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Institutional Bricolage in Irrigation Governance in Rural Northwest China: Diversity, Legitimacy, and Persistence

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ABSTRACT: The emergence and development of diverse institutions is an important yet understudied subject in community-based irrigation governance. Drawing on empirical evidence gathered from 30 administrative villages located in the upstream Yellow River, northwest China, this paper builds on the theoretical perspective of institutional bricolage and adopts an interpretative approach to examining diversity, legitimacy and the persistence of different institutional modalities in the case-study area. It is shown that monocentric, polycentric, bureaucratic and individualised institutions emerge and co-exist in a relatively small area and have been sustained by various sources of legitimacy. Moreover, the process of legitimisation is heterogeneous, as the various institutional modalities have drawn their legitimacy from different sources. These may be both internal and external, synthesise and contradict simultaneously, and change as the irrigation institutions initiate, operate and evolve. The findings connect irrigation institutions with everyday practices, which are non-linear and uncertain, thus bringing about a more nuanced understanding of institutional bricolage and offering more in-depth explanations for the puzzles of why institutions demonstrate different characteristics in similar contexts and why some institutions persist when faced with challenges and tension.

KEYWORDS: Irrigation governance, institutions, bricolage, legitimacy, China

INTRODUCTION

Community-based irrigation systems have been framed as common-pool resources (CPRs) that typically encounter collective-action problems, such as water distribution, water payments and operation and maintenance (O&M) of irrigation infrastructure (Ostrom and Gardner, 1993; Dayton-Johnson, 2000; Meinzen-Dick et al., 2004). These problems are present in many forms in different geographical localities and arise frequently as the pursuit of short-term individual benefits contradicts the group's long-term interests. The problems are also nested in particular socioeconomic, political and ecological settings that have been undergoing rapid transformation in many developing countries (Araral, 2009; Meinzen-Dick et al., 2002; Lam, 2001). These contextual changes not only complicate the dynamics of community-based irrigation governance but also threaten the sustainability and prosperity of rural communities.

Irrigation institutions, both formal and informal, are considered an important approach through which the collective-action problems can be addressed (Cleaver, 2012; Lam, 2001). They include social arrangements that shape and regulate individual behaviours in water distribution, water fees payment and the O&M of irrigation systems, and also organisational structures and groups in irrigation governance (Meinzen-Dick, 2007; Tang, 1993; Wang et al., 2007). Studies of institutions in community-based irrigation governance constitute a significant portion of the CPR literature and mainstream institutional analysis. Building on the seminal work of Ostrom and her colleagues (e.g. Ostrom, 1990, 2005), scholars of mainstream institutionalism examine the fundamental questions of which institutional features or which type of irrigation institution may lead to successful irrigation governance (Tang, 1991; Lam, 2001; Cox et al., 2010; Cox and Ross, 2011; Baggio et al., 2016; Lam and Chiu, 2016). For this line of inquiry, Ostrom's 'designed principles' have become guidelines for diagnosing institutional problems and a benchmark for robust institutions in successful, community-based irrigation governance (Ostrom, 1990; Cox et al., 2010; Wang et al., 2010).

Although mainstream institutionalism has achieved prominent influence in academia and policy-making, scholars also agree that there is no panacea for irrigation governance in reality (Ostrom et al., 2007; Meinzen-Dick, 2007; Araral, 2014). In fact, the diagnostic institutional approach has encountered several theoretical and empirical challenges. Theoretically, mainstream institutional thinking is based on several questionable premises. First, it is assumed that institutions are fully amenable to artificial design and thus can be crafted, shaped and replicated purposely (Cleaver, 2012; De Koning and Cleaver, 2012; Ostrom, 1992; Hall et al., 2014). Second, an implicit assumption is that the designed institutions can be translated into manageable and operational arrangements that are practical and effective in complex real-life situations. Third, individuals are assumed to be self-interested actors who calculate costs and benefits before making decisions about water appropriation, cooperation and coordination within a relatively closed social-ecological system (Ostrom et al., 1994; Ostrom, 1990). Finally, mainstream institutionalism adopts an instrumentalist and functionalist perspective and presumes that most variables can be evaluated by actors, including cultural, social, historical and political factors that usually influence human behaviour in a subtle way (Cleaver, 2001, 2002).

Empirically, the evidence for relationships between irrigation institutions and their governance performance is diverse and not always consistent. Similar irrigation institutions may lead to differing governance performance depending on the local context (Wang et al., 2019b), while different institutional arrangements may all result in favourable outcomes (e.g. effective canal maintenance; Huang, 2014). More importantly, empirical evidence has suggested that designed institutional arrangements may not function as expected in practice, thus raising questions about efficient and sustainable implementation in local communities (Wang et al., 2019a). These empirical findings point to a potential overestimation of the effects of crafted irrigation institutions on governance outcomes and a potential oversimplification of the effects of the local context and human actions on institutions (Wang et al., 2018).

The high degree of diversity in irrigation institutions and their performance in empirical settings points to a need for further investigation into the complexity and dynamics of institutional function, formation, persistence, change and alienation (Cleaver and De Koning, 2015). Moving beyond the assumptions of mainstream institutionalism, we adopt a critical perspective to re-examine community-based irrigation institutions.

Critical institutional thinking assumes that individuals are conscious and unconscious social agents, embedded in social structures and cultural milieux, who are able to act in line with the limitations of their circumstances (Cleaver, 2001). Irrigation institutions are thus entwined with everyday practices of water governance, such as water distribution, conflict resolution and agricultural practices. Moreover, irrigation institutions are subject to contextual changes, ranging from broader frames of political economy and political ecology to community-based social relations, micro politics, culture and history. Cleaver (2002, 2012) and De Koning (2014) have taken a relational approach and attributed the result of institutional

diversity to an ad hoc process of bricolage – different bricoleurs gather and apply whatever resources are available (e.g. knowledge, existing institutions, styles of thinking, power, etc) concerning collective action and CPR governance, thus rendering institutions constantly invented, modified and restructured in different ways.

The framework of institutional bricolage emphasises two questions that the mainstream institutionalists have rarely answered, namely, how do institutions evolve and why are some institutions robust while others fail in a particular political and socioeconomic context (Verziji and Dominguez, 2015; Karambiri et al., 2020; Sakketa, 2018)? They are important because, from a critical perspective, institutions are not constrained by their design or isolated from the context in which they operate but often adapt, reshape and evolve as that context changes.

While mainstream institutionalism focuses on institutional conditions for 'better performance', this paper was inspired by the social phenomenon of 'underperforming' irrigation institutions enduring while those presumed to lead to 'good governance' fail and are replaced. This phenomenon indicates a previously understudied institutional process in which diverse irrigation institutions draw legitimacy from various sources as they evolve, adapt and reshape in community-based irrigation governance. As Beetham (1991) put it, rules "cannot justify themselves simply by being rules"; they require justification "by reference to considerations which lie beyond them". Unpacking the relationships between institutions and their sources of legitimacy can go further than illustrating institutional changes. It helps to understand institutional diversity and persistence under specific political structures and social contexts, where institutions are interpreted and defined by local communities. The issue of institutional legitimisation thus offers an opportunity for new insight into a more nuanced understanding of the dynamics of institutional evolution in complex empirical settings.

Based on empirical evidence gathered in 30 administrative villages of Qingtongxia (QTX) Irrigation District in the upstream Yellow River, northwest China, this paper adopts a panoramically and scenically interpretative approach to illustrating varied institutional modalities of irrigation in local communities and interpreting why and how they have been legitimised and sustained under existing social tensions and the broader socioeconomic context. We associate the endurance of diverse institutional modalities with the social-ecological and political-economic structures in the rural community, and we unpack the sources of institutional legitimacy from the established mechanisms of authority, socioeconomic discourse, institutional performance and customary governance structures. This paper addresses some challenges faced by mainstream institutionalism and furthers critical institutional thinking by delving into the sources of institutional legitimacy and the dynamics of institutional legitimisation.

In the following section, we first review the theoretical insights of institutional legitimacy, combining this with the perspective of institutional bricolage. Next, we introduce the background to, and justifications for, our selected case and the process of data collection and analysis. We then illustrate four institutional modalities of irrigation governance and examine the diverse sources of legitimacy that have sustained them. Finally, we discuss the complex dynamics of heterogeneous institutional legitimisation and how our findings may contribute to the literature on institutional analysis and institutional bricolage before concluding.

FURTHERING INSTITUTIONAL BRICOLAGE BY UNPACKING INSTITUTIONAL LEGITIMACY

The notion of institutional bricolage provides an alternative perspective from which to understand how institutions reshape, adapt and evolve in practice. From this perspective, critical institutionalists often adopt a legitimacy approach in their analysis. Institutional legitimacy is a shared cognition of a community that the institution is acceptable within the broader social environment and principles (Douglas, 1986). The legitimacy approach does not only unpack the 'messiness', interconnectedness and sociocultural relations in institutional change, but also gauges institutions' social fitness with local communities and underpins their emergence and persistence (De Koning and Cleaver, 2012). For example, irrigation

institutions must 'dress themselves' as legitimate configurations and be socially meaningful in managing the hydro-social relationship when translated into workable and practical arrangements (Cleaver and Whaley, 2018). Thus, institutional bricolage is a process that weaves together the available resources to address challenges, while recombining symbolic principles to justify the logic of the appropriateness of institutions (Campbell, 1997).

Institutional legitimacy functions in a variety of ways, as the available sources of that legitimacy are multifarious for bricoleurs within the extant structure. In the critical institutionalism literature, the most commonly identified sources of legitimacy have been classified into three categories – tradition, leakage of meaning, and naturalisation. These serve to justify the validity and value of changing institutions by local bricoleurs (Cleaver, 2012). First, traditional practices and customs perceived as legitimate could provide bricoleurs with rationales for the reproduction, existence and enforcement of adapted institutional arrangements (Cleaver and De Koning, 2015). Pre-existing arrangements also create effects of path dependence on the development of institutions because traditional arrangements already laid a foundation for how things may evolve in the future (Hall and Taylor, 1996; Thelen, 1999; Pierson, 2000). Second, extant cultural symbols and power relations represent meanings that could leak from one institutional setting to another, such as legitimised discourses, symbolic language, rhetorical devices and lofty and culturally accepted principles (Campbell, 1997). For example, in a village in Zimbabwe, a waterpoint committee draws on state-like authority to justify its legitimacy through titling – a bureaucratic practice – and using formal stamps even though the state does not interact with members of the local society (Cleaver, 2012). Third, adapted institutional arrangements constructed through bricolage are often naturalised by analogy with unassailable laws in the physical world and eternal rules in the supernatural world; for instance, the shared analogy of left and right is a device for legitimising the division of labour between males and females used in the past (Douglas, 1986; Needham 1973), and with the 'right way of doing things', which usually includes categorisations, hierarchies and notions of proper order (De Koning and Cleaver, 2012; Cleaver, 2012; Boelens, 2015). Generally speaking, these three types of source could be conceptualised as stable principles that are commonly recognised and accepted by all members of the community who share the same structural restrictions of social relations.

The multifarious definitions of legitimacy documented in the literature are conducive to understanding institutional bricolage through connecting and scrutinising the relationships between the past and the present, between self and others and between human beings and nature. However, much more about institutional legitimacy remains to be explored. For instance, more sources of legitimacy might be included in the process of bricolage. Suchman (1995) argues that an institution draws pragmatic legitimacy when it satiates the self-interest of those who design and support the institutions. Esty (2006) identifies six types of legitimacy that apply to international institutions in global governance: democratic, results-based, order-derived, systemic, deliberative and procedural. A key feature of these sources of legitimacy is that each can be consciously constructed in a specific context. A dynamic and dialectical understanding of legitimacy is also needed, as the process of institutional legitimisation is by no means linear or determined by the established political structure, accepted knowledge or historical path. Rather, it is complex, diverse and uncertain, because tradition and the 'right way of doing things' can be reinvented, meanings can change, and an institution's performance and outcomes can reinforce or undermine its legitimacy. In other words, institutional legitimacy is not a fixed, absolute or tangible quality that can be grasped at any moment and in any place but a subject that is constantly established and re-established through conflict and negotiations (Sikor and Lund, 2009). As Beetham (1991, 39) put it, "legitimacy is not the icing on the cake, which is applied after baking is complete, and leaves the cake itself essentially unchanged. It is more like the yeast that permeates the dough, and makes the bread what it is".

Various theoretical and empirical observations suggest a need to embrace a dynamic perspective in examining institutional legitimacy. Different sources of legitimacy are not mutually exclusive; nor do they function in isolation. In fact, they can co-exist and interact with one another, resulting in synergies, trade-

offs and contradictions. For instance, while traditions provide familiar frameworks and routines that community members consciously or unconsciously accept, these are simultaneously subject to changing discourses (e.g. neoliberalism) and shifting power relations, and thus do not necessarily remain constant. Even those institutions enjoying legitimacy may encounter challenges in a transformative context. Previous sources of legitimacy, such as efficiency and authority, may become unstable in the light of changes in the social-political structure (Douglas, 1986). Likewise, new institutions that contradict local traditions, meanings and worldviews can nonetheless be accepted by community members where new sources of legitimacy have emerged. Therefore, institutional bricolage may embody both familiarisation and disenchantment, owing to the dynamic process of legitimisation.

Institutional outcomes and local bricoleurs' evaluation and feedback also play a major role in reshaping and reinventing institutional legitimacy, as institutions continuously evolve and adapt in the process of implementation (Biermann and Gupta, 2011; Esty, 2006; Suchman, 1995). Unlike tradition and established authority that pre-exist an institution, its outcomes will justify or undermine the institution retroactively. The logic of instrumentality, which indicates that institutional endurance relies on the results of efficient problem-solving (Campbell, 1997; Thelen, 1999), supports the inclusion of institutional outcomes as a source of legitimacy (Campbell, 2004). Once institutions are established, their outcomes are transposed into the structure, becoming a resource that influences the thinking and strategies of bricoleurs. When institutional performance is accorded common expectations and local meaning, it becomes one of the rightful and normative foundations for locals to utilise and legitimise the institution. In the case of irrigation governance, an efficient, effective, equal and sustainable result of water allocation and delivery might provide local bricoleurs with a rationale to justify, legitimise and maintain certain institutions. Alternatively, the irrigation institutions are legitimised because their plasticity and multifunctionality satisfy locals' willingness to employ the institutions to achieve multiple goals (Verzijl and Dominguez, 2015). The inclusion of evaluations and outcomes thus grounds legitimacy in a substantial historical context and an empirical anchor, which echoes Habermas's argument that legitimacy is tenable with an immanent relation to tangible truth (Habermas, 1979, 1976).

In general, institutions cannot speak and they cannot justify themselves. Institutional legitimisation is a process whereby the initiators, supporters and followers of the institution evaluate, justify and defend why and how the institution should be complied with during conflicts, negotiations, and collaboration. Within this process, bricoleurs could interpret and justify institutions by drawing from various sources of legitimacy that interact with each other both before and after the institutions come into effect. As critical institutionalists continue to explore institutional bricolage, it is important to disentangle the complex dynamics of institutional legitimisation and its relationship with the understudied subject of institutional diversity and evolution.

METHODS

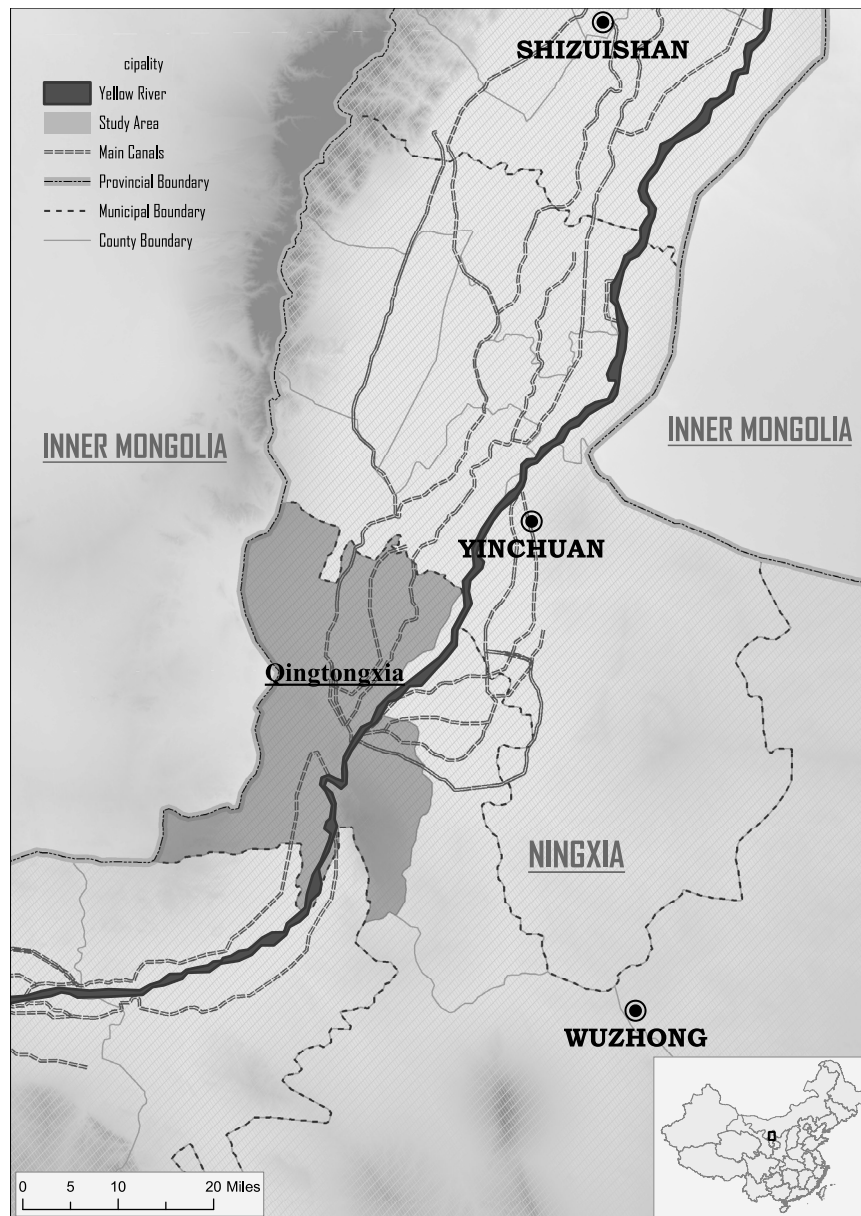
The case area

This paper selects QTX, a county located in the Wuzhong municipality, Ningxia Hui Autonomous Region (Ningxia), as a case area to examine the diversity, legitimacy and persistence of irrigation institutions in rapidly transforming rural China. The unit of analysis is administrative village.

QTX has a long agricultural history of irrigation dating back over 2000 years (Wang et al., 2007). Its continental monsoon climate brings about 200 mm of precipitation annually, mostly in the summer (Wang et al., 2004). With nearly half of the population of 292,000 being rural residents (QLGO and QBS, 2016), agriculture and irrigation play a major role in local socioeconomic development. Paddy rice, wheat and corn are the major grain crops, accounting for around three quarters of the total 754,000 mu (15 mu = 1 ha) of farmland (QBS, 2019). Currently, more than 97% of the irrigation relies on surface water diverted from the Yellow River through ten traditional and intricate canal irrigation systems (Figure 1)

that cover irrigation sub-districts within and outside of the administrative boundaries of QTX. Six canal administrative offices (CAOs), which are affiliated with the Provincial Bureau of Water Conservancy in Ningxia, are responsible for governing the main canal systems.

Figure 1. The case area.



With the long-standing and sophisticated irrigation systems, a series of irrigation institutions have been developed in QTX to address water conflicts and maintain the sustainable use of irrigation systems. These institutions are embedded not only in complex interactions among actors within and beyond rural communities, but also in a rapidly changing Chinese socioeconomic context where the neo-liberalisation of rural land and rural-urban migration have substantially reshaped irrigation practices. The diversity and commonalities of governance practices in QTX thus provide abundant empirical material concerning irrigation institutions, which may shed light on a nuanced understanding of evolving institutions in changing socioeconomic contexts.

Data collection and analysis

We began following irrigation governance in Ningxia, particularly its institutional dynamics, in September 2014 when two focus-group discussions were held in the Provincial Department of Water Resources. From October 2015 to January 2016, we organised three rounds of fieldwork in Yinchuan, the capital city of Ningxia, where major water governance agencies are located, to establish more local contacts and acquire more in-depth knowledge, specifically about irrigation institutions in Ningxia. In-depth interviews were conducted with officials from water resources departments at the provincial, municipal and county levels, as well as with academics from the Ningxia Academy of Agricultural Sciences and the Ningxia Institute of Environmental Planning. The interviews elicited information on the establishment of the local irrigation institutions and how they developed under a top-down policy approach. We also learnt how they gained legitimacy from an official, hierarchical/top-down, and authoritative perspective.

Subsequently, we concentrated the data collection mainly in QTX, where another three rounds of fieldwork were conducted in December 2017, May 2018 and July-August 2019 looking at the grounded institutional practices of irrigation at the lowest operational level, namely, administrative villages. As data collection delved deeper, we were able to gauge local actors' readings of institutional legitimacy. During the three rounds of fieldwork in QTX, we carried out semi-structured interviews in 30 administrative villages; each lasted between one hour and about two hours, with key informants including village cadres, members of water-user associations (WUAs) and ditch tenders who are directly responsible for everyday irrigation practices in their communities, such as water allocation, water-fee collection, infrastructure maintenance and dispute settlement. These in-depth interviews with key local actors sought to understand their knowledge and level of acceptance of the local irrigation institutions. We gauged views on how the institutions were initially conceived and how they evolved and exercised authority, how villagers felt about these processes, why they viewed those institutions the way they did and their thoughts on how the institutions maintained their authority over time.

The interviews also included discussion of the basic demographic and socioeconomic features of the rural community, land use and agricultural arrangements, and external policy changes. We purposely selected the 30 administrative villages, which are taken as the embedded units of analysis (McClintock, 1985; Yin, 2018), in order to ensure a high degree of diversity in terms of biophysical, demographic and institutional settings (e.g. distance to the main canal, the entity of irrigation governance and nested governance structure). Taking these issues into account allows us to assess the relationship between the village settings and institutional legitimacy. In addition, eight interviews were also conducted with officials from the Water Affairs Bureau (WAB), street-level bureaucrats from pumping stations, local large farmland households and external agricultural investors who interact directly with local rural communities and participate in irrigation practices. These interviews provided additional information on the external constraints that can affect local community irrigation institutions and how the various stakeholders interpret institutional legitimacy.

Secondary data, including official documents, project reports and local statistics, and informal interviews conducted in casual settings (e.g. dinners) were used as supplementary information. The information garnered from interviewees was triangulated and verified through extensive grey literature. Data collection ended once saturation was reached.

We follow an interpretative approach to organising and analysing our data (Schwartz-Shea and Yanow, 2012). The main objective is to explain the emergence and persistence of diverse irrigation institutions through the lens of institutional legitimacy. The interpretative approach derives its strength from in-depth description, and connecting the analysis of a social-political phenomenon to its context and structure. It also reflects on perceptions of the meaning of an objective within that structural situation. Thus, such an analysis is suitable to reveal local actors' perceptions and the external sources of institutional legitimacy. The analytic approach is both iterative and recursive, moving back and forth

between the theories informed by the literature on institutional bricolage and institutional legitimacy and the field data informing the realities of institutional stories.

All materials, such as transcriptions, secondary data, memos and field notes, were analysed using qualitative analysis software, Nvivo-12, and were read line by line. Each transcription was triple coded. These measures guarantee the reliability and adequacy of information mining.

The data not only help researchers to interpret the institutional phenomena but also provide insights about the legitimate meaning that local participants attached to everyday practices of institutions and concepts of irrigation governance. We compared institutional arrangements in each sample village and then incorporated the similarity, identity, nuance, complexity and diversity. The synthesised results for each village provide a comprehensive picture of the grounded reality of irrigation institutions that are embedded in interactions among local stakeholders and the interplay between contextual settings and local agents, thus reflecting explanations for the emergence and persistence of diverse irrigation institutions in everyday practices.

RESULTS AND ANALYSIS

In the case-study area, we identified four institutional modalities – monocentric, polycentric, bureaucratic and individualised – each with a distinctly dominant governance entity (i.e. the pumping station, the WUA, the village committee and the ditch tender). The features and sources of legitimacy of each modality are illustrated in Table 1.

Table 1. Summary of the four institutional modalities.

Institutional modality	Characteristics	Specific sources of legitimacy	Number of villages identified
Monocentric	A pumping station solely manages a lift irrigation system as the only water supplier and the only administrative unit.	Formal and due diligence; neoliberalising discourse.	3
Polycentric	Imported self-governing organisations (WUAs) with multiple stakeholders involved in decision-making and rule enforcement with regard to irrigation management and are largely independent from the traditional governing entity.	Authority of higher-level government; satisfactory irrigation governance outcomes.	7
Bureaucratic	The endurance of village committees in irrigation management. These are self-governing organisations, also demonstrating features of governmental bodies.	Traditional rural governance structure; balanced governance outcomes.	16
Individualised	Ditch tenders play a leading role in irrigation management, independent of other governance entities in the village.	Desirable governance outcomes; social recognition of ditch tenders' experience and knowledge.	4

The monocentric institution and neoliberal reform in agricultural water supply

The first institutional modality is characterised by the dominance of a pumping station that has managed a lift irrigation system since 2002 in the Ganchengzi (GCZ) development area. It is monocentric in the sense that the pumping station is the only water supplier, the only administrative unit responsible for O&M and the only coordinator of irrigation affairs within and between the villages in the irrigation system.

The pumping station and its canal system were constructed in the mid-1980s to support an agricultural project aimed at developing the uncultivated land by providing generous benefits (e.g. land-use rights, subsidies and seedlings) to immigrants from other areas of China. The pumping station was originally operated as a public-service organisation¹ affiliated with the QTX prefectural WAB, lifting water from the Xigan Canal to irrigate the development area.

In 2002, the pumping station became a quasi-enterprise, responsible for its own profits and losses as a result of the institutional reform of public service organisations and the local water market in QTX. This reform was in line with China's nationwide paradigm shift towards introducing market instruments into water governance (Liu et al., 2020). Aiming to increase water efficiency, improve water services and create incentives for water conservation, the Chinese water sector went through a neoliberalising process that enabled the division of water rights, the establishment of a water market, price reform in water supply and the introduction of private capital in water utility services in both urban and rural areas (Shen and Speed, 2009; Speed, 2009; Shen and Wu, 2017; Lewis and Zheng, 2018; Qian et al., 2019; Wang et al., 2020).

The impacts of the neoliberal reform, however, are not necessarily optimal in the GCZ development area. Two salient problems have emerged since the pumping station's reform. One is an increasing financial burden on local smallholders. Previously the pumping station received an annual subsidy of 400,000 RMB² from the QTX government. Since the reform, with smallholders' water payments as its only source of income, it has had to meet all of its own expenses, including water resource fees³ paid to the Xigan Canal administration, more than 60 staffs' salaries, employee pensions and maintenance costs. In the absence of the government subsidy, the station has had to up the fees to the local smallholders to twice that paid by those relying on similar lift irrigation systems in nearby counties, including Minning, which also lifts water from the Xigan Canal.

The other problem is a lack of flexibility in relation to climatic disturbances, such as drought shocks. Despite having changed the pumping station's financial structure, the neoliberal reform did not affect its strong connections to the government. The pumping station still has to comply with the water control and allocation plan stipulated by the Provincial Bureau of Water Conservancy rather than be freely mediated by the 'invisible hand'. The quasi-enterprise is unable to meet the smallholders' urgent water demands once the quota is used up. As a village cadre member explained, "there is a unified water-use plan. You cannot pay more to get more water" (SGD, 2019). Thus, the neoliberal reform is limited in that the macro-level water allocation is strictly controlled by the government, leaving the pumping station incapable of procuring sufficient supply in times of shortage.

In light of these problems, smallholders have taken various approaches to modifying the monocentric institution. These have included negotiating with the pumping station directly, submitting proposals at the standing committee of the Municipal People's Congress and the municipal government, and even petitioning the Ningxia provincial government. However, none of these was able to substantially alter the institution in spite of some inquiries into the pumping station's operations in response to the grievances.

¹ The definition of a public service organisation and its relationship with government refers to Tang and Lo (2009).

² Note: 6.5 RMB \approx 1 USD.

³ China's natural resources belong to the people, according to the Water Law of the People's Republic of China (2016, Article 3; NPC, 2016; Wang et al., 2018).

In 2019, a new party secretary took office in the QTX government, but the problems have persisted. A village secretary attributed this institutional dilemma to the prefectural public finance problems of QTX:

There is nothing that the prefectural public finance of QTX can do with not a penny left. In the past, the public financial deficit of QTX ranked 27th among the top 100 counties in western China. Now, it is the second to last in the whole province (SGG, 2019).

In addition to the financial difficulties, we identify two factors that legitimised and sustained this monocentric institution: the legal process that determined the water price and the domination of neoliberal discourse in irrigation water supply reform.

Firstly, the agricultural water price in the GCZ development area was not a unilateral decision by the pumping station; rather, it was authorised and legitimised by a series of formal decision-making processes. In practice, the pumping station in GCZ acts as a second-level water supplier – it lifts water from the first-level water supplier (i.e. the Xigan Canal) and sells it to local smallholders (water users). Hence, the agricultural water price in this area has two components: water fees paid to the first-level water supplier and the pumping station's operational costs. Since the water fees are fixed for all irrigation systems covered by the Xigan Canal, the only factor that differentiates the GCZ development zone from other irrigation areas is the pumping station's operational costs.

As it is only a *quasi*-enterprise, the GCZ pumping station is not a profit-driven entity, even with the institutional reform; it is still subject to regulation and audit by the QTX government. On behalf of the government, the QTX prefectural price bureau exercises the right to calculate the operational cost of the pumping station and announces the total water price, which is then deliberated in public meetings and hearings. Various stakeholders, such as experts, government officers, local smallholder representatives, and land contractors, are invited to the deliberation process. Once approved, the water price is announced by the QTX prefectural price bureau before being enacted in the GCZ development area. Thus, the pumping station's water charges are sustained by an established due process that legitimises the monocentric institution.

On the other hand, a neo-liberal discourse has dominated the agricultural water supply sector, from the division of water rights to the commodification of the water supply. More significantly, this new agenda has been internalised by government officials and local smallholders. The latter now accept that 'water is a commodity' (SGG, 2019) and that users must pay for it. As one told us, "if you do not pay, you cannot irrigate. You pay first and get as much water as you pay for" (SGD, 2019). Moreover, the monopolistic position of the pumping station has rarely been questioned, nor the institutional reform related to marketisation. Smallholders have resented the expense but seem to accept the market rule that they will not receive water if they fail to pay the bill.

As a result, we have witnessed a peculiar situation in which the underperforming monocentric institution has been legitimised by a set of formal pricing processes and a neoliberal discourse, yet tension continuous to exist between the local communities and the pumping station. The monocentric institution itself was a product of the public-service institutional reform and the embrace of market principles in agricultural water supply, which are nested in China's broader political and economic changes. Although the functioning of the monocentric institution is fraught with controversies, grievances and even resistance, this institutional modality has persisted by drawing legitimacy from due processes and mainstreaming discourse.

The polycentric institution and the introduction of WUAs

The second institutional modality is characterised by the introduction of an imported self-governing organisation, namely, the WUA. The WUAs have multiple stakeholders involved in decision-making and rule-enforcement with regard to irrigation management, and are also largely independent, both financially and physically, from the traditional governing entity in rural communities, thereby forming a

polycentric institution in some villages (e.g. Shangqiao, Daba and Honogxing). Since 1995, WUAs have been gradually established across Ningxia along with World Bank aid programmes (Wang et al., 2007; Huang et al., 2009). In 2004, the provincial government decided to support WUA models across Ningxia (WCDN and PBN, 2004). The introduction of the WUAs was regarded as expeditious in improving the efficiency of water delivery and usage (Wang et al., 2007; Huang, 2014), partly because it represented the dominant international paradigm shift towards participatory, community-based natural resource management (Meinzen-Dick et al., 2002; Wang et al., 2010).

The key features of WUAs are polycentricity and independence. In QTX, the polycentricism of the irrigation governance system is visible in the clear division of responsibility between the president, accountant and ditch tenders, as well as in the network of WUAs at the levels of lateral and sub-lateral canals that coordinate with each other regarding irrigation. Meanwhile, they are independent in terms of their legal status and finance. Legally, a WUA is a registered non-governmental organisation (NGO) with a valid status as a legal person and is subject to the guidance of the WAB and regulation by the prefectural civil affairs bureau. Financially, a WUA has an independent budget source (i.e. the water refund⁴) and a set of formal financial regulations requiring all transactions to be recorded (e.g. staff salary payments and the collection of water fees) for inspection and monitoring by the WAB and the village supervisory committee. In this sense, WUAs are presumed to be able to facilitate democratic decision-making and prevent arbitrariness and corruption in irrigation management.

However, the expected advantages of the WUA are limited by empirical conditions as the polycentric institution is translated into working arrangements in practice. The WUAs are, in general, unable to operate professionally as independent NGOs due to a lack of full autonomy and capacity. All WUAs are subject to the scrutiny of the prefectural civil affairs bureau, which inspects their operations on a regular basis. Those that fail to meet the requirements (e.g. normal financial operations, defined obligation and clear division of labour) may face disqualification.

Moreover, WUAs tend to be loosely structured, based on existing social relations and governance systems rather than on an independent set of formal regulations. For instance, a WUA's president is usually nominated by village cadres, and the remaining WUA members are not always elected by local smallholders. More importantly, we found that smallholders have a relatively low willingness to become involved in the WUA as long as they can "get enough water in time with less money and effort" (CYTC, 2019; SGYH, 2019; QJJ, 2019). In other words, what matters to them is not necessarily the polycentric governance structure or the decision-making process but the outcome of irrigation governance (Huang et al., 2009; Wang et al., 2018). Despite such constraints, the polycentric institution remains robust in certain local communities by drawing legitimacy from the governmental authority and proven governance outcomes.

WUAs were not initiated or promoted from the bottom-up; instead, they were imported and diffused actively from the top-down by senior government offices (i.e. the Ministry of Water Resources of China and the Water Resource Department of Ningxia). In the Chinese context, government-initiated policy normally operates with the support of the state's power, which infiltrates not only the bureaucratic system but also rural areas. In this sense, the establishment and operation of the WUAs resembles a government-organised task assigned to lower branches of governmental agencies and self-governing communities. Although the WAB and local smallholders were aware of the limitations of WUAs and complained about them, they still had to try to maintain the presence of WUAs, resulting in passive acceptance of the polycentric institution at the authority's behest.

⁴ The water fees levy in Ningxia includes two lines of process: collection and refunds. The management agency of the lateral canals collects water fees from smallholders and passes them to municipal finance. The finance department then refunds fixed percentages of the fees according to water consumption to the appropriate agency, which funds the budget for lateral canal repairs and managers' salaries.

WUAs are also associated with greater efficiency in irrigation governance at the prefectural and household levels, which to some extent has legitimised the persistence of the polycentric institution. At the prefectural level, the WAB is able to establish a self-governance network to coordinate irrigation affairs without the involvement of township governmental agencies and village committees, as some of the community-based WUAs have become an executive arm of the WAB. This network of WUAs encapsulates irrigation affairs in an exclusive arena of irrigation governance, thus allowing more timely, efficient and professional responses to irrigation problems (QTXWABO, 2019). At the household level, the efficiency of water delivery may be improved by separating the collection of water fees from other collective issues. The role of WUA members is also conducive to keeping the discussion of irrigation issues on water itself, thus facilitating compliance and conflict resolution.

Overall, the polycentric institution evolved gradually following the irrigation reform that introduced WUAs in Ningxia. Although guided by the hailed participatory principles, the WUAs encountered practical constraints when involved in the everyday practice of irrigation governance. Although recognised by local smallholders and lower-level governmental agencies, these constraints have not prevented the WUAs from operating. In some cases, the polycentric institutional modality has been sustained by the authority of higher-level government and satisfactory irrigation governance outcomes.

The bureaucratic institution and the persistence of village committees

The third institutional modality is characterised by the persistence of village committees, which are the traditional governing body in rural China. According to the Chinese Constitution (Article 111; NPC, 2018), village committees are self-governing organisations, whose members are directly elected by the villagers (The Organic Law of the Villagers' Committees of the People's Republic of China, Chapter Three, Article 11; NPC, 2010). In practice, they also demonstrate features of governmental bodies, as they are closely associated with senior government and become end branches of the Chinese governance system. The key role of village committees thus defines the bureaucratic institution, which includes both a hierarchical governance structure and close community-government relations in collective irrigation affairs.

Village committees undertook irrigation governance prior to the establishment of WUAs in the villages of QTX. Since the 2000s, although almost every village has established its WUA, the committees still play a salient role in many rural communities where the WUA is either malfunctioning or it overlaps with the committee since the village cadres fill key positions in the WUA (Huang et al., 2010).

One reason behind the introduction of WUAs was the need to address a lack of clarity in rural irrigation affairs under the governance of village committees. When the village committee serves as the sole coordinator of all rural collective affairs, irrigation governance is often mingled with other collective issues. For instance, villagers may be stalling the payment of water fees to pursue more compensation for land expropriation (Wang et al., 2018) or to urge village cadres to provide social services more quickly.

Moreover, the power of village committees has been significantly reduced by their interactions with villagers since the early 2000s, when the agricultural tax was abolished and social stability became the top priority in China (Chen, 2014; Liu and Wang, 2018; Liu et al., 2018). Hence, village cadres are likely to be held responsible by senior government when any major confrontation or conflict occurs in the village, regardless of whether they are truly liable or not. This is because maintaining social stability at the grassroots level is one of the top indicators in village cadre assessment (Lee and Zhang, 2013). They may be held accountable by senior government under the Xinfang system⁵ if they fail to respond to villagers' appeals for urgent irrigation. The restructuring of power relations in rural China thus further weakened the village committees' capacity to penalise violations or opportunism, thereby hampering collective action in irrigation governance.

⁵ The Xinfang system is an alternative, less formal, legal approach than administrative litigation for citizens, legal persons and other organisations to present their cases, opinions, proposals or requests to government bodies at various levels directly to Xinfang offices through letters (literally: 'Xin'), phone calls or personal visits ('Fang'; cf. Minzner, 2006; Zhang, 2009).

Nevertheless, most village committees persisted despite the introduction of WUAs. There are two possible reasons for this: the WUAs' budgetary restrictions and the village committees' historical experience in dealing with rural affairs. Firstly, the WUAs' only source of income is refunded water fees, which is inadequate and unstable when they have difficulties collecting water fees from villagers. Consequently, village cadres (e.g. the village party secretary and committee chair) end up simultaneously filling positions at WUAs to maintain the day-to-day operations. This arrangement saves the WUAs money as the village cadres already receive salaries from the prefectural fiscal budget (Ministry of Water Resources of China, 2008).

Secondly, village committees have a long tradition of managing collective affairs in Chinese rural society, with village cadres serving as agents of both the state and the villagers. The village committee is not only responsible for maintaining justice and social equality among villagers on behalf of the state without the intervention of state apparatuses (e.g. judiciary authorities) but also represents the community themselves in internal conflict reconciliation and interest negotiation (Wang et al., 2018). With this history, irrigation affairs, such as orders and disputes, naturally fall within the scope of the village committee's traditional responsibility. More importantly, the bureaucratic institution, has gained a high level of social acceptance over time and as an arrangement is taken for granted by village cadres and villagers. It is standard practice for villagers to seek the intervention of village cadres rather than enter into direct confrontation when dealing with conflicts, needing fair judgements or seeking solutions to everyday problems. For village cadres, the village committee inspires a sense of duty as the umbrella governance entity is responsible for almost every aspect of rural society. Hence, the bureaucratic institution has been legitimised as a traditional practice and an agricultural custom in community-based irrigation governance during the delicate institutional reproduction and adaptation to changing situations. It seems an acceptable arrangement for villagers, senior officials and village cadres. For the villagers, the village committee provides the most convenient, direct and time-tested source of assistance in irrigation affairs. From the senior officials' perspective, the village committee makes financial sense, as no extra budget is needed to manage rural irrigation affairs. For village cadres, participating in irrigation affairs allows them to monitor, respond to and reconcile rural conflicts in a timely manner, which helps fulfil their responsibility of maintaining social stability.

To sum up, we have found that the bureaucratic institution was prevalent in QTX because of the fiscal consideration and the role of village cadres in rural conflict resolution, despite irrigation reform having been promoted for a long time and subtle tensions existing between village committees and villagers. This institutional modality draws legitimacy from balanced governance outcomes and the traditional rural governance structure that has been long recognised by villagers.

The individualised institution and the role of ditch tenders

The last institutional modality is symbolised by the leading role of independent ditch tenders who serve as prosaic managers for collective irrigation affairs in villages such as Guanghui, Jiangnan and Shaoxi. It is individualised in the sense that these ditch tenders are independent of other governance entities in managing irrigation affairs in the village. They do not necessarily cooperate with each other, but their capacity and experience are essential to the performance of the individualised institution.

Ditch tenders are essentially contractors who carry out collective irrigation duties individually and receive payments from water fee refunds (Wang et al., 2016). Their managerial responsibilities are not significantly different from those of the previously mentioned governance entities. In fact, ditch tenders also exist in the polycentric and bureaucratic institutions, but they only function as part of a village committee or WUA. Their shifting role within different governance structures is not an uncommon scenario within China's rural governance. Indeed, the malleable, contingent and fluid societal relationship that blurs the boundaries of rights and responsibilities could sometimes allow flexibility in addressing practical rural governance problems (Wang and Liu, forthcoming). In the individualised institution, ditch

tenders operate in a distinct way in the sense that they have taken a leading role in managing the village's irrigation affairs while village committees are not involved and WUAs are not functioning. Ditch tenders are not a direct product of the neoliberal or decentralisation reform in the water sector; nor are they a traditional authority attending to rural collective affairs. Rather, they represent the simplest structure in which an individual specialist, normally a stable one, is in charge of the coordination, monitoring and enforcement of irrigation rules. As a result of the flattened governance structure, the costs of inter- and intra-village communication and coordination are reduced, while the ditch tenders can act more flexibly in an urgent situation (e.g. drought), thus potentially improving water delivery efficiency.

The individualised institution is built on several physical, political and personal conditions. First, the physical infrastructure in the villages that adopt the individualised institution is relatively simple. Unlike villages that are covered by several lateral canal systems, those adopting the individualised institution use only one. This simplifies irrigation affairs significantly, thus enabling ditch tenders to fully manage an entire community. Second, other governance entities, particularly village committees and cadres, must be willing to allow ditch tenders to perform this function, which is normally the case when village cadres are overwhelmed by complicated and tedious collective issues. With satisfactory outcomes, village cadres are happy to have their workloads reduced as much as possible, although ditch tenders may only be smallholders with no formal credentials.

Last, and most importantly, the ditch tenders' personal financial, social and technical capacity is indispensable in the individualised institution. Financially, they are motivated by a fixed rate⁶ refund of the total water fee payments from the CAOs, but they simultaneously risk losing money because they must pay the CAOs at a specific point in the irrigation season, irrespective of the amount they have been able to collect from the farmers. For example, the community using the Taimin Main Canal is required to pay three instalments of water fees annually and some deposits before the water delivery begins. Any delay in payments to the CAOs will impede timely water supply and agricultural production. Thus, ditch tenders have to pay the CAOs in full and on time, sometimes from their own income when they are unable to collect sufficient water fees from the smallholders. Thus, their personal financial capacity is important because even a small portion of the total payments can be a significant burden (e.g. in 2018 the total water fee was 300,000 RMB in Guanghui, 210,000 RMB in Jiangnan, and 330,000 RMB in Shaoxi; QXTMCO, 2019).

Socially, a positive relationship with villagers could alleviate the ditch tenders' risk. A well-connected ditch tender who gains villagers' trust usually collects water fees more easily. Even when villagers are short on cash before the harvesting season, they are more willing to pay fees to ditch tenders with whom they have a good relationship. In this sense, ditch tenders, like village committees and WUAs, could play an important role in ensuring accountability and maintaining stability between water agencies and villagers.

With regard to the technical side, agricultural knowledge and irrigation experience are core abilities. Ditch tenders are required to monitor and address various problems emerging at any moment during the irrigation season, such as the mismatch between uneven land and fixed sluice gates and the smallholders' ad hoc water demand and temporal adjustments of water delivery. Thus the job of the ditch tender is not an easy one; it requires specific skills that take time to learn (SGSX, 2019). As a village cadre told us, "we haven't replaced a single ditch tender since 2013" (QJG, 2019).

Although seemingly simple and potentially unstable, the individualised institution has drawn legitimacy from its positive governance outcomes and the social and technical prowess of specific ditch tenders. On one hand, its performance, in certain biophysical settings, is generally satisfactory for smallholders, village cadres and ditch tenders. Ditch tending is a stable job that can bring a reasonable income, despite the financial risks involved. For village cadres and villagers, ditch tenders provide a

⁶ The refund rate is 0.55 cent per cubic metre. The agricultural water price varies by canal system, village and irrigation season. It normally ranges between 3.05 and 5.05 cents per cubic metre in QTX.

flexible, transparent and accountable mode of governance that solves everyday irrigation issues (SGSX, 2019). On the other hand, the individualised institution has been sustained by specific ditch tenders' well-recognised knowledge and experience. As the individualised institution endures and stabilises, its incentives and governance approach gradually come to be taken for granted as effective, everyday practice by the villagers and even the ditch tenders themselves. As a result, it seems to be tacitly agreed that experienced ditch tenders work continuously on the same terms unless they are no longer qualified, for example due to age, illness or taking up another business.

In conclusion, despite new challenges in irrigation bringing strict requirements for ditch tenders, the individualised institution is effective in meeting these challenges with a highly individualised mode of governance. It persists by drawing legitimacy from positive governance outcomes and recognition of ditch tenders' experience and knowledge.

DISCUSSION

Our findings demonstrate a high degree of diversity in irrigation institutional modality within a small-scale case area where basic physical and socioeconomic conditions are similar. Each modality is characterised by its own governance actors and implementation challenges, and each has persisted or evolved by drawing legitimacy from various sources. More importantly, we have identified and interpreted heterogeneous processes of legitimisation that bring new insight into our understanding of institutional bricolage in community-based irrigation governance.

Specifically, we argue that the legitimisation of institutions is not stabilised in a specific context where certain traditional rules, customs and meaningful norms prevail; rather, it is a dynamic process through which local agents continuously compare, select and integrate the available sources of legitimacy. This argument furthers institutional bricolage in the sense that it not only emphasises the process of how local bricoleurs adapt to and reshape institutions by utilising and integrating existing tradition, knowledge and authority, but also probes the dynamics of different sources of legitimacy that can be grasped and reinvented to sustain certain institutional arrangements. This dynamic process of legitimisation unpacks diverse institutional rationales and how they are woven together for the formation, adaptation and evolution of institutions. From this point of view, different institutional modalities can endure in a localised context as a result of heterogeneous institutional legitimisation, even though the established power relations, accepted knowledge and cultural systems are similar. We elaborate on how heterogeneous institutional legitimisation helps us understand the complexities of institutional bricolage from two perspectives. One is the diverse sources of legitimacy at different stages of institutional formation and evolution; the other is the complex interactions between the different sources of institutional legitimacy.

A variety of sources of institutional legitimacy may emerge as institutions are established, function and evolve. First, institutions can draw legitimacy from overarching discursive and governance structures even prior to their establishment within the community. For instance, a neoliberal discourse had dominated the water-supply sector and the local communities before the monocentric institution was implemented. It was also acknowledged that ensuring due process justifies adjustments in water fees. The polycentric governance model had already gained popularity globally when the WUAs were promoted in China. Second, as certain institutional arrangements are introduced in local communities, they are examined and judged by local agents in terms of their consistency with local expectations and practices. It is during this process that these institutional arrangements can be compared with tradition, customs and accepted knowledge. Those that are congruent with the local context can be internalised, naturalised and eventually taken for granted. Last, institutional outcomes, whether positive or negative, are also an indispensable tool with which to assess institutional arrangements as they come into effect and evolve. Negative outcomes, such as higher water fees, challenge the monocentric institution. Positive outcomes, such as effective and efficient water delivery, reinforce the validity of institutions as local

agents accept and recognise these practices. Thus, institutional legitimisation is not a linear or unidirectional process but complex, dynamic and filled with examination and introspection.

Moreover, different sources of institutional legitimacy may co-occur and interact, whether contradicting or complementing each other. This results in different institutional dynamics during the process of institutional bricolage. For instance, the negative outcomes that challenge the monocentric institution (e.g. higher water fees) are offset by the formal procedural justification and neoliberal discourse that provides legitimacy. Likewise, the empirical restrictions that polycentric institutions face are balanced by the senior government's authority in promoting WUAs and the positive outcomes associated with them. One should note that contradictory sources of legitimacy do not necessarily lead to the collapse of certain institutional modalities. Instead, it is possible that institutions persist while simultaneously facing legitimacy challenges from their own situational structure.

As well as contradiction, different sources of legitimacy may combine with each other. For instance, favourable outcomes, in combination with the ditch tenders' recognisable experience and knowledge, legitimised the individualised institution. Also, bureaucratic institutions draw their legitimacy from the traditional rural governance structure and their positive outcomes. In the process of legitimisation, those institutions that endure do not necessarily draw legitimacy from all theoretical sources at the same time. Nor does it follow that institutions will be more durable if more sources of legitimacy are included. Some sources may be absent or less important than others in certain social-ecological conditions, and this will vary for different institutions and communities.

In addition, the interactions within the process of institutional legitimisation do not necessarily rely on the explicit or active expression from bricoleurs. Indeed, aside from the local community's opposition to the monocentric institution (pumping station), institutional modalities do not experience public or active dissent from local agents. Similarly, although the WAB obviously supported the WUAs, this is not the only source from which the polycentric institution drew legitimacy – it also enjoyed common acquiescence thanks to its positive outcomes. Thus, interactions between different sources of legitimacy may occur implicitly.

The complex process of legitimisation indicates that legitimacy is highly sensitive to context. The four institutional modalities that emerged in QTX may not be found in other parts of China. Neither will the ways that different sources of legitimacy appear, interact and interweave in our case study area necessarily apply elsewhere. In other words, this paper does not intend to outline a general pattern of irrigation institution in China or evaluate its performance. Rather, it offers an alternative explanation for an important yet understudied phenomenon – institutional diversity and change. Following this line of inquiry, researchers should not only study different combinations of legitimacy sources within a given context but also explore local communities closely to understand their social realities, thus revealing the nuances of institutions and their relationships with their settings.

CONCLUSION

Institutions are significant tools in addressing collective-action problems in community-based irrigation governance. Earlier studies led by mainstream institutionalists have mainly focused on the relationship between institutional conditions and irrigation performance, but they have paid relatively little attention to how institutions are animated in a dynamic process of formation and evolution. Thus, the processes of and rationales for the emergence and persistence of diverse irrigation institutions remain inadequately understood. Based on empirical evidence in the upstream Yellow River, northwest China, this paper has adopted an alternative theoretical perspective of institutional bricolage and an interpretative approach to unpacking the diversity, legitimacy and endurance of four modalities: monocentric, polycentric, bureaucratic and individualised institutions. We have illustrated the diverse origins and features of, and problems with, each modality and interpreted the respective rationales for the persistence of these irrigation institutions through an analysis of the dynamic process of legitimisation.

The monocentric institution, illustrated by the sole management role of the quasi-marketised pumping station, has been legitimised by a set of due processes for water fee adjustments and the neoliberal discourse of irrigation reform despite underperforming in terms of outcomes. The polycentric institution, exemplified by the WUAs, was hampered by practical conditions, such as limited autonomy and financial independence, but has drawn legitimacy from the authority of senior government and satisfactory outcomes. The bureaucratic institution, characterised by the village committee, was legitimised by positive governance outcomes and the customary structure of rural governance, although subtle power tensions exist between village cadres and villagers in the governance of collective affairs. Lastly, the individualised institution, represented by the leading role of individual ditch tenders, has persisted by drawing legitimacy from the social recognition of ditch tenders' experience and knowledge and their positive outcomes in a relatively simple biophysical and political setting.

The findings of this paper contribute to institutional analysis and the literature on institutional bricolage in several ways. First, the sources of legitimacy for community-based irrigation institutions are not confined within the elements that have already been formed during the historical development of local communities, such as tradition and culture. Those that are relevant to institutional outcomes or come from the external milieu affecting local agents, such as authority imposed from above and procedural justification, are also included. Second, the process of legitimisation is dynamic and complex in the sense that the sources of legitimacy are not given in a specific social-ecological setting when institutions are formed. Rather, local agents weave together the different forms of legitimacy that are available from the social, political and historical structure at different stages of the formation, operation and evolution of institutions. Last, different sources of legitimacy may contradict or complement each other and influence institutional change, demonstrating a complex structure of rationales for the emergence and persistence of diverse institutional modalities.

Our findings have implications for future studies of institutions and community-based irrigation governance. The perspective of institutional bricolage is not only useful in examining institutional outcomes but also enables us to reveal the complex and diverse process of institutional emergence, evolution and persistence. Our approach connects irrigation institutions with everyday practices and situates institutional change in local communities. It shows that the translation of institutional arrangements into real-life practice involves a non-linear and uncertain process. This warrants further investigation as scholars attempt to answer the question of why institutions demonstrate different characteristics within a similar context and how they persist despite challenges and tension.

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