizations (CNO) [7], according to which a KIO can be seen as a long-term strategic alliances and small teams inside the KIO as goal-oriented networks [6]. The lifecycle of a CNO consists of the main phases of creation, operation, evolution, metamorphosis and dissolution [8]. While in existing literature long-term strategic alliances are mostly studied in their capacity to enhance dynamic and fluid establishment of goal-oriented networks in their creation phase [9], the operation phase of small teams also needs constant support from their KIO environment. This paper mainly concentrates on the operation stage of the small teams and puts forward the concept of Agile Operation of Small Teams.

If the operation stage of a goal-oriented network can be supported by the long-term strategic alliance in an agile way, we then define this stage as Agile Operation. Considering this context, our work is guided by a main question:

How to effectively support Agile Operation of small teams in Knowledge Intensive Organizations?

The paper is structured as follows: after introducing and contextualizing the research question in Section 1, Section 2 presents an overview of the main foundations used in this work on Agile Operation in KIOs. Section 3 describes a three-layer collaboration framework, the main idea of which is adding a new Operation Layer to improve interaction between small teams and the KIO. Then Section 4 provides a case study to better illustrate the framework. Finally, Section 5 presents the conclusion and opportunities for further work.

2 Related Works

2.1 Knowledge Creation in KIOs

As knowledge is the main production factor and the outcome they offer [10], Knowledge creation is one of the most important task for KIOs. In Nonaka and Takeuchi's theory of Organizational Knowledge Creation, the notion of "knowledge conversion", which focuses on how tacit knowledge is converted to explicit knowledge and vice versa, is the cornerstone [11]. While prior literature provided evidence that processes related to knowledge conversion may foster organizational knowledge creation, most knowledge management projects based on Nonaka's SECI model failed [12]. In [13] there is an argument that tacit and explicit knowledge are not the two ends of a continuum but two sides of the same coin, and it makes no sense to talk about two types of knowledge separately or to believe that one is converted into the other.

Actually, the production of knowledge is increasingly collaborative [14]. From the complex responsive processes perspective, Stacey [15] assumes that knowledge is continuously replicated and potentially transformed in the communicative interaction between people. Starting from this assumption, it is crucial to pay particular attention to two aspects. From one side, internal and external connections of KIOs should be established and maintained (somehow related to the open innovation concept). In knowledge creation networks, the strength of connections between individuals has a positive effect on knowledge creation before a certain threshold [16]. Researchers also stressed the importance of the collaboration with external networks for knowledge creation [17]. From another perspective, KIOs need to help individual professionals to better engage in related knowledge creation activities [15]. Fresh forms of interaction are also need to be established for small teams' knowledge creation performance [13].

2.2 Collaborative Networks and Their Operation

CNs consist of sets of entities that collaborate to better achieve common or compatible goals, thus jointly generating value [18]. From the grasping of a collaboration opportunity to a successful collaboration, normally a CN will go through several stages of its lifecycle, which generally include: creation, operation, evolution, metamorphosis and dissolution [8].

By definition, operation is the phase where the network runs, executing the required business processes towards reaching its goals, that is, developing a solution and further maintaining it [8]. In [19] it is stated that operation is the most important stage not only for its longer activity duration comparing to other stages, but also because operation is the phase when a network really offers services and makes business. During operation, goal-oriented networks need to be managed and supported effectively. For instance, [20] introduces a framework in which promises can be made and monitored to make sure that collaborative behaviors will be done in goal-oriented networks. Other works also focus on further support such as risk control mechanisms [21] and performance indicators [19].

Evolution is a phase that may happen when problems take place during the operation phase [8]. As an illustration, [22] presents a comprehensive list of collaborative business processes and base practices, in which the Operation and Evolution phases are organized into the same subcategory. As mentioned before, small teams in KIOs get involved in a lot of unpredictable and complex tasks, so activities in the evolution stage actually happen at a high frequency for them. This is also one of the main reasons why Agile Operation is crucial for these teams. Thus, in this paper, evolution is considered as a part of the operation stage for small teams in KIOs, and the supporting activities for the evolution phase are also considered as a requirement of Agile Operation.

3 An Agile Operation Framework

In the Information System field, agility can be defined as "the continual readiness to rapidly or inherently create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value, through its collective components and relationships with its environment" [23]. Nevertheless, due to the lack of appropriate principles and methods, supporting goal-oriented networks in an agile way during their operation stage is still challenging.

In a KIO environment, activities in small teams are often interdependent and cannot be fully predetermined. Efficient knowledge creation needs individual professionals to engage in related processes in a more agile way. Thus, small teams need to interact with the KIO environment to quickly fulfill changing demands such as adding a new member, setting a new ICT service, or merely finding an answer for a single question from a professional individual. However, acting as long-term strategic alliances (of people), current KIOs cannot respond quickly enough to those real-time demands in most cases. Although the mission for a long-term strategic alliance is increasing the network's preparedness towards rapid configuration of temporary alliances for potential collaboration [18], managing a large network requires stable and reliable mechanisms and information infrastructures. Once a long-term strategic alliance finishes the creation of a goal-oriented network with configuration of related resources and services, it is hard for such entities to make further changes due to the high time cost and labor cost. The contradiction between fast evolving demands and stable resources is the main challenge for realizing Agile Operation.

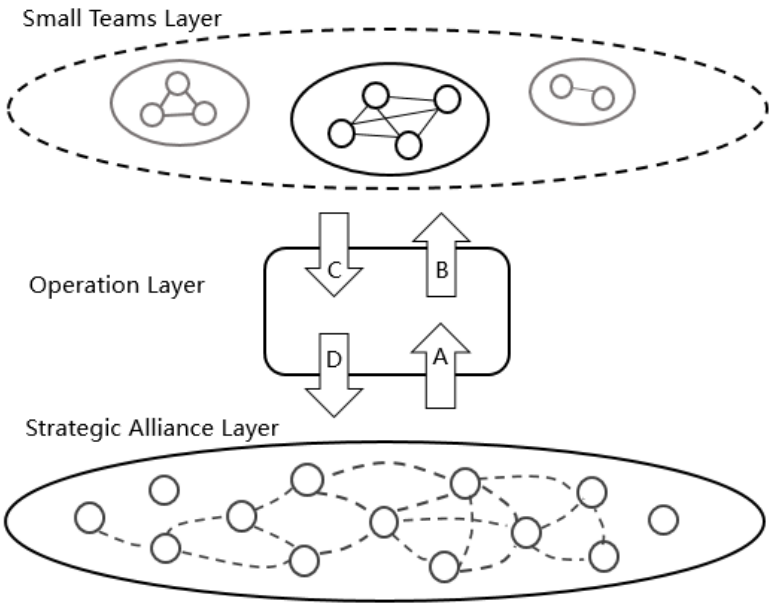


Fig. 1. Agile Operation Framework for Small Teams in KIOs

For the purpose of improving the interaction efficiency between small teams and their KIO environment, thus supporting Agile Operation, this section suggests a three-layer collaboration framework.

As shown in Fig. 1, the proposed Agile Operation Framework comprises three layers: (1) Small Teams Layer, (2) Operation Layer, and (3) Strategic Alliance Layer, which are further explained below.

Small Teams Layer: contains several small teams (goal-oriented networks). Each small team includes a set of participating members as well as related resources and services to support them working on the collaborative goal. In a KIO environment, small teams' knowledge creation activities take place in this layer directly. These activities may involve online and offline communication, training and learning, document writing and processing, etc. [4].

Operation Layer: aims at fulfilling agile demands from the Small Teams Layer and contains a number of support mechanisms and roles. This layer keeps frequent interaction with both the Small Teams Layer and the Strategic Alliance Layer. Roles in this layer act similarly to "Virtual Organization Brokers" in existing literature [24], but the difference is that they keep close contact with goal-oriented networks during their whole lifecycle, especially during the operation stage.

Strategic Alliance Layer: composed of members of the KIO, resources, and "connections" in a long-term strategic alliance. The resources may include facilities, information systems and data, financial resources, external relationships, etc. "Connections" generally include agreements, principles, mechanisms that support on-going and future collaboration, as well as relationships between members, and members' access to the resources. The Strategic Alliance Layer aims at increasing members' preparedness towards rapid configuration of temporary networks for collaboration [18] (the Small Teams in this case), as well as providing support during the operation of those temporary networks.

Regarding the Operation Layer, the interaction with the other two layers can comprise four processes. Process A represents the interaction started by the Strategic Alliance Layer. The main aim for this process is the organization of "abilities". An ability is a collection of resources and methods which can be abstractly packaged and integrated to accomplish a certain task. Process B and C are the interaction between the Operation Layer and the Small Teams Layer. Fully acquainted with the abilities, "brokers" in the Operation Layer can quickly develop customized services for the Small Teams in Process B. Process C represents that the Operation Layer getting feedback from the Small Teams Layer. In this process, members of the Small Teams may directly tell "brokers" their demands, or the Operation Layer keeps collecting and analyzing the data from the Small Teams Layer during their operation phase. In this way, Process B and C make a close loop: customized services, feedback, new customized services, new feedback. Finally, the Operation Layer brings collaborative record and experience back to the Strategic Alliance Layer in Process D, which can improve the connections and help the whole KIO better prepared for future collaboration.

With the Operation Layer and namely through its four processes, the operation of small teams can fulfill the demand of agility: rapidly creating changes, proactively embracing changes, and learning from changes.

4 Case Study

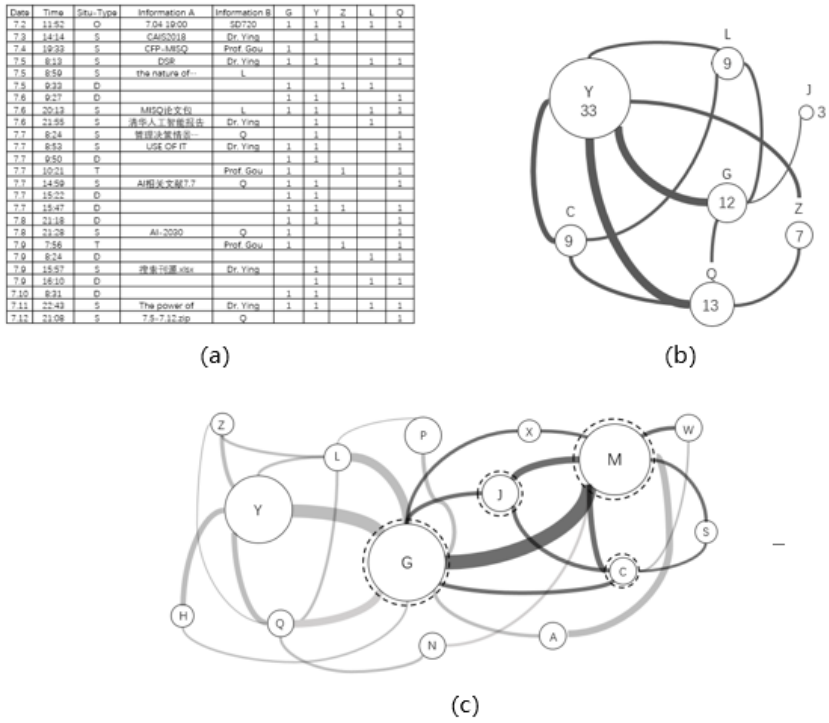
To better illustrate how the framework described in Section 3 should be applied in real situations, a brief case study was conducted in a research group.

The research group (the KIO, in this case) is based on a university, consisting of 3 faculties and more than 20 graduate students. The research group also maintains continued cooperation with a number of external partners.

WeChat, an online instant messaging application, is used by the team to help with communication, file sharing and other joint work, accompanied by occasional offline meetings. There is a WeChat group for all team members, which can be labeled as "the public group". About 20 smaller groups, each comprising 4-10 members ("small teams"), also exist. These groups are created for certain goals, like working on a given project or discussing an academic topic during a period of time.

The usage of WeChat makes the research group similar to a Professional Virtual Community (PVC), which is a typical long-term strategic alliance in CNs [18], and the smaller groups act as Virtual Teams bred from the PVC. But the difference is that professional individuals are independent in typical PVCs, while members in the public group belong to the same KIO, the research group. The research group has left a history of communication records in both public group and smaller groups in WeChat. Based on these records, as a kind of resource in the Strategic Alliance Layer, the case developed one "ability" and provided some simple agile services to the small teams to simulate the processes in an Operation Layer.

First, as shown in Fig. 2(a), the communication record in WeChat groups was collected and reorganized. A complete conversation for a period of time was defined as a "situation" [25]. Situations were divided into four types: communication, sharing, tasks, and offline meeting notice. In addition to recording the date, time and participants, each type of situation records different additional information, such as filename, sharer, place of an offline meeting, etc.



Data	Time	Situ-Type	Information A	Information B	G	Y	Z	L	Q
7.2	11:52	Q	7.04 19:00	SD720	1	1	1	1	1
7.3	14:14	S	CAIS2018	Dr. Ying		1			
7.4	19:33	S	CFP-MISQ	Prof. Gou	1				
7.5	8:13	S	DSR	Dr. Ying	1	1		1	1
7.5	8:59	S	the nature of-	L					
7.5	9:33	D			1		1	1	
7.6	9:27	D			1	1			1
7.6	20:13	S	MISQ论文包	L	1	1		1	1
7.6	21:55	S	清华人工智能报告	Dr. Ying		1		1	
7.7	8:24	S	管理决策情景-	Q		1			1
7.7	8:53	S	USE OF IT	Dr. Ying	1	1			1
7.7	9:50	D			1	1			
7.7	10:21	T		Prof. Gou	1		1		1
7.7	14:59	S	AI相关文献7.7	Q	1	1			1
7.7	15:21	D			1	1			
7.7	15:47	D			1	1	1		1
7.8	21:18	D			1	1			1
7.8	21:28	S	AI-2020	Q	1				1
7.9	7:56	T		Prof. Gou	1		1		1
7.9	8:24	D						1	1
7.9	15:57	S	搜索引擎.xlsx	Dr. Ying		1			
7.9	16:10	D				1		1	1
7.10	8:31	D			1	1			
7.11	22:43	S	The power of	Dr. Ying	1	1		1	1
7.12	21:08	S	7.5-7.12.zip	Q					1

Fig. 2. WeChat Group Communication Record Analysis

The organized records extracted from WeChat groups can help in obtaining some preliminary analysis results. It can be assumed that the more situations did a group member participate in, the more active he or she was in the group. Likewise, if two group members participated in the same situations for many times, they tend to have a close connection. Fig. 2(b) shows the analysis results in a WeChat group which consists of 7 members. Each circle in this figure represents a member in the group and the number in a circle (proportional to its radius) indicates how many situations did the member participate in. The thickness of a connecting line between two circles represents how many situations include both these two members. Obviously, in the example, Y was the most active member in the group, and he has strong connection with G and Q. Using the same method to analyze all smaller WeChat groups which bred from the public group and superposing their figures, a possible result is shown in Fig. 2(c), which indicates members' activities and connections for the whole research group.

Each smaller WeChat group has its goals or academic topics represented by "keywords". For example, the keywords of the group in Fig. 2(b) are "System Analysis" and "Writing an Article". If a member of the research group participates in many situations in this group, he or she is more likely to have experience and knowledge on "System Analysis". In Fig. 2(c), the highlighted circles and the

corresponding connecting line represent members who are active on a certain keyword and the connection between them.

The data analysis above can be considered as a part of Process A in Fig. 1 Confirmed the willingness of all members in the research group to provide their help to projects if their professional skills are needed, an "ability" had been developed based on the analysis result: if the knowledge creation processes in a research project needs certain knowledge or professional skills, the right member in the research group will be quickly found.

Then, the other three processes in the Operation Layer can also be developed. Process B in this case can be the developing of a kind of service or AI assistant, to help a small team find and make a quick agreement with "the right member" and then make him or her engaged in the knowledge creation activities. In Process C, a "broker" in the research group will keep hearing the demands from the small teams: what the "keywords" they are working about and what kind of knowledge or skills they probably need. Another possible scenario is that a "broker" or n artificial intelligence agent may find small teams' demands directly from ongoing WeChat interaction or data from other digital platforms. Finally, in Process D, all new interaction records emerged during the small teams' operation, including their interaction with the Operation Layer, will be collected and stored into the Strategic Alliance Layer.

Some other abilities can also be developed from the WeChat group chat records. For instance, as the four situation types contain different information, data from other sources like document profiles (matched with "sharing" situations) and offline meeting records (matched with "offline meeting notice" situations) can be introduced to enrich the Operation Layer of the research group.

Like many other digital platforms, WeChat provides a sound base for the research group to communicate and share digital resources. Based on a single kind of data resource, the WeChat record, the four processes of an Operation Layer are illustrated to fulfill the real-time demands of small teams. In this way, the small teams in the research group can be operated in a more agile way: On one hand, the research group can keep hearing the demand from the small teams and make further interactions; on the other hand, small teams are provided the continual readiness to rapidly find right partners for the emerging changes.

5 Conclusion

Knowledge Intensive Organizations require new models and mechanisms to face the challenge of uncertainties and complexities. Based on the paradigm of Collaborative Networks, this paper put forward a new concept—Agile Operation of Small Teams, which means small teams in KIOs can be continuously supported by their breeding environment during their operation stage. In practice of CNs, goal-oriented networks' interaction with the long-term strategic alliance are mostly limited to their creation stage, so it is hard to provide small teams with constant agile services to embrace changes. This paper proposes a framework for a possible approach to support this Agile Operation.

In the proposed three-layer framework, the Small Teams Layer and Strategic Alliance Layer focus on small teams' agile services and KIOs' resource management separately. As CNs address structuring organizations into two high levels of CNO, the main innovation of this work is adding an Operation Layer to the framework. Acting as a "transmission gear" between the other two layers, the Operation Layer can keep frequent interaction with both resources in KIO environment and KIOs operation through four key processes. A case study was also presented and discussed in the paper to better illustrate the applicability of the framework.

Future work will focus on development methods for related components in the three-layer collaboration framework and intelligent applications for knowledge creation activities in KIOs.

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