

Research on the Optimization of Management Models for Interdisciplinary Research Organizations in Higher Education Institutions

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Abstract: *The changes in knowledge production modes generate interdisciplinary research organizations in higher education institutions which operate fundamentally inconsistent with the traditional discipline-based management system. We focus on optimizing the management model of interdisciplinary research organizations in higher education institutions. By analyzing the structural features and generative logic of interdisciplinary research organizations, we find not only the organizational tension between disciplinary logic and problem logic, but also various constraining effects generated by the traditional management architecture. Three core problems were found such as ambiguous organizational position; resource dependence structures and imbalanced allocation; knowledge integration mechanisms and organizational learning barriers. Further suggesting that the optimization of management models need a cognitive reconstruction from a discipline-based orientation to a problem-oriented orientation, providing institutional support via the flexible design of organizational structure, multidimensional calibration of academic evaluation, and coordinated adjustment of incentive mechanism. This study provides an analytical framework and path reference for the management improvement of interdisciplinary research organizations.*

Keywords: *interdisciplinary research organizations in higher education institutions; management models; disciplinary logic and problem logic; knowledge integration; academic evaluation*

Introduction

We emphasized the importance of interdisciplinary research in today's academia. Every breakthrough in great scientific questions or exploration of new fields relies upon the cross-fertilization of multidisciplinary knowledge. Higher education institutions (a core field of knowledge production) has invested much resource over recent years to establish interdisciplinary research organizations with aim to provide a stable institution for interdisciplinary collaboration. The majority of interdisciplinary research organizations face dilemmas of low efficiency and lack of sustainability in actual operations. Not due to questioning about the academic value of interdisciplinary research but lying in the structural incompatibility between the operational logic of such organizations and the discipline-based management system of higher education institutions—former demands problem-oriented management support for flexible integration whereas the latter provides a rigidly segmented discipline-based institutional framework. With regard to this issue, there are accumulated valuable results from some studies regarding its classification of organizational models; however, systematic analysis based on the deep structure of management logic needs to be deepened. Based on the organizational theory perspective, we analyze the structural features, operational dilemmas and optimization directions of interdisciplinary research organizations so that it can provide theoretical references for improvement of their management effectiveness.

1. Structural Characteristics and Management Dilemmas of Interdisciplinary Research Organizations

1.1 Generative Logic and Morphological Evolution of Interdisciplinary Research Organizations

Generation of interdisciplinary research organizations emerges from the deep context of transformation of contemporary knowledge production modes. Traditional disciplinary system

demonstrates its duality of limitation regarding explanatory power and problem solving capability towards complex scientific questions or social issues. Knowledge reserves, methodology of one discipline cannot cover the whole scope of a problem domain. Cognitive gap gives birth to the need for interdisciplinary collaboration in practice. Change in the orientation of the research funding system provides institutional support for the emergence of interdisciplinary organizations. Increasing number of funding programs require applicants' team to have multidisciplinary background which gradually transform interdisciplinary collaboration as a spontaneous academic activity into an institution on the organizational level. Generation of interdisciplinary research organizations is not just an extension of academic logic it results from the interaction between cognitive needs and the institutional environment^[1].

In terms of structure, interdisciplinary research organizations range between loose collaboration networks to very operationalized ones: some interdisciplinary organizations functioned as virtual research centers with its members scattered in different departments and schools creating phased collaborations via project ties; while others had been given independent staffing quotas and spatial resources and integrated within the regular management system of higher education institutions by taking the form of university-level platforms or interdisciplinary research institutes. One structural feature that underlies all these forms – the permeable organizational boundaries. Personnel composition in interdisciplinary organizations is dynamically adapted depending upon changing research questions, and the channels of resource acquisition depends not only on a single administrative channel. Permeability offers flexibility to interdisciplinary organizations which at the same time is a structural condition for the emergence of their management dilemmas.

1.2 The Organizational Tension Between Disciplinary Logic and Problem Logic

There is an inherent conflict between the logic of disciplines and the logic of problems in interdisciplinary research organizations: the former depends on the integrity of knowledge systems, the stability of methodological norms, as well as the consensus of peer evaluation; its organization carrier manifests itself through departmental structure and discipline-based resource allocation approach. Pursuing the systematic nature of knowledge accumulation and the operability of evaluation criteria, the logic of disciplines has become a relatively mature management habitus after a long period of time. In contrast, the logic of problems focuses on solving some scientific problems or social needs, emphasizing fast mobilizing resources, immediately integrating multidisciplinary perspectives and flexibly adjusting the research process. The time scale and output form are different from the traditional disciplinary knowledge production model.

Two logics constitute an irreconcilable conflict within interdisciplinary organizations: On one hand (personnel management): most members of interdisciplinary teams still belong to their original discipline, professional title promotions/workload recognitions dominate by disciplinary units – the management power of interdisciplinary organizations is nominal; on the other hand (resource) the current funding allocation system and space allocation systems for higher education institutions take disciplinary evaluation results as its basic basis, making it hard for interdisciplinary organizations to get stable resource support due to lacking corresponding evaluation channels; on the other hand (operational rhythm); disciplinary logic has a time sequence of long-term accumulation and periodic evaluation while problem logic needs fast response with visible phased output. Misaligned between these two temporal sequences will affect the operational efficiency of interdisciplinary organizations under project cycles.

1.3 The Constraining Effects of Traditional Management Architecture on Interdisciplinary Collaboration

Management architecture of higher education institutions is based upon disciplinary differentiation – every facet of its architectural structure revolves around disciplinary units. Such an architecture has certain limitations towards interdisciplinary collaboration: administratively, there exist barriers between different departments or schools which makes it hard for interdisciplinary organizations to achieve substantial integration of personnel; team members have a dilemma about dual affiliation—the separation of project affiliation with administrative affiliation blurs the transmission path of management directives leaving uncertainty over who will be assessed and evaluated. Processes-wise, management links like funding approval, equipment procurement, output registration etc., all depend on disciplinary units as their basic accounting nodes. Approval chains for interdisciplinary activities

need to shuttle back and forth across multiple disciplinary units causing significant increase in transaction costs and greatly lower the response speed of management^[2].

Deep constraints arise at the cognitive and cultural levels: Epistemology traditions, methodology preferences and discourse systems created within different disciplinary communities create implicit knowledge barriers which reduce the efficiency of communication and foundation of mutual trust for members in interdisciplinary collaboration; when members belong to disciplines having radical difference in their methodological assumptions, they might have differences about fundamental things like "what constitutes valid evidence" or "what constitutes a reasonable argumentation path", which can't be managed via management directives. There is no institutional tool available in traditional management architecture to manage conflicts at this cognitive level. It focuses on visible administrative coordination and resource allocation, ignoring systematically the erosion of organizational performance due to deep cognitive friction in interdisciplinary collaboration. We conclude that the root of the management dilemma of interdisciplinary organizations lies not only in lack of institutional design but also in the structural incompatibility between the cognitive framework of the existing management model itself and the intrinsic attributes of interdisciplinary activities.

2. Internal Tensions and Core Issues in the Management Optimization of Interdisciplinary Research Organizations

2.1 Ambiguous Organizational Positioning and the Allocation Dilemma of Governance Authority and Responsibilities

The ambivalence of inter-disciplinary research organizations' management system of higher education institutions is always there: neither exactly matching traditional second-level schools or colleges nor different from project-based temporary team; between entity and virtual entity, permanent and temporary. The ambiguity of its administrative affiliation – some interdisciplinary organizations are a part of one specific school or college without qualification as an independent governance subject while others have title of university level platform but lack definite institution definition for authority and responsibility boundary with their host schools or colleges. Suspended status of organization's identity makes hard for defining their own governance authority according to existing institutional framework. Autonomy over important links (personnel deployment, fund use), needs negotiations case by case that lacks institutional basis for normalization and standardization of management.

This ambiguity aggravates the dilemma on allocating governance authority and responsibilities. It is unclear who attributes decision-making power in interdisciplinary organizations. How to split authority and responsibility between collective deliberation by academic committees vs directive from the administrative hierarchy has not been solved for a long time: every proposition comes along with its cost and limitation in practice. A head of an organization gets two sets of assessment from the host school/college as well as the university's competent administrative department, it is hard to keep consistent internally with multiple accounting priorities. When some issues arise (e.g., recognition of cross-departmental personnel workload, attribution of interdisciplinary outputs), the ambiguity of authority and responsibility often turn into a gray zone in management. Costs of coordination among various subjects are increased significantly, which greatly limit the overall operational efficiency of the organization^[3].

2.2 Resource Dependence Structure and Imbalanced Allocation Mechanism

The resource acquisition channel of interdisciplinary research organizations is very dependent: during the start-up stage, most interdisciplinary organizations depend on the university's special construction fund or talent recruitment fund at first with a clear phased cycle. Their sustainability after the end of this cycle mainly depends on their ability to acquire external projects and the extent of their external cooperation network. This resource structure makes it very hard for interdisciplinary organizations to establish a stable funding expectation, planning research plans will spend much energy chasing resources instead of focusing on promoting interdisciplinary problems itself. They don't have an independent authority to allocate resources, using funds often need to go through the approval process of the host school or college; which weakens the flexibility and response speed of resource allocation.

The imbalance in resource allocation is exacerbated on the base of the above-mentioned dependence structure. Internal resource competition in higher education institutions include that there

exists an unequal competitive position between interdisciplinary organizations and traditional disciplinary units—the performance references are provided by disciplinary evaluation systems, however, the output of interdisciplinary organizations can't be incorporated into this measurement framework. There is no convincing evaluation basis for the interdisciplinary organizations to compete for university-level resources. A differentiated accumulation pattern appears: the interdisciplinary organizations with strong social network and project acquisition capacities will eventually enter a positive cycle of resources while those located at the frontiers of intersection or relatively marginalized problem fields suffer from the dilemma of diminishing resources. This doesn't come from the different efforts made by interdisciplinary organizations themselves, instead, it comes from the structural mismatch between the resource allocation mechanism and the intrinsic attributes of interdisciplinary activities.

2.3 Knowledge Integration Mechanisms and Barriers to Organizational Learning

The main mission of interdisciplinary research organizations is a significant integration of knowledge elements from different disciplines. The essence of knowledge integration includes the combination and restructure of heterogeneous cognitive resources within some problem domain. Knowledge integration includes an exchange and fusion of explicit knowledge and also a transmission and transformation of tacit knowledge through collaboration. It is hard to set up effective knowledge integration mechanisms in interdisciplinary organizations. A root cause of these difficulties lies in absence of institutionalized carrier or procedure for the integration process – there is no regular, structured in-depth communication mechanism for interdisciplinary teams; communication between team members is restricted with information reporting which it is difficult to enter into substantive interaction on the cognitive level. Integration turns out as just formality without reconstruction at the knowledge level.^[4]

This dilemma is exacerbated by the obstruction of organizational learning: The composition of interdisciplinary teams has high mobility; researchers collaborate with one another on projects on a cycle-by-cycle basis before returning to their original disciplinary unit when each cycle ends. Such mobility makes it impossible for interdisciplinary organizations to build up stable organizational memory—experience and methodological adjustments made during the last round of collaboration are interrupted/lost because of member turnover. Worst yet, there is no channel for interdisciplinary organizations to convert cognitive gain at an individual level into knowledge stock at an organizational level. Integrative insights resulting from academic discussions stay inside the individual cognitive scope of participants and it is hard to record, abstract, and integrate these insights into the organization's knowledge base. Cumulative effects of organizational learning therefore get stuck in a low-level repetitive cycle.

3. Logical Turn and Path Selection in the Optimization of Management Models for Interdisciplinary Research Organizations

3.1 Cognitive Reconstruction of the Management Paradigm: From Discipline-Based Orientation to Problem-Oriented Orientation

Optimizing managing model of interdisciplinary research organizations need a cognitive change in management paradigm. Traditional management model has clear disciplinary differentiation and clear knowledge boundary; design and selection of management tools takes disciplinary units as basic reference. Management philosophy must be adjusted from multiple perspectives: From the perspective of organizing goals, management should use the internal structure of the interdisciplinary problem and its progress of solving it as the basis for setting up management cycle and assessment node instead of using mechanical linear timetable applied in disciplinary construction. From the perspective of defining organizational boundaries, management should realize the openness of interdisciplinary organization is moderate so that the composition of participants and mode of collaboration can adapt dynamically with evolving problems instead of solidifying organizational boundaries like disciplinary unit.

Criteria for assessing management performance must change accordingly. Output form of interdisciplinary organization is not same as traditional disciplines' knowledge increment, so we can establish connection among different knowledge domain and open up a new cognitive space. Observational aspect of management performance has to shift from one measurement of outputs to assess the degree of knowledge integration: whether interdisciplinary collaboration really facilitate

intersection and reconstruction at the cognitive level or just contented with the spatial aggregation of multidisciplinary personnel. Cognitive reconstruction doesn't mean totally replace the current management system but revise and expand its implicit premises. Its essence lies in changing the focus of management from keeping disciplines and guarding boundaries to analyze problems and advance solutions.

3.2 Flexible Design of Organizational Architecture and Institutional Adaptation

We argue for flexibility and modularization on the architecture of interdisciplinary research organizations according to the problem oriented management paradigm: Flexibility implies flattening of organizational levels and streamlining of decision-making process such that interdisciplinary teams can flexibly adjust their direction of resource allocation and rhythm of collaboration based upon research progresses without any fixed cycles or rigid procedures; For personnel management, flexibility implies recognition of multiple identity attributes of interdisciplinary members and allow researchers' moderate mobility between disciplinary units and interdisciplinary organizations rather than forcing them to have only one fixed affiliation; Modularization is about the composability of internal units inside an interdisciplinary organization—the breaking down of large interdisciplinary problems into several relative independent sub-problems (modules) which are dealt with by a team having the corresponding disciplinary background while knowledge transfer and output integration across different modules could be realized via clear interface mechanisms.

A flexible architecture also requires developing its supporting institutions: setting up a flexible staffing system offers an appropriate way through which we carry the identity of interdisciplinary personnel in order to record and recognize the work engagement of interdisciplinary organizations; building a differentiated assessment system stipulates different evaluation cycles and output form requirements for different types of interdisciplinary activities without employing uniform academic output standards to evaluate all kinds of interdisciplinary research; improving a project-based financial management system gives autonomy of interdisciplinary organizations about fund usage by enabling them to flexibly adjust their expenditure structure based on the real need of research progress. Institutional adaptation refers to putting management rules at the service of actual processes of interdisciplinary knowledge production rather than forcing disciplinary activities conforming to the established framework of the existing management system.

3.3 Multidimensional Calibration of Academic Evaluation and Reconstruction of Incentive Mechanisms

To ensure the continuous operations of interdisciplinary research organizations, there must be fundamental change in evaluations and incentives. Current academic evaluation system relies upon peer review in disciplines which mismatch the interdisciplinary nature of its output. Value of interdisciplinary research outputs is usually reflected by an integrated response to problem domains instead of incrementally contributing to a single discipline; thus traditional evaluation frameworks cannot reflect such integrative value dimensions. Directions of improvement of multidimensional calibration suggests that we need a three-fold adjustment for evaluation subjects, evaluation dimensions, and evaluation cycles. In terms of evaluation subjects, we should involve review experts from multiple relevant disciplines with preset structured communication procedure to help each other understanding and moderating integration of their evaluation criteria so as not to make one-sided judgment about interdisciplinary outputs only from a single disciplinary perspective.

Closing the loop on adjusting the evaluation system is needed for reconstructing incentive mechanism: Establish a clear recognition path via the channel of professional title promotion so that interdisciplinary outputs are given equal institutional recognition as disciplinary outputs; establish equivalent exchange benchmarks between interdisciplinary output and disciplinary output in important fields like allocation of academic honors or acquiring project resources (decreasing the opportunity cost for researchers who participate in interdisciplinary collaboration); the core is transforming "extra contribution" of interdisciplinary participation within the existing institutional framework into an attractive path equally appealing in academic career development. Adjusted coordination of evaluation and incentives makes interdisciplinary organization more institutionally attractive, alleviates the dilemma of overly high talent mobility which has long plagued interdisciplinary organizations, provides institutional condition for the cumulative effect of organizational learning.

Conclusion

Analyzing "generative logic—operational dilemmas—optimization paths" we discuss key issues and improvement direction for management models of interdisciplinary research organizations in higher education institutions. Permeability of organizational boundaries, multiple affiliations of personnel composition and integrative nature of knowledge activities are characteristics that differentiate interdisciplinary research organizations from traditional disciplinary units – it represents multifaceted structural incompatibility with the existing management system. Ambiguity of organizational positioning and dilemma in allocation of governance authority and responsibilities, resource dependence structures and imbalanced allocation mechanisms and knowledge integration mechanisms and barriers to organizational learning three intertwined core issues, nesting each other reinforcing each other form the deep-seated difficulties in optimization of management models. Optimization paths propose a cognitive shift of management paradigm from discipline-based to problem-oriented and advocate flexible design of organizational architecture and coordinated adjustment of incentive mechanisms. The analytical framework is yet to be tested in more specific research context where further research could address the typological classification of interdisciplinary organizations and differentiated governance mechanisms.

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