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Using the institutional grammar to understand collective resource management in a heterogenous cooperative facing external shocks

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Abstract

Worker cooperatives in the gig economy can involve large and heterogeneous memberships, which makes them vulnerable to member opportunism depleting collective resources. External shocks may present another challenge for collective resource management. This raises the question of how heterogeneous cooperatives design rules to mitigate opportunistic behavior and whether these rules evolve in the face of external shocks. We study the case of Smart Belgium between 2017 and 2022, thereby covering the COVID-19 pandemic and new cooperative legislation as external shocks. Building on the institutional grammar methodology, we analyze 412 rules of Smart. The findings indicate that external shocks with sudden resource scarcity do not necessarily motivate rule changes (COVID-19) while external shocks without an effect on collective resources can motivate rule changes (national policy change). The study also shows what kind of rules heterogeneous cooperatives may design to mitigate opportunism.

Keywords: collective resource management, external shock, heterogeneity, institutional grammar, worker cooperative.

1. Introduction

The gig economy, defined as short-term service jobs organized through intermediaries (Stanford, 2017), challenges established labor market institutions in the Global North. As a form of non-standard employment, gig work lacks the protections that modern welfare states guarantee for regular employees and is often excluded from collective representation by unions (Woodcock & Graham, 2020). This leaves many gig workers dependent on corporate intermediaries such as digital labor platforms, while also facing insecurity in matters of income, employment, working hours, social security, skill development, and occupational health and safety (Koene & Pichault, 2021; Lorquet et al., 2018). In response, bottom-up organizations in the form of worker-owned (platform) cooperatives have developed and are gaining traction in recent years (Eum, 2019; Martinelli, 2021; Mondon-Navazo et al., 2022). Cooperatives of gig workers resemble other labor market intermediaries but "with the key difference being that collective ownership allows for organizing protections against precarity and removing dependence on outside owners" (Bunders & Akkerman, 2023, p. 2). For instance, members can become employed by the cooperative and gain access to labor rights while continuing to work on a project basis with shifting clients that are allocated by the cooperative or have been acquired themselves. These worker cooperatives can thus be regarded as a form of collective entrepreneurial action which aims to produce a collective good for its members in the form of more secure working conditions (Navarra, 2015). In this study, we examine the regulations set up by one such cooperative in order to manage, preserve and protect the collective resources it creates.

Collectively managed resources may deplete due to endogenous threats, like opportunistic member behavior, or exogenous shocks, such as economic crises (Dehkordi et al., 2021). Although opportunism can occur in any exchange relationship (Williamson, 1985), the atomized and competitive nature of gig work may further evoke it (Hart & Moore, 1996). Opportunistic behavior could also go undetected more easily when the tasks are variable and performance is difficult to evaluate (Bhardwaj & Sergeeva, 2022), as is the case with diverse and dispersed

forms of work in the gig economy. Adverse selection occurs when cooperatives attract more high-risk gig workers as members and high-performance gig workers choose not to join, whereas moral hazard arises when members behave more risky than non-members and thus put a larger burden on collective resources (Vriens & De Moor, 2020). Opportunism might then manifest in various forms. For instance, free-riding happens when members transact outside of the cooperative while still making use of their collective provisions (i.e., side-selling), thereby reaping the benefits but not bearing the costs of this collective good (Olson, 1965). Nevertheless, collective action is still observed in the gig economy, which raises the question of how it is protected against tendencies of opportunism.

External shocks may put pressure on collective resources by increasing needs and decreasing income streams, even if cooperatives are found to be more resilient to shocks than conventional firms (Billiet et al., 2021; Carini & Carpita, 2014). Worker cooperatives typically respond to economic crises with pay cuts rather than layoffs as to secure stable employment (Cristini et al., 2023). They may even start as worker buy-outs by saving conventional firms from bankruptcy (Mirabel, 2021). Still, financial losses of worker cooperatives are typically similar or even higher than those suffered by conventional firms during economic downturn (Cristini et al., 2023; Prushinskaya et al., 2021). With fewer resources available, competition between members becomes more likely, thereby widening the gap between individual and group interests, which could limit cooperation (Kramer, 1989). Some studies on collective resource management indeed find that members act more opportunistically when resources are scarce by fending for themselves first (Gatiso et al., 2015), while others find no evidence for an increase in opportunism following a disaster (Conte, 2022). Moreover, not all external shocks negatively affect collective resources. External shocks could also positively affect collective resources (e.g., a drop in procurement costs) or, as we will later show, have no effect.

Cooperatives can set up institutional rules of the game aimed at preserving and protecting their collective resources (Sacchetti & Tortia, 2015), for instance by stimulating higher contributions of members or by putting up restrictions on usage. Institutions are defined here as formally codified or informally understood "prescriptions that humans use to organize all forms of repetitive and structured interactions" (Ostrom, 2005, p. 3). Previous research on a cooperative of freelance photographers emphasizes the importance of trust, screening of new members based on shared values, and limitations on membership size to mitigate opportunism (Bhardwaj & Sergeeva, 2022). Soetens and Huybrechts (2022) demonstrate that the trade-offs of such an approach include sacrificing individual aspirations, excluding members who hold different values, and thus reaching a more limited and homogenous group. In many cases it might not be possible or desirable to maintain a small and homogeneous membership, especially in the gig economy where intermediaries benefit from network effects and there is high socioeconomic diversity among workers (Vallas & Schor, 2020). Recent literature suggests that the design of formal rules might help to create shared expectations on cooperation in large heterogeneous groups, which would arise more naturally in small homogenous groups (Geary et al., 2019; Van Klingeren, 2022). Hence, we focus on institutions as rules.

When collective resources are affected by an external shock, cooperatives may need to change their rules in order to rebalance what members use and contribute. Dehkordi et al. (2021) theorize that institutional response to external shocks depends on whether the shock introduces sudden resource scarcity or an increase in fixed costs, with only the latter invoking a change in rules. Others find institutional change in response to sudden resource abundance (Tschopp et al., 2018). However, one could also argue that if the rules are set up well initially, there is no need to change them in the event of an external shock. It may further be questioned if changing the rules is even helpful at all when collective resources diminish as a direct result of the external shock instead of any deliberate behavior. Modifying or tinkering with the rules is not always a solution (Cook, 2018), also for reputational reasons. Thus, it remains unclear in what ways regulative institutions address opportunistic behavior in heterogeneous groups and whether they evolve in the face of external shocks. This knowledge is crucial for a better understanding of what makes collective resource management resilient when faced with both internal and external impediments.

We formulate the following research question: How are regulative institutions used to curb members' opportunism in a heterogeneous cooperative while facing external shocks? We investigate this question using an explorative case study of Société Mutuelle pour artistes (Smart), which was founded in Belgium as a non-profit association in 1998 to provide freelance artists an employment status with associated labor rights. At present,

Smart is a worker cooperative with all kinds of gig workers as its members (Murgia & de Heusch, 2020). Our analysis covers the period from 2017—when Smart officially became a cooperative—to 2022, thereby covering two external shock events: the COVID-19 pandemic and a new cooperative law. Whereas previous institutional analysis of Smart Belgium focuses on how the organization evolved until 2016 to strengthen their legitimacy as perceived by external stakeholders (Xhauflair et al., 2018), the current study examines the regulations set up by Smart itself to manage their collective resources after being converted to a cooperative. Focusing on the design and adaptation of Smart's regulative institutions, we build on the institutional grammar approach to systematically analyze its rules (Frantz & Siddiki, 2021).

2. Background on the institutional analysis of collective resource management

There has been substantial attention in the literature for managing common-pool natural resources, like pastures and fisheries, but far less research addresses the human-made collective resources of worker cooperatives (Tortia, 2018). Use of their worker protections and welfare provisions is rivalrous and non-excludable among members, as they need to be funded from collective budgets. As such, some researchers describe worker cooperatives as labor commons (Peuter & Dyer-Witheford, 2010). Others do not go so far and rather point to the similarities of cooperatives and commons as governance regimes, but with the latter not engaged in capital accumulation (De Moor, 2008, 2015; Guttmann, 2021). For the purpose of this research, it is appropriate to view worker cooperatives as a distinct governance form.

From the starting point of their legal incorporation, worker cooperatives may design original rules to manage their collective resources. In contrast to classic theories on resource depletion as a result of uncoordinated actions of users overexploiting the resource (Hardin, 1968; Olson, 1965), Ostrom's seminal work posits that self-governance of collective resources by user groups can in fact be sustainable under certain conditions (Ostrom, 1990). Key to her research is the ability of user groups to create a set of tailored institutional rules that help to coordinate collective action and thereby make it robust. To achieve this, user groups engage in institutional work: "the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions" (Lawrence & Suddaby, 2006, p. 214). The design of institutions forms a second-order social dilemma as every user benefits from reduced first-order social dilemmas, by mitigating opportunism, regardless of their contribution in the institutional work (Kollock, 1998). However, scholarship on collective resource management has only sparingly paid attention to how these institutions emerge and whether they evolve in response to external shocks (De Moor, 2008, 2015; Ensminger, 1996; Landolt & Haller, 2015; Tschopp et al., 2018). One reason for this may be that specific methodologies for studying the content of institutions lacked in applicability (De Moor et al., 2016; Frantz & Siddiki, 2021).

Introduced by Crawford and Ostrom (1995), the institutional grammar is a form of content analysis that allows for systematic inquiry of how institutions intend, succeed, or fail to structure behavior. The development of an institutional grammar was driven by their assessment that approaches hitherto used to study institutions were not mutually exclusive, and that in fact all institutions signal information on behavioral directives. Since the institutional grammar initially lacked applicability, it only started to be used after two pioneering studies (Basurto et al., 2010; Siddiki et al., 2011) and the more recent revision into an institutional grammar 2.0 (Frantz & Siddiki, 2021). The institutional grammar allows analysts to dissect any set of institutions into statements, which can either be constitutive (i.e., x counts as y) or regulative (i.e., if x do y), and then deconstruct these statements into components according to a standardized syntax. As the current study focuses on the regulation of collective resources, we use the regulative syntax that describes the structure of regulative statements. There are six components in this syntax, which are often abbreviated as ADIBCO (see Table 1).

Institutional statements can take the form of strategies, norms or rules. Crawford and Ostrom (1995) originally distinguished these by the presence or absence of syntactic components: AIC for strategies, ADIC for norms, and ADICO for rules (the oBject was only later introduced as an optional component, in: Siddiki et al., 2011). However, Schlüter and Theesfeld (2010) argued that all three forms can have an Or else, but of a different nature. In a situation where actors are interdependent, shared strategies emerge as equilibria to coordinate collective action by conveying information on efficient behavior. Since deviating from a shared strategy is inefficient, its sanction is automatic in nature. For example, when one avoids jay-walking due to the risk of getting hit

TABLE 1 Example of an institutional statement: Members shall not spread confidential information during and after the execution of a contract or the cooperative may claim a compensation

Syntactic component	Definition of component	Coding of example statement
Attribute	The actor to whom the statement applies	*Members*
Deontic	Defines if an action or outcome is permitted, obliged or forbidden	*Shall not*
aIm	The action or outcome specified in the statement	*Spread*
oBject	The animate or inanimate receiver of the action or outcome	*Confidential information*
Context	The circumstances that are prerequisites or restrictions for the action or outcome	*During and after the execution of a contract*
Or else	The incentive linked to the action or outcome	*The cooperative may claim a compensation*

by cars. Norms are shared perceptions of what actions are right or wrong in a certain situation, thus motivating actors by internally or externally imposed emotional sanctions like feelings of morality or a damaged reputation. Most studies using the institutional grammar define rules as behavioral prescriptions that get enforced through tangible sanctions for (non)compliance, such as a fine (Basurto et al., 2010; Geary et al., 2019). Nevertheless, rules do not always specify a sanction and even if they do, the sanction can be specified separate from the initial rule (De Moor, 2015). What then distinguishes rules is that these are formal institutions, not because they are commonly written down in legal documents, but since they are designed and (actively or passively) monitored by an actor that is officially appointed in a legitimized process (Frantz & Siddiki, 2021). In the current study, we focus on regulative institutions as rules set up by the cooperative because norms and shared strategies regarding cooperation are less likely to arise naturally in large heterogeneous groups (Geary et al., 2019; Van Klingeren, 2022).

Most of the existing institutional grammar research focuses on institutional structure instead of meaning, which makes sense for a grammatical approach but it also limits explanatory power (Dunlop et al., 2019). For example, how much can we infer from the modal Attribute? There is also a strong computational orientation in recent developments of the institutional grammar, making it machine-readable (Frantz & Siddiki, 2021), automatically encodable via machine learning (Rice et al., 2021), and using it for agent-based modeling or network analysis (Abebe et al., 2019; Mesdaghi et al., 2022). Although these are important advancements, it reinforces the existing focus on institutional structure. For instance, by analyzing concepts like polycentricity in terms of network relations between Attributes and oBjects (Weible et al., 2020). To better capture institutional meaning, some authors have suggested to only make use of statement-level classifications (Dunlop et al., 2019). Attempts at classifying institutional meaning on the component-level have so far been fragmented and focused on a limited number of components (De Moor et al., 2016; Frantz & Siddiki, 2021).

3. Methodology

To better understand collective resource management in a heterogenous group facing external shocks, we conducted an explorative case study on 412 rules of Smart Belgium for the period 2017–2022. We selected this case for three reasons. First of all, Smart is based on self-governance of collective resources (Ostrom, 1990), with the members and their representatives being responsible for the design of regulative institutions. All ordinary members can exert influence by voting for board candidates, standing for election themselves, voting on major decisions during the general assembly, but also by participating more deliberative in rulemaking as part of the "Smart in progress"-committees. Additionally, there is an ethics committee for monitoring the alignment between Smart's values and practices, which consists for a majority of ordinary members that are selected randomly. Smart's board is elected by and largely from its own membership, which in turn delegates one or more chief executive officers that are supported by the executive staff (referred to together as "executive team"). The cooperative's bylaws are its constitution, which can only be changed by a supermajority vote at the general assembly. Other regulations can be more flexibly changed. These are specified in the "house rules" for any economic activities that members undertake as gigs and in the "production and work regulations" for anything related to

members' status as employees of the cooperative. While our main interest here is in the rules that are designed by Smart itself, the cooperative is also tied to broader legal frameworks for all of the roles that members have (see Fig. 1). As shown later in the findings, a new cooperative law that was introduced during the period of observation turned out to be consequential as an external shock.

Second, Smart forms an ideal case since it is a worker cooperative that provides employment status with associated labor rights to a heterogeneous group of gig workers. Smart operates as federated but independent entities in eight European countries (Murgia & de Heusch, 2020). We limit our scope to Smart Belgium, as it has existed for long enough to track institutional change and is by far the largest and most diverse. While Smart Belgium was originally founded in 1998 as a non-profit association with only artists and creative workers, between 2008 and 2016 the organization expanded its role of employer to all kinds of gig workers (Xhauflair et al., 2018). At the end of 2016, Smart began its legal conversion to a cooperative. In contrast to traditional worker cooperatives, Smart does not direct its members to produce a certain product or service but instead functions as an intermediary for its members who "each produce their own product or service that they sell independently" (Murgia & de Heusch, 2020, p. 216). The collective resources of Smart consist of its protections and welfare provisions for members (e.g., training, legal advice, access to social security). These are primarily created by means of a 6.5% commission on all transactions that members conduct via the cooperative.

Third, Smart's development from 2017 to 2022 is selected to include the period preceding, during, and following two external shock events: the COVID-19 pandemic and Belgium's new cooperative law. It covers the time since Smart first operated as a worker cooperative in 2017, the new cooperative law that was issued in 2019, and the recovery of the Belgian economy after a massive vaccination campaign in the second half of 2021 until 2022. While the new cooperative law posed no direct threat to collective resources, the COVID-19 pandemic did. The first wave of COVID-19 and restrictions to contain its spread in Belgium started from March 2020, "with increasingly more severe policies implemented as case numbers began to spike" (Desson et al., 2020, p. 438). It is important to note that, during the height of this pandemic, the Belgian federal and regional governments mitigated a significant share of the negative economic effects through a wide range of support measures. Nevertheless, 55% of all Belgian enterprises suffered a loss of turnover during the height of the pandemic between April 2020 and March 2021 compared to 45% one year earlier (Dhyne & Duprez, 2021). To put this into context, 50% of all Belgian enterprises saw a decrease in turnover during the 2008 financial crisis (Dhyne & Duprez, 2021). Most of Smart's members are still active in the creative sector (e.g., in 2019, around 70% of the total work budget came from creative sector jobs), which was precisely one of the most severely restricted sectors during the pandemic.

Data on Smart's rules were collected from relevant documents and webpages of the cooperative (see Table 2). Since not all versions were archived well, we used the Wayback Machine of The Internet Archive to retrieve earlier versions. The data thus reflect Smart's institutions-in-form instead of their institutions-in-use, which limits our insight into actual compliance with rules but is appropriate considering our interest in the cooperative's design of regulative institutions. Coding of the data followed the institutional grammar's regulative syntax (Crawford & Ostrom, 1995; Frantz & Siddiki, 2021), by parsing the documents into institutional statements and dissecting their syntactic components (i.e., ADIBCO). A dataset was generated with 412 institutional rule
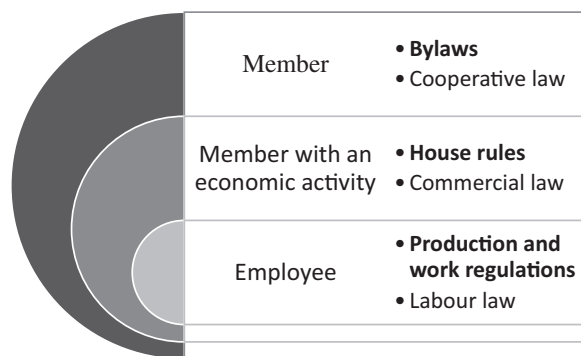

FIGURE 1   Rules designed by Smart and the respective national laws as they relate to the various roles that members have (adapted from: Smart, 2019).

TABLE 2　Overview of archival data

Type	Versions	Total number of pages
Bylaws	January 2017, June 2020	53
House rules	June 2017, December 2017, June 2020, May 2022	28
Production and work regulations	September 2015[a], November 2020, March 2022	121

[a]Since a version of the production and work regulations from Smart's early years as a cooperative (2017–2019) could not be retrieved, we used a version from 2015 to identify which rules from the November 2020 version are in fact older. However, we did not code rules only appearing in the September 2015 version, since it is unclear when these have been discarded exactly. Hence, we minimize the overestimation of institutional rule changes in 2020.
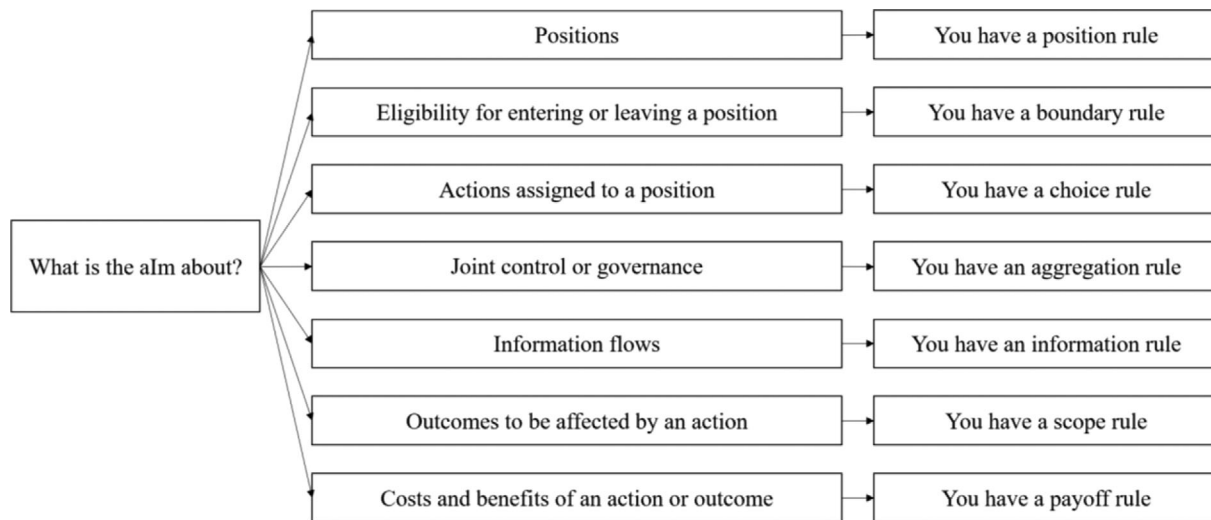

FIGURE 2　Decision tree to classify the aIm (adapted from: Watkins & Westphal, 2016), used for coding.

statements as the unit of analysis across rows, and syntactic components as variables with semantic classifications as values across columns (also see Appendix I). For each statement, we also registered its source document and the year it was introduced and, if applicable, discarded.

For our operationalization, we developed the institutional grammar's ability to measure institutional meaning at the component-level by integrating various semantic classifications (De Moor et al., 2016; Frantz & Siddiki, 2021; Ostrom, 2005). The syntactic components (i.e., ADIBCO) then function as categorical variables, while semantic classifications are used to specify the possible values. For the Attribute, we adapted five rule parties from De Moor et al. (2016): ordinary members, general assembly, officials, non-members, cooperative as a whole, and other. In the current study, we are particularly interested in regulations directed at ordinary members of Smart.

To classify oBjects, we used the same rule parties except for the addition of an inanimate category that is of special interest: collective resources. This is a specification of the animacy taxonomy by Frantz and Siddiki (2021), which allows for comparing rules that do relate to collective resources with those that do not. In the coding process, we classified oBjects as collective resources if they referred to either protections and welfare provisions for members or to the finances required to create these collective resources.

The Deontic is measured similarly as in the institutional grammar 2.0 (Frantz & Siddiki, 2021) and in De Moor et al. (2016), using the following categories: permission, obligation, and prohibition. These categories express the relative stringency or discretion by which a certain rule is applied, which says something about how consistently a rule should be followed.

We used Ostrom's (2005) rule typology to classify the actions or outcomes in the aIm (see Fig. 2). Position rules concern the positions of actors (e.g., the position of member), while an actor's eligibility to enter or exit a position is regulated by boundary rules (e.g., membership criteria). If an aIm sets the actions for a position, it is a

choice rule. Aggregation rules relate to joint control over an action and determine how decisions are made when more than one actor is involved. The exchange of information between actors is defined by information rules. Scope rules specify the outcomes to be affected by actions. Hence, choice and scope statements capture any action or outcome respectively that does not fit under one of the other types. Finally, payoff statements assign costs and benefits to an action or outcome.

The institutional grammar 2.0 (Frantz & Siddiki, 2021) provides a detailed Context taxonomy to specify whether activation conditions and execution constraints relate to: (1) temporality like a point in time, time frames, or frequencies; (2) spatiality such as locations, directions, or paths; (3) domain of activity, topic or existence; (4) order of procedure; (5) method like manners or instruments; (6) purpose; (7) state of affairs; and (8) event occurrences. Because institutional statements often provide multiple Context specifications, we classify separately for activation conditions and execution constraints if the taxonomy's categories apply or not. The Context specificity of each rule is then measured by counting the number of activation conditions and execution constraints, each ranging between 0 and 8.

For the Or else component, we used a simplified version of the sanction typology in De Moor et al. (2016) while also adding non-punitive incentives: (1) exclusion from membership; (2) exclusion from assembly; (3) lose official appointment; (4) gain official appointment; (5) lose right to use collective resources; (6) gain right to use collective resources; (7) monetary fine; (8) monetary bonus; (9) exposure of compliance; (10) exposure of violation; (11) legal action; and (12) other.

Our analytic approach consists of three steps. First, we provided a performance overview of Smart Belgium based on its annual reports between 2017 and 2022 to identify if and when pressure on collective resources has increased. After all, these collective resources are primarily funded by the commission on all transactions that members conduct via the cooperative. The overview is based on data provided by Smart about their total number of members and the cooperative's turnover. Second, we compared the extent of institutional change during the external shocks to the preceding and following periods. To assess whether the rules changed in response to any of the external shocks, the number of rules added or removed in each year provided some initial insight. We then inspected Smart's accompanying rationale for rule changes, but their stated reason could not be taken at face value as it allows for multiple interpretations. The nature of rule changes was examined by comparing the components of rules that changed in 2020 versus the rules that did not change, which evidenced that institutional change occurred in response to only one of the two external shocks. Third, we further examined what kind of rules are used to mitigate members' opportunism. We did so by analyzing the characteristics of rules that apply to ordinary members (Attribute) and have to do with collective resources (oBject), since these rules regulate how members use and contribute to collective resources. In particular, we compare these rules to all other rules on stringency (Deontic), type (aIm), activation conditions and execution constraints (Context), and incentives (Or else).

4. Findings

Since becoming a cooperative in 2017, Smart has grown steadily and more than doubled the number of members to almost 35,000 in 2022 (see Fig. 3). The height of the COVID-19 pandemic, 2020–2021, shows little to no deviation from this pattern. Hence, while membership increased during this external shock event, it did not do so more strongly than in the period before or after. The total number of members does not show how many members left the cooperative in a given year, but it is clear that the influx of new members was continuously greater than the outflux of members.

A clearer impact of COVID-19 as an external shock can be observed in Smart's financial performance, which is shown in Figure 4. Smart experienced a negative net result of over five million euros in 2020, which also resulted in a 20.5 percentage point loss in equity compared to 2018. In their annual report of 2020, Smart Belgium explains this poor performance as a direct result of members being unable to work due to lockdowns during the pandemic. Nevertheless, it becomes clear that Smart was already making a recovery in 2021, reporting a positive net result of more than 300,000 euros and only a 15.3 percentage point loss in equity compared to 2018. Hence, if Smart adapted its regulative institutions in response to sudden resource scarcity caused by the pandemic, we should be able to find it in 2020.
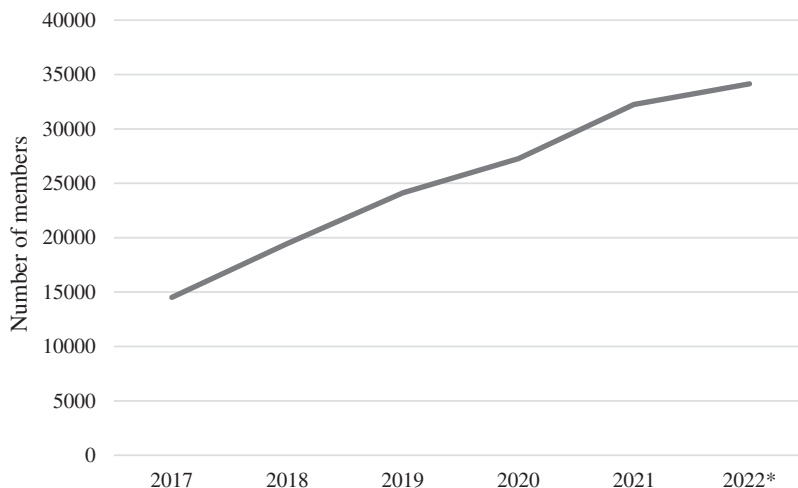
FIGURE 3 Number of members in Smart Belgium since 2017 (*2022 is a provisional number).
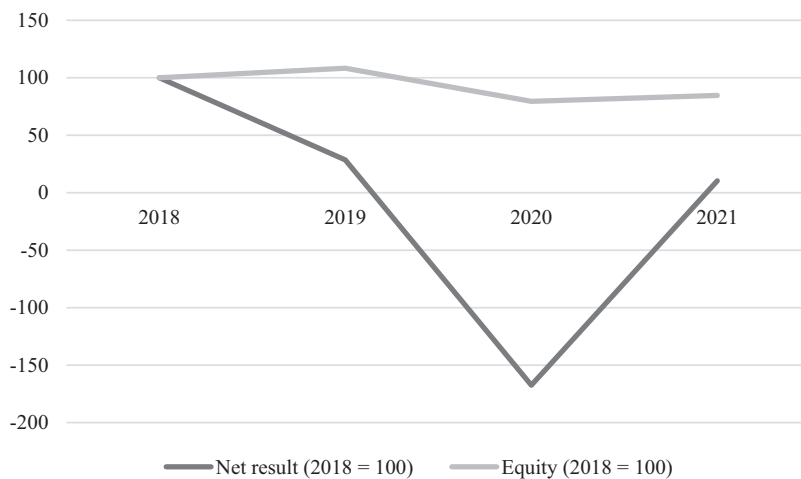

FIGURE 4 Indexed financial performance of Smart since 2018, in net result and equity.
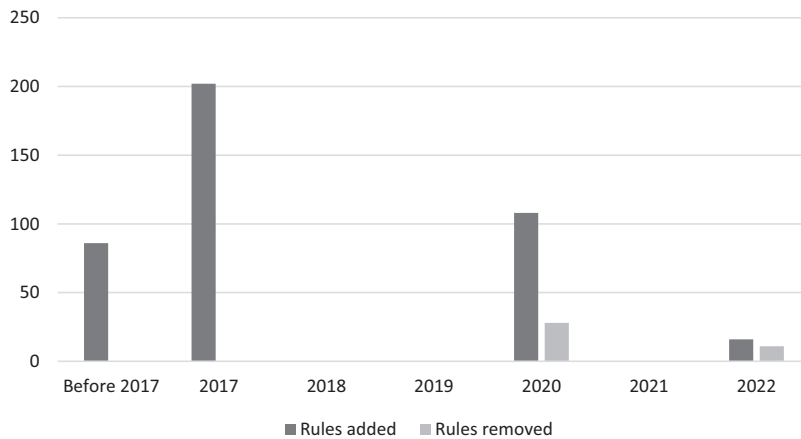

FIGURE 5 Number of rules added and removed each year in Smart between 2017 and 2022.

Figure 5 shows the institutional change per year. After being formed as a cooperative in 2017, we observe 108 rules added and 28 rules removed in 2020. Then 2 years later, in 2022, we find only 16 rules added and 11 rules removed. In their accompanying rationale for changing the bylaws during a general assembly meeting on 23 June 2020, Smart does not refer to the COVID-19 pandemic as direct reason for its revised rules (Smart, 2020). Instead, they point to Belgium's new cooperative law issued on 23 March 2019, which became applicable for already existing cooperatives like Smart in 2020 and is binding by 1 January 2024. Thus, while resource scarcity due to the pandemic is not mentioned as a reason for the institutional change in 2020, an external shock of a different nature is: national policy change. The new cooperative law only required minor changes in terminology and technical specifications, but in its rationale for the rule changes of 2020 Smart describes it as "a good occasion to repeat or specify certain principles or concepts." In other words, it is likely that more rules were changed than strictly required by the new cooperative law. It could still be the case that some rules were changed in response to the pandemic, but that it is not mentioned by Smart for reputational reasons. Hence, it is crucial to look at the nature of institutional change to fully refute a pandemic-effect and to ascertain it is indeed related to the new cooperative law.

If we compare the aIm of rules that changed in 2020 versus rules that did not change in 2020 (see Table 3), we find significantly more position and boundary rules but fewer choice and scope rules: $\chi^2(6, 412) = 15.40$, $p = 0.02$. We also find that rules which changed in 2020 had significantly more execution constraints: $r_{pb} = 0.14$, $p = 0.004$. However, there is no evidence for significant differences in the other rule components nor do we find that rules which changed in 2020 are significantly more often rules against opportunistic member behavior. This is in line with Smart's stated reason for the rule changes in 2020, because the new cooperative law standardizes the positions that can be held (i.e., position rules) and when one becomes eligible for these positions (i.e., boundary rules). More specifically, in 2020 Smart changed their membership categories to more clearly distinguish members on the executive staff from members that are external partners and set additional eligibility requirements for running in a board election. We can also refute the notion of a pandemic-effect, since the rules that changed in 2020 were not more often about collective resources (oBject) nor directed at mitigating opportunism (Attribute = ordinary members, oBject = collective resources). Institutional change during the period of observation is therefore related to only one external shock: national policy change.

Next, we analyze what kind of rules are used to mitigate opportunistic member behavior in Smart. A few patterns can be observed. First of all, compared to all other rules, the Deontics of rules against opportunism are significantly more stringent (see Table 4): $\chi^2(3, 412) = 12.34$, $p = 0.01$. In particular, by obligating contributions to collective resources (obligation = 45.45% in opportunism rules compared to 22.16% in other rules) and to a lesser extent also by prohibiting overuse (prohibition = 9.09% in opportunism rules compared to 6.33% in other rules). Second, we find significant differences in the aIm of rules against opportunism compared to all other rules (see Table 5): $\chi^2(6, 412) = 22.97$, $p = 0.001$. Opportunistic member behavior is especially regulated by boundary (15.15% compared to 10.03%), choice (39.39% compared to 22.16%), scope (15.15% compared to 8.71%), and payoff rules (24.24% compared to 10.82%). Third, we find that rules against opportunism had significantly more execution constraints that specify its application: $r_{pb} = 0.17$, $p = 0.001$. Finally, there is no evidence for significant differences in the other rule components. It is particularly striking that most rules did not specify a sanction in

TABLE 3 Relative frequencies of the aIm in rules that changed in 2020 versus rules that did not change in 2020 (change = added or removed)

	Rules that did not change in 2020	Rules that changed in 2020
aIm = position	4.35%	7.35%
aIm = boundary	6.88%	17.65%
aIm = choice	25.72%	19.12%
aIm = aggregation	19.93%	18.38%
aIm = information	19.93%	20.59%
aIm = scope	10.51%	6.62%
aIm = payoff	12.68%	10.29%
Total	276 (100%)	136 (100%)

TABLE 4 Relative frequencies of the Deontic in rules against opportunism (Attribute = ordinary members, oBject = collective resources) compared to all other rules

	Other rules	Opportunism rules
Deontic = none	45.12%	18.18%
Deontic = permission	26.39%	27.27%
Deontic = obligation	22.16%	45.45%
Deontic = prohibition	6.33%	9.09%
Total	379 (100%)	33 (100%)

TABLE 5 Relative frequencies of the aIm in rules against opportunism (Attribute = ordinary members, oBject = collective resources) compared to all other rules

	Other rules	Opportunism rules
aIm = position	5.80%	0.00%
aIm = boundary	10.03%	15.15%
aIm = choice	22.16%	39.39%
aIm = aggregation	21.11%	0.00%
aIm = information	21.37%	6.06%
aIm = scope	8.71%	15.15%
aIm = payoff	10.82%	24.24%
Total	379 (100%)	33 (100%)

the Or else, regardless of whether these were rules against opportunism (96.97% Or else = none) or other rules (94.20% Or else = none).

5. Conclusions and discussion

Returning to our research question on how rules are used to curb members' opportunism in a heterogeneous cooperative while facing external shocks, the findings show no evidence that institutional change occurred in response to resource scarcity during the COVID-19 pandemic. Instead, we find that new national legislation motivated Smart to change their rules. At the same time, it is likely that many rule changes have no relation to an external shock at all. Moreover, the findings demonstrate what kind of rules are used against opportunistic behavior in a heterogenous cooperative. In particular, these are rules that obligate contributions to collective resources or prohibit overuse but without necessarily specifying any sanctions for non-compliance. Rules against opportunism mainly deal with members' actions (choice rules) or outcomes to be affected by members' actions (scope rules) with respect to collective resources. These rules often also specify entry or exit requirements for membership (boundary rules) and assign costs or benefits to members (payoff rules). Smart does not apply rules against opportunistic behavior without any restraint. In fact, rules aimed at mitigating opportunism contain more execution constraints than other rules do. Taken together, these findings illustrate how cooperatives can design regulative institutions in order to preserve and protect collective resources when faced with internal and external impediments.

This explorative study makes three important contributions. First, it further develops the institutional grammar's ability to measure institutional meaning whereas most of the existing institutional grammar research focuses on institutional structure (Dunlop et al., 2019). Attempts at classifying institutional meaning on the component-level have long been fragmented and included only a limited number of components (De Moor et al., 2016; Frantz & Siddiki, 2021), which are now integrated in the current study. The resulting data structure contains institutional statements as the unit of analysis across rows, and syntactic components as variables with semantic classifications as values across columns. Such an adaptation of the institutional grammar methodology can also be used to study the rules, norms and strategies of other types of cooperatives or different types of organizations. Future research could, for example, use it to compare rules, norms and strategies across policy

documents, organizations, or contexts. A limitation is that component-level classifications are typically context-specific. For example, the rule parties taken from De Moor et al. (2016) to operationalize the Attribute component work well for community-based organizations such as cooperatives but would be less applicable for the analysis of public policies created by governments. In addition, some component-level classifications would likely benefit from greater detail. While the rule typology by Ostrom (2005) is commonly used in institutional grammar research, future research would likely benefit from unpacking the "container categories" of choice and scope rules into a more meaningful classification for the aIm.

Second, the findings show that external shocks with sudden resource scarcity (COVID-19) do not necessarily motivate rule changes while external shocks without an effect on collective resources (new national legislation) can motivate rule changes. Despite the pandemic's negative effect on Smart's financial performance, rule change was not motivated by efficiency pressures but by institutional pressures of conforming to new standards and thereby gaining legitimacy (DiMaggio & Powell, 1983). A clear implication of this finding for theorizing how collective resource management adapts to external shocks is that a wider variety of external shock types needs to be taken into account. There are at least two dimensions that can help advance the study of external shocks by creating a spectrum along their axes. The vertical axis entails the impact on collective resources, which ranges from external shocks that result in resource scarcity to relatively understudied external shocks that have no impact on collective resources at all or that generate resource abundance (Tschopp et al., 2018). The horizontal axis describes whether external shocks are sudden but temporary or more slowly developing and long-lasting (Dehkordi et al., 2021; van Bavel et al., 2020). While most literature focuses on how collective resource management changes its rules in response to an external shock that creates resource scarcity (on the vertical axis), more attention is needed for institutional change as a result of rapid and slow onset external shocks (on the horizontal axis). Some pioneering research shows that external shocks with a slow onset present most difficulties for collective resource management, because members then perceive a lower individual agency (Cerutti & Schlüter, 2019). Future research should examine if these external shocks are also the most conducive to institutional change.

Third, the study provides support for the notion that cooperatives with a heterogeneous membership design rules to prevent members from overusing or under-contributing to collective resources (Geary et al., 2019; Van Klingeren, 2022). In particular, by obligating them to do their part, restricting access to membership, or assigning costs and benefits. It is also striking how rules against opportunism are applied with restraint, since they have more execution constraints and similarly little sanctions as other rules. This is in line with recent research that questions the importance of sanctioning for preventing opportunism in collective resource management (De Moor et al., 2021). While the effectiveness of certain rules in mitigating opportunistic member behavior requires further assessment, for instance by observing compliance behavior, their design shows that cooperation in heterogeneous groups is not necessarily destined to fail (Bhardwaj & Sergeeva, 2022; Soetens & Huybrechts, 2022).

As worker cooperatives have emerged as collective good producers in the gig economy (Navarra, 2015), by providing their members with more secure working conditions, it is timely to examine how such cooperatives design regulative institutions in order to preserve and protect this collective good. Especially since the vast majority of research on collective resource management still focuses on natural resources and has neglected the human-made resources of worker cooperatives (Tortia, 2018). Bottom-up organizing in cooperatives provides gig workers with protections against various kinds of insecurity (Koene & Pichault, 2021; Lorquet et al., 2018), while at the same time giving them influence in shaping the institutional rules of the game (Eum, 2019; Martinelli, 2021; Mondon-Navazo et al., 2022). Our analysis emphasizes the importance of regulative institutions for resilience in these heterogeneous cooperatives.

Acknowledgments

Data availability statement

The data that support the findings of this study are openly available in EUR Data Repository at https://doi.org/10.25397/eur.22717171.v1.

References

Abebe, Y. A., Ghorbani, A., Nikolic, I., Vojinovic, Z., & Sanchez, A. (2019). A coupled flood-agent-institution modelling (CLAIM) framework for urban flood risk management. *Environmental Modelling & Software*, 111, 483–492. https://doi.org/10.1016/j.envsoft.2018.10.015

Basurto, X., Kingsley, G., McQueen, K., Smith, M., & Weible, C. M. (2010). A systematic approach to institutional analysis: Applying Crawford and Ostrom's grammar. *Political Research Quarterly*, 63(3), 523–537. https://doi.org/10.1177/1065912909334430

Bhardwaj, A., & Sergeeva, A. (2022). Values-based trust as a shift parameter for collective organizing: The case of magnum photos. *Journal of Management Studies*, 60, 2022–2059. https://doi.org/10.1111/joms.12820

Billiet, A., Dufays, F., Friedel, S., & Staessens, M. (2021). The resilience of the cooperative model: How do cooperatives deal with the COVID-19 crisis? *Strategic Change*, 30(2), 99–108. https://doi.org/10.1002/jsc.2393

Bunders, D. J., & Akkerman, A. (2023). Commitment issues? Analysing the effect of preference deviation and social embeddedness on member commitment to worker cooperatives in the gig economy. *Economic and Industrial Democracy*, 44(4), 1007–1026. https://doi.org/10.1177/0143831X221101425

Carini, C., & Carpita, M. (2014). The impact of the economic crisis on Italian cooperatives in the industrial sector. *Journal of Co-Operative Organization and Management*, 2(1), 14–23. https://doi.org/10.1016/j.jcom.2014.03.001

Cerutti, N., & Schlüter, A. (2019). Resource changes: Exogenous or endogenous, gradual or abrupt. Experimental evidence. *International Journal of Environmental Studies*, 76(6), 1004–1018. https://doi.org/10.1080/00207233.2019.1644022

Conte, T. (2022). A natural disaster framed common pool resource game yields no framing effects among Mongolian pastoralists. *Human Ecology*, 50(2), 259–271. https://doi.org/10.1007/s10745-021-00287-0

Cook, M. L. (2018). A life cycle explanation of cooperative longevity. *Sustainability*, 10(5), Article 5. https://doi.org/10.3390/su10051586

Crawford, S. E. S., & Ostrom, E. (1995). A grammar of institutions. *American Political Science Review*, 89(3), 582–600. https://doi.org/10.2307/2082975

Cristini, A., Grasseni, M., & Signori, S. (2023). Can worker cooperatives stabilize employment and remain financially sound during a prolonged recession? *Applied Economics*, 55(33), 1–21. https://doi.org/10.1080/00036846.2022.2118963

De Moor, T. (2008). The silent revolution: A new perspective on the emergence of commons, guilds, and other forms of corporate collective action in Western Europe*. *International Review of Social History*, 53(S16), 179–212. https://doi.org/10.1017/S0020859008003660

De Moor, T. (2015). *The dilemma of the commoners: Understanding the use of common-pool resources in long-term perspective*. Cambridge University Press.

De Moor, T., Farjam, M., van Weeren, R., Bravo, G., Forsman, A., Ghorbani, A., & Ale Ebrahim Dehkordi, M. (2021). Taking sanctioning seriously: The impact of sanctions on the resilience of historical commons in Europe. *Journal of Rural Studies*, 87, 181–188. https://doi.org/10.1016/j.jrurstud.2021.08.009

De Moor, T., Laborda-Pemán, M., Lana-Berasain, J. M., Weeren, R. v., & Winchester, A. (2016). Ruling the commons. Introducing a new methodology for the analysis of historical commons. *International Journal of the Commons*, 10(2), Article 2. https://doi.org/10.18352/ijc.760

Dehkordi, M. A. E., Ghorbani, A., Bravo, G., Farjam, M., van Weeren, R., Forsman, A., & De Moor, T. (2021). Long-term dynamics of institutions: Using ABM as a complementary tool to support theory development in historical studies. *Journal of Artificial Societies and Social Simulation*, 24(4), 7.

Desson, Z., Weller, E., McMeekin, P., & Ammi, M. (2020). An analysis of the policy responses to the COVID-19 pandemic in France, Belgium, and Canada. *Health Policy and Technology*, 9(4), 430–446. https://doi.org/10.1016/j.hlpt.2020.09.002

Dhyne, E., & Duprez, C. (2021). Belgian firms and the COVID-19 crisis. *NBB, Economic Review*, *September*, 68–89.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160. https://doi.org/10.2307/2095101

Dunlop, C. A., Kamkhaji, J. C., & Radaelli, C. M. (2019). A sleeping giant awakes? The rise of the Institutional Grammar Tool (IGT) in policy research. *Journal of Chinese Governance*, 4(2), 163–180. https://doi.org/10.1080/23812346.2019.1575502

Ensminger, J. (1996). *Making a market: The institutional transformation of an African society*. Cambridge University Press.

Eum, H. (2019). *All for one—Response of worker-owned cooperatives to non-standard employment*. CECOP. https://cecop.coop/works/cecop-report-all-for-one-reponse-of-worker-owned-cooperatives-to-non-standard-employment

Frantz, C., & Siddiki, S. (2021). *Institutional grammar: Foundations and applications for institutional analysis*. Springer Nature.

Gatiso, T. T., Vollan, B., & Nuppenau, E.-A. (2015). Resource scarcity and democratic elections in commons dilemmas: An experiment on forest use in Ethiopia. *Ecological Economics*, 114, 199–207. https://doi.org/10.1016/j.ecolecon.2015.04.005

Geary, J., Reay, T., & Bubela, T. (2019). The impact of heterogeneity in a global knowledge commons: Implications for governance of the DNA barcode commons. *International Journal of the Commons*, 13(2), Article 2. https://doi.org/10.5334/ijc.861

Guttmann, A. (2021). Commons and cooperatives: A new governance of collective action. *Annals of Public and Cooperative Economics*, 92(1), 33–53. https://doi.org/10.1111/apce.12291

Hardin, G. (1968). The tragedy of the commons. *Science*, 162(3859), 1243–1248. https://doi.org/10.1126/science.162.3859.1243

Hart, O., & Moore, J. (1996). The governance of exchanges: Members' cooperatives versus outside ownership. *Oxford Review of Economic Policy*, 12(4), 53–69. https://doi.org/10.1093/oxrep/12.4.53

Koene, B. A. S., & Pichault, F. (2021). Embedded fixers, pragmatic experimenters, dedicated activists: Evaluating third-party labour market actors' initiatives for skilled project-based workers in the gig Economy. *British Journal of Industrial Relations*, 59(2), 444–473. https://doi.org/10.1111/bjir.12563

Kollock, P. (1998). Social dilemmas: The anatomy of cooperation. *Annual Review of Sociology*, 24(1), 183–214. https://doi.org/10.1146/annurev.soc.24.1.183

Kramer, R. M. (1989). When the going gets tough: The effects of resource scarcity on group conflict and cooperation. In E. Lawler & B. Markovsky (Eds.), *Advances in group processes* (pp. 151–177). JAI Press.

Landolt, G., & Haller, T. (2015). Alpine common property institutions under change: Conditions for successful and unsuccessful collective action by alpine farmers in the Canton of Grisons, Switzerland. *Human Organization*, 74(1), 100–111. https://doi.org/10.17730/humo.74.1.x55m464806q67156

Lawrence, T. B., & Suddaby, R. (2006). Institutions and institutional work. In *The SAGE handbook of organization studies* (2nd ed., pp. 215–254). SAGE Publications Ltd.. https://doi.org/10.4135/9781848608030

Lorquet, N., Orianne, J.-F., & Pichault, F. (2018). Who takes care of non-standard career paths? The role of labour market intermediaries. *European Journal of Industrial Relations*, 24(3), 279–295. https://doi.org/10.1177/0959680117740425

Martinelli, F. (2021). *LIGHTS ON! Worker and social cooperatives tackling undeclared work*. CECOP. https://cecop.coop/works/cecop-report-lights-on-worker-and-social-cooperatives-tackling-undeclared-work

Mesdaghi, B., Ghorbani, A., & de Bruijne, M. (2022). Institutional dependencies in climate adaptation of transport infrastructures: An Institutional Network Analysis approach. *Environmental Science & Policy*, 127, 120–136. https://doi.org/10.1016/j.envsci.2021.10.010

Mirabel, T. (2021). Survival advantage of worker buyouts over newly created worker-owned firms. *Journal of Participation and Employee Ownership*, 4(3), 212–234. https://doi.org/10.1108/JPEO-08-2021-0006

Mondon-Navazo, M., Murgia, A., Borghi, P., & Mezihorak, P. (2022). In search of alternatives for individualised workers: A comparative study of freelance organisations. *Organization*, 29(4), 736–756. https://doi.org/10.1177/13505084211041709

Murgia, A., & de Heusch, S. (2020). It started with the arts and now it concerns all sectors: The case of smart, a cooperative of 'Salaried Autonomous Workers'. In S. Taylor & S. Luckman (Eds.), *Pathways into creative working lives* (pp. 211–230). Springer International Publishing. https://doi.org/10.1007/978-3-030-38246-9_12

Navarra, C. (2015). Worker co-operatives as Collective Entrepreneurial Action: Review of the economic literature and new theoretical insights. In A. Jensen, G. Patmore, & E. Tortia (Eds.), *Cooperative Enterprises in Australia and Italy: Comparative analysis and theoretical insights* (pp. 157–173). Firenze University Press.

Olson, M. (1965). *The logic of collective action: Public goods and the theory of groups*. Harvard University Press.

Ostrom. (2005). *Understanding institutional diversity*. Princeton University Press. https://press.princeton.edu/books/paperback/9780691122380/understanding-institutional-diversity

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.

Peuter, G. d., & Dyer-Witheford, N. (2010). Commons and cooperatives. *Affinities: A Journal of Radical Theory, Culture, and Action*, 4(1), 30–56. https://ojs.library.queensu.ca/index.php/affinities/article/view/6147

Prushinskaya, O., Pockrandt, J., McKinley, J., & Hoover, M. (2021). When workers matter most: A study of worker cooperatives and the prioritization of workers through COVID-19. *Journal of Participation and Employee Ownership*, 4(2), 106–115. https://doi.org/10.1108/JPEO-08-2021-0009

Rice, D., Siddiki, S., Frey, S., Kwon, J. H., & Sawyer, A. (2021). Machine coding of policy texts with the Institutional Grammar. *Public Administration*, 99(2), 248–262. https://doi.org/10.1111/padm.12711

Sacchetti, S., & Tortia, E. (2015). The Silver Lining of Co-operation: Self-defined rules, common resources, motivations, and incentives in co-operative firms. In A. Jensen, G. Patmore, & E. Tortia (Eds.), *Cooperative Enterprises in Australia and Italy: Comparative analysis and theoretical insights* (pp. 175–190). Firenze University Press.

Schlüter, A., & Theesfeld, I. (2010). The grammar of institutions: The challenge of distinguishing between strategies, norms, and rules. *Rationality and Society*, 22(4), 445–475. https://doi.org/10.1177/1043463110377299

Siddiki, S., Weible, C. M., Basurto, X., & Calanni, J. (2011). Dissecting policy designs: An application of the institutional grammar tool. *Policy Studies Journal*, 39(1), 79–103. https://doi.org/10.1111/j.1541-0072.2010.00397.x

Smart. (2019). *Op ontdekking door Smart*. Smart.

Smart. (2020). Buitengewone algemene vergadering van SmartCoop van 23 juni 2020: Herziening van de statuten—Toelichting [Extraordinary general assembly of SmartCoop of 23 June 2020: Revision of the bylaws—Explanation].

Soetens, A., & Huybrechts, B. (2022). Resisting the tide: The roles of ideology in sustaining alternative organizing at a self-managed cooperative. *Journal of Management Inquiry*, 32, 134–151. https://doi.org/10.1177/10564926211070429

Stanford, J. (2017). The resurgence of gig work: Historical and theoretical perspectives. *The Economic and Labour Relations Review*, 28(3), 382–401. https://doi.org/10.1177/1035304617724303

Tortia, E. C. (2018). The firm as a common. Non-divided ownership, patrimonial stability and longevity of co-operative enterprises. *Sustainability*, 10(4), Article 4. https://doi.org/10.3390/su10041023

Tschopp, M., Bieri, S., & Rist, S. (2018). Quinoa and production rules: How are cooperatives contributing to governance of natural resources? *International Journal of the Commons*, 12(1), Article 1. https://doi.org/10.18352/ijc.826

Vallas, S. P., & Schor, J. B. (2020). What do platforms do? Understanding the gig economy. *Annual Review of Sociology*, 46, 273–294.

van Bavel, B., Curtis, D., Dijkman, J., Hannaford, M., De Keyzer, M., Van Onacker, E., & Soens, T. (2020). *Disasters and history: The vulnerability and resilience of past societies*. Cambridge University Press. https://doi.org/10.1017/9781108569743

Van Klingeren, F. (2022). Using player types to understand cooperative behaviour under economic and sociocultural heterogeneity in common-pool resources: Evidence from lab experiments and agent-based models. *PLoS One*, 17(5), e0268616. https://doi.org/10.1371/journal.pone.0268616

Vriens, E., & De Moor, T. (2020). Mutuals on the move: Exclusion processes in the welfare state and the rediscovery of mutualism. *Social Inclusion*, 8(1), 225–237. https://doi.org/10.17645/si.v8i1.2125

Watkins, C., & Westphal, L. M. (2016). People don't talk in institutional statements: A methodological case study of the institutional analysis and development framework. *Policy Studies Journal*, 44(S1), S98–S122. https://doi.org/10.1111/psj.12139

Weible, C. M., Yordy, J., Heikkila, T., Yi, H., Berardo, R., Kagan, J., & Chen, C. (2020). Portraying the structure and evolution of polycentricity via policymaking venues. *International Journal of the Commons*, 14(1), Article 1. https://doi.org/10.5334/ijc.1021

Williamson, O. E. (1985). *The economic institutions of capitalism*. Free Press.

Woodcock, J., & Graham, M. (2020). *The gig economy: A critical introduction*. Polity Press.

Xhauflair, V., Huybrechts, B., & Pichault, F. (2018). How can new players establish themselves in highly institutionalized labour markets? A Belgian case study in the area of project-based work. *British Journal of Industrial Relations*, 56(2), 370–394. https://doi.org/10.1111/bjir.12281

Codebook of institutional grammar coded database on Smart's rules

Variable	Measurement	Values
ID	Unique identification number for each institutional rule statement	1 to n
Source	Source label	Source name and version number
Year_added	Year that rule was added	Year
Year_removed	Year that rule was removed	Year
A	Literal coding of Attribute	Text fragment from source document
A_party	Classification of Attribute	Ordinary members (1), general assembly (2), officials (3), non-members (4), cooperative as a whole (5), other (6)
D	Literal coding of Deontic	Text fragment from source document
D_modal	Classification of Deontic	Permission (1), obligation (2), prohibition (3)
I	Literal coding of aIm	Text fragment from source document
I_type	Classification of aIm	Position (1), boundary (2), choice (3), aggregation (4), information (5), scope (6), payoff (7)
B	Literal coding of oBject	Text fragment from source document
B_party	Classification of oBject	Ordinary members (1), general assembly (2), officials (3), non-members (4), cooperative as a whole (5), collective resources (6), other (7)
Cac	Literal coding of Context activation condition	Text fragment from source document
AC_temp	Activation condition refers to temporality like a point in time, time frames, or frequencies	No (0), yes (1)
AC_spat	Activation condition refers to spatiality such as locations, directions, or paths	No (0), yes (1)
AC_dom	Activation condition refers to domain of activity, topic or existence	No (0), yes (1)
AC_ord	Activation condition refers to order of procedure	No (0), yes (1)
AC_meth	Activation condition refers to method like manners or instruments	No (0), yes (1)
AC_purp	Activation condition refers to purpose	No (0), yes (1)
AC_state	Activation condition refers to state of affairs	No (0), yes (1)

(Continues)

Variable	Measurement	Values
AC_event	Activation condition refers to event occurrences	No (0), yes (1)
Cec	Literal coding of Context execution constraint	Text fragment from source document
EC_temp	Execution constraint refers to temporality like a point in time, time frames, or frequencies	No (0), yes (1)
EC_spat	Execution constraint refers to spatiality such as locations, directions, or paths	No (0), yes (1)
EC_dom	Execution constraint refers to domain of activity, topic or existence	No (0), yes (1)
EC_ord	Execution constraint refers to order of procedure	No (0), yes (1)
EC_meth	Execution constraint refers to method like manners or instruments	No (0), yes (1)
EC_purp	Execution constraint refers to purpose	No (0), yes (1)
EC_state	Execution constraint refers to state of affairs	No (0), yes (1)
EC_event	Execution constraint refers to event occurrences	No (0), yes (1)
O	Literal coding of Or else	Text fragment from source document
O_type	Classification of Or else	Exclusion from membership (1), exclusion from assembly (2), lose official appointment (3), gain official appointment (4), lose right to use collective resources (5), gain right to use collective resources (6), monetary fine (7), monetary bonus (8), exposure of compliance (9), exposure of violation (10), legal action (11), other (12)