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How Self-regulating can it be? Explaining Limitations in Firms' Compliance with Reflexive Regulation

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Abstract

The article investigates whether reflexive regulation, which emphasizes the regulatee's ability to self-regulate – and in particular to adapt their organizational structure and behavior to the regulators' prescriptive goals – leads to companies behaving in the way prescribed by the regulator. Five conditions, which can explain why companies comply or do not comply with reflexive regulation, are specified and then tested empirically. The findings show that almost half of the companies did not comply, or complied only partly, with the reflexive regulation, and that for companies to comply with reflexive regulation certain conditions are salient, including worker involvement, professionalization, and management support. The overall results highlight the limitations of a self-regulatory approach and stress the heterogeneity of companies.

Keywords

public policy, self-regulation, QCA, occupational health and safety, reflexive regulation, Denmark, regulatory compliance

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Introduction

The public regulation of companies and their behavior remains a core societal challenge (Baldwin et al., 2012; Parker & Nielsen, 2011; Wilson, 1980). However, regulating – and not least inspecting – companies requires significant public resources, particularly in policy areas such as environmental protection, food safety, and occupational health and safety (OHS). Therefore, the traditional “command-and-control” approach has been criticized in these policy areas for being both ineffective and too costly (Aalders & Wilthagen, 1997; Ayres & Braithwaite, 1992; Sinclair, 1997; Teubner, 1983). The logic behind command-and-control systems was mainly one of deterrence through the threat of punitive action by the regulator toward regulatees (Parker & Braithwaite, 2003). From the 1970s onwards, various forms of self-regulating practices at company level have supplemented, and in many cases replaced, the command-and-control approach as a way of reducing the public resources needed and to increase the efficacy of public regulation (Ayres & Braithwaite, 1992; Gilad, 2010; Gunningham & Grabosky, 1998; Teubner, 1983). However, the optimal balance between deterrence and self-regulatory practices remains disputed, and the self-regulatory approaches have been criticized for resembling deregulation rather than regulatory innovation (Tombs & Whyte, 2013; Tucker, 2013).

Initially, the new regulatory approach was labelled *self-regulation* and later *enforced self-regulation* (Braithwaite, 1982); however, various terms (with somewhat diverging diagnoses of the phenomenon) have been used over the years (Gilad, 2010).¹ While it is clear that there are important differences between these terms, they all analyze aspects of the same underlying development in the regulatory and legal approach: a shift from a formal rational approach, based on deterrence and universality, to one of focusing increasingly on regulation of the organizations’ own “compliance systems” and – more importantly – on their capacities for *self-evaluation* of their conduct and their compliance systems, instead of on regulating direct output and operations (Gilad, 2010). I refer here to this type of self-regulation as “reflexive regulation” (cf. Aalders & Wilthagen, 1997; Teubner, 1983; Treiber, 1985). The ideal is that reflexive law and regulation will lead to the systematic development of “reflexion structures” at the firm level (Teubner, 1983, p. 275; Parker, 2002). Following earlier contributions, I define reflexive regulation as regulation that specifies policy goals rather than the means of achieving these, while emphasizing regulatees’ own ability to self-regulate and, more importantly, to adapt their organizational structure and behavior to the regulators’ prescriptive goals. Although reflexive regulation has been on the agenda for decades, the knowledge of why companies comply with reflexive regulation is still limited (Dunlop et al., 2012; Thomann, 2017) and this article contributes to filling this knowledge gap. In addition, it is not clear whether a certain high level of “*reflexivity*” may result in companies simply abstaining from complying with the reflexive regulation, turning it into mere deregulation, as argued by some critics (Tombs & Whyte, 2013; Tucker, 2013).

The overall research question that this article addresses is: What conditions explain the degree of companies’ compliance with reflexive regulation? The aim is thus to explain compliance *as well as* non-compliance. This article thus contributes by providing knowledge on *why* companies may (or may not) comply with reflexive regulation by examining the conditions under which companies comply (or not), hence scrutinizing the limits of reflexive regulation. This is done through a qualitative comparative analysis (QCA) of 61 companies’ compliance with a

1 — These include “meta-regulation” (Parker, 2002), “smart-regulation” (Gunningham & Grabosky, 1998), and “responsive regulation” (Ayres & Braithwaite, 1992), among others. See Gilad (2010) for a discussion of the commonalities.

2010 reform of Danish occupational health and safety (OHS) legislation, which can be seen as the culmination of reflexive regulation in this field (Hasle et al., 2016). It is argued that regulatory contexts such as the Danish one, characterized by effective tripartism – where strong partners can negotiate and implement the regulation – are more likely to lead to compliance with various forms of self-regulation (Ayres & Braithwaite, 1992, p.54-100; Tombs & Whyte, 2013). This makes the case selection well suited to testing compliance with reflexive regulation in practice. Hence, it functions as a critical case in the sense that, if Danish companies are not complying with reflexive regulation, it is even less likely that companies in less favorable settings will do so.

This article proceeds as follows: I next present the context of the study before turning to the theoretical concept of reflexive regulation and the conditions that I hypothesize will determine the companies' degree of compliance. Thereafter I discuss QCA as a research approach, as well as the design and the data collection, before discussing measurement and operationalization (calibration in QCA terminology). Next, I present the empirical analysis and the results, and finally I discuss the implications of the results for reflexive regulation in relation to the literature.

The context of the study: Occupational health and safety (OHS) and reflexive regulation

OHS was one of the first policy fields where a more reflexive approach to regulation was introduced early on (Aalders & Wilthagen, 1997; Dawson et al., 1988; Tucker, 2013). Since the first work-safety laws were passed in most Western European countries in the mid-19th century, OHS regulation has evolved from narrow laws regulating specific issues (e.g., on child labor and unsafe machinery) into more comprehensive “workers’ protection acts” (Swuste et al., 2014), albeit still modeled after the command-and-control principles. However, a shift toward reflexive regulation started to occur in the late 1970s in most Western European countries, especially after the very influential “Robens Report” was published in 1972. This report, commissioned by the British government, criticized the command-and-control approach and called for increasing use of “self-regulation” (Aalders & Wilthagen, 1997; Dawson et al., 1988). The Robens Report showed that the increasing volume of “commands” of mandatory preventive actions and prohibitions of dangerous substances had prevented neither accident rates nor severe work-related health problems from reaching hitherto unseen heights. The debate over the Robens Report led governments in many Western European countries to adopt regulatory frameworks and laws that emphasized organizational responsibility and high degrees of self-regulation as the main regulatory strategy in the OHS policy field, rather than the command-and-control type of regulation.

The Danish OHS system and the 2010 reform

The Danish OHS system has been transformed from a prescriptive legislative system, where rules were firmly established in legislation and then inspected by the labor inspectorate, to a reflexive regulatory system where companies have substantial discretion in complying with the legislation. Denmark adopted the first reflexive framework in 1976, in the wake of the Robens Report, when the Work Environment Act was passed. The law is still in place today but has been revised numerous times since its inception. In recent years the most significant move toward more reflexive regulation came in 2010 when the regulatory framework and law underwent a major revision. In the initial proposal, the Minister of Employment underscored the policy-makers’ strong assumption of reflexivity in the new law:

“The bill makes it possible for enterprises to organize their cooperation on the work environment in a more flexible manner, so it will fit into the existing structure and tasks of the enterprise,... thus making it more efficient” (Minister of Employment, 2010).²

After its 2010 reform, the OHS legislation still retains some standard requirements – for instance, that companies must set up a basic OHS organization with employee and management representation – but the demands made on the OHS organizations have changed. Previously, the law defined the organizational structure, whereas it is now up to the companies to decide on the best design for the OHS organization in their particular organizational context. Furthermore, the election and training of OHS worker representatives remains compulsory, along with annual deliberations between management and workers on OHS matters. The Danish labor inspectorate, despite some noticeable reductions in funding in the last decade, still operates at a comparatively high level and inspects the organizational adaptation of the 2010 reform. All my case companies therefore face a credible risk of being inspected (and most have been inspected in the past).

The Danish labor market is characterized by strong social partners (unions and employer associations), who negotiate wages and working conditions bilaterally within the collective bargaining system. The state and legislation play a less dominant role than in most other industrial relations systems (Andersen et al., 2014) and the social partners are broadly represented at both national and local levels (in particular in the workplaces). The social partners also have a strong role in relation to OHS, although this is mainly regulated in legislation, yet when OHS legislation is passed, it is typically “cleared” with the social partners beforehand (typically in the tripartite Work Environment Council). If the social partners agree on certain policies, it can be difficult for the political system to oppose it (although this does occasionally happen). However, this leaves OHS regulation caught somewhere between the core issues of the partners’ voluntary regulation (in particular, wages) and the legislation (Jacobsen, 2011). This means, according to critics, that OHS is trapped in limbo, where the legislators respect the partners’ autonomy but the social partners’ devotion to OHS is constrained by the prominence of other core issues – in particular, wages. Overall, this results in inertia in terms of developing policies and improving the work environment at company level, where OHS is trapped between being a management issue and something managed by the local social partners in the OHS cooperation committees (Busck, 2014; Jacobsen, 2011). Finally, it is argued that employers do not pay enough attention to OHS because the financial burden of work injuries and accidents is, to a large extent, covered by the welfare state (Busck, 2014).

Reflexive regulation

The point of departure for reflexive regulation is summarized by Estlund (2010, p. 136) as the idea of reducing the centrality of the state in regulating companies’ behavior and of replacing direct regulatory commands with an emphasis on the regulated organizations’ own efforts to self-regulate. In particular, the latter part, which emphasizes the organizations’ self-governance and ability to adjust their behavior to fit the intentions of policymakers, is key in reflexive regulation. Teubner’s original, ideal version of reflexivity in law does not determine how companies act or perform, but rather supports an organizational development toward more reflexive practices that will improve performance (Teubner, 1983, p. 275). Hence, the pivotal

2 – Minister of Employment (Inger Støjberg), written proposal (skriftlig fremsættelse), Danish Parliament, 10 February 2010 for L126 “Forslag til lov om ændring af lov om arbejdsmiljø.”

dimension in reflexive regulation is the company's relation to "itself" (to paraphrase Aalders & Wilthagen, 1997, p. 415), rather than the relationship to a regulator. In reflexive regulation, the internal "reflexion structures", and the integration of societal goals into the company's market-oriented strategy (as highlighted by Teubner (1983)), take on an important role, where OHS considerations should be incorporated into the company's behavior and decision-making (Aalders & Wilthagen, 1997, p. 430-431). Following this, public (OHS) inspectors will ideally monitor the internal control systems rather than the OHS behavior itself.

The traditional "command-and-control" approach and "reflexive self-regulation", along with other types of self-regulation, can be seen as opposite ends of a continuum; however these rarely exist in pure forms, as most regulatory systems display elements of both (Fairman & Yapp, 2005, p. 492; Gunningham & Grabosky, 1998; Sinclair, 1997). Conversely, since the earliest theoretical perspective on reflexive regulation, it has been the subject of fierce scholarly debate between "optimists" who see the development as necessary and desirable, to "pessimists" who view the new regulatory systems as nothing more than deregulation and shifting responsibility onto employees and lower organizational echelons, in particular when combined with cutbacks in regulatory enforcement (Almond & Esbester, 2018; Almond & Gray, 2017; Tombs & Whyte, 2013). While much of this criticism has been UK-centered, Danish scholars have voiced the same critique in relation to the Danish OHS reform of 2010 (Busck, 2014).

Business compliance with public regulation in general, and reflexive regulation in particular, is complex and determined by a number of factors, such as monitoring of performance, fear, sense of duty, regulatory licenses, public pressure, law, and normative commitments of organizations and individuals within those organizations (Ayres & Braithwaite, 1992; De Nevers, 2010; Gunningham et al., 2005; Kagan et al. 2011; Nielsen & Parker, 2012; Winter & May, 2001). However, a frequent finding is that, for reflexive regulation to work, the regulator needs a credible and efficient enforcement and inspection capacity (Teubner, 1992; Aalders & Wilthagen, 1997). Hence, efficient self-regulation is found to be closely linked to inspection and the risk of governmental intervention (cf. the "shadow of hierarchy": De Nevers, 2010; Héritier & Eckert, 2008; Kagan et al. 2011; Rees, 1988; Short & Toffel, 2008, 2010), often aimed particularly at apprehending "regulatory laggards" (e.g., Lobel, 2005). Accordingly, the presence of a comparatively strong enforcement agent in this study, which increases the likelihood of compliance, could mean that the results are unique in terms of international comparison. Hence the Danish case serves as a critical case for assessing whether reflexive regulation is complied with in practice.

The regulatees' compliance with different types of regulation, including reflexive regulation, remains less studied (Dunlop et al., 2012; Thomann, 2017) and the overall knowledge of why reflexive regulation works or not is limited. I therefore seek to contribute to a better understanding of this core question. Despite the shortcomings, previous research has identified various conditions (beyond the risk of governmental intervention) explaining why reflexive regulation may be successful in achieving the aims of policymakers. Some of these come from a more generic approach to reflexive regulation (e.g., Lobel, 2005), while others come from empirical studies scrutinizing compliance with reflexive regulation. Fairman and Yapp (2005, p. 494) suggest that self-regulation is contingent upon worker empowerment, market conditions (economic incentives), company knowledge, and motivation and capacity for change. Genn (1993) argues that reflexive regulation works mainly in larger companies and under some sort of threat of coercion, combined with information and encouragement. Lobel (2005) highlights worker participation and state support for OHS management in companies (in addition to enforcement and inspection capacity so as to deal with non-compliant companies). Previous

research has additionally shown that companies must be seen as heterogeneous (Kagan et al., 2011; Lobel 2005; Nielsen & Parker, 2012) and both my research design and the QCA approach (see discussion below) helps to capture this heterogeneity in firm-level responses to regulation.

Conditions for compliance (and non-compliance) in reflexive regulation

Drawing on the literature, and on my own qualitative considerations, I arrive at five conditions, which I assume to be the main conditions that explain the outcome I am exploring, namely, compliance and non-compliance with reflexive regulation. These conditions are worker participation, professionalization, management support, external pressure, and being a public or private entity. Below, I discuss the theoretical expectations for each of these conditions.

Managerial commitment

Managerial commitment and support is important in explaining compliance at company level in relation to workplace health and safety in general (Dahler-Larsen & Sundby, 2019; Rees, 1988; Rundmo & Hale, 2003; Zohar, 2002) and reflexive regulation in OHS in particular (Dawson et al., 1988). I therefore expect management commitment to be a necessary condition in the analysis. If management neglects or even obstructs compliance, then compliance may very well be almost impossible. This applies to top management, yet it is equally important for line managers (Parker & Gilad, 2011). If line management is not on board, it may be of less relevance if top management is very engaged in compliance. Furthermore, Parker and Gilad (2011, p. 181-182) argue that managerial support needs to be sustained by compliance systems and by OHS professionals and employees acting to create actual compliance; hence I would expect managerial commitment to be an insufficient condition on its own. Managerial support may be driven by various factors, such as norms or societal pressure (cf. Parker & Gilad, 2011), but I do not engage in explaining the underlying factors here, and I only assess the degree to which management is committed to compliance. While managerial support is important, it may be further inhibited by the wider socio-economic context (Greasley & Edwards, 2015) which I thus include in the condition *external pressure*.

Worker participation

There is an abundant amount of literature highlighting how worker participation is important for OHS outcomes and safety management, and it has consistently been shown that OHS policies and measures that include workers are more likely to be successful (Dahler-Larsen & Sundby, 2019; James & Walters, 2002; Knudsen et al., 2011; Walters & Nichols, 2007, 2009). The same is emphasized in terms of reflexive regulation (Dawson et al., 1988; Estlund, 2010; Lobel, 2005) and it is argued that reflexive regulation is more likely to succeed in a context characterized by strong partners, as organized labor can provide a counterbalance to corporate interests (Aalders & Wilthagen, 1997, p. 432). Along the same lines, Fairman and Yapp (2005, p. 494) argue explicitly that workers have a prominent role in enforcing self-regulation through acting as “...shop-floor inspectors and whistle-blowers”. I therefore expect worker involvement to be necessary for compliance with the reform.

OHS can be a conflictual policy field if workers and management disagree on what to achieve or on how to achieve it (Estlund, 2010; Nichols & Walters, 2013), while worker involvement in health and safety matters has become increasingly politicized in many countries (Almond & Gray, 2017). Worker participation can be problematic if employee-employer relations are hostile (Gunningham, 2008), but Gunningham and Sinclair (2009) further suggest that, if there

is internal tension in the workplace, active worker participation may be a necessary condition for improving the work environment. Nevertheless, company-level worker involvement is still the norm rather than the exception in Denmark and the other Nordic countries, where a strong tradition of worker engagement in work organization endures (Andersen et al., 2014; Gallie, 2009; Hasle & Sørensen, 2013). In general, the participatory practices reinforce the overall approach to worker involvement (Sørensen et al., 2015). Nevertheless, this does not translate into workers being *partout* involved in all aspects of regulation and day-to-day practices.

Professionalization of OHS

Professionalization increases the likelihood that companies will be attentive to reflexive regulation and will enforce it internally (Dawson et al., 1988; Fairman & Yapp, 2005; Rees, 1988). In particular, if the regulatory requirements are aligned with the professionals' norms and beliefs, then companies are much more likely to comply (Corneliussen, 2005; Gilad, 2010). It may be easier for regulators to convey the messages – as there are designated receivers within the companies – since OHS information (and hence information on the reform) could drown in the general knowledge flow in companies without professional OHS sections or personnel. Professionalization is also closely aligned with the call for more attention to internal compliance systems in the reflexive regulation literature (Aalders & Wilthagen, 1997, p. 431-433) and it is typically characterized by an increased systematic approach to OHS, which may include standardization of OHS procedures and processes such as compliance management systems (cf. Aalders & Wilthagen, 1997). Professionalization often, but not necessarily always, includes assigning staff to specific OHS tasks and areas of competence, such as in-house OHS professionals or external OHS consultants.

Private/Public

I include a condition indicating whether the case companies are private or public entities. It is hypothesized that public sector companies are more attentive toward reflexive regulation because of a potentially stronger attention to regulation in general. Furthermore, while industrial relations and worker/management relations are not highly distinctive between the Danish public and private sectors, there are differences. Cooperation between management and workers, for instance, is often more formalized in public entities, which may also increase the likelihood of compliance. Hence, the causal junctures may differ between the two types.

External pressure on the organization

From the initial qualitative analysis, I found that several companies were so engaged in handling (non-regulatory) external pressure that the reform was not given any substantial attention (either by management, staff, or worker representatives). I therefore include a condition for external pressure in the QCA analysis, but I expect this to be mainly a barrier to compliance with reflexive regulation; hence the condition of when external pressure is *present*.³ In this condition I include various pressures such as re-structuring, organizational changes, and conflicts, as well as competition-based pressures such as major changes in markets.

Qualitative comparative analysis⁴

QCA is a configurational and set-theoretic research approach, originally developed by Charles Ragin (1987). It emphasizes how certain conditions are either necessary or sufficient for ex-

3 – As external pressure is only present in few cases (n=7), this may result in issues of skewness in the QCA analysis (Schneider & Wagemann, 2012). However, my results seem to be less sensitive to this (see the tests and discussion in the Technical Appendix).

4 – For further insights into the QCA research approach, see, e.g., Dusa, 2019; Marx et al., 2014; Ragin, 1987; Schneider & Wagemann, 2012.

plaining a certain outcome of interest by applying a configurational understanding of causality, hence focusing on combinations of conditions rather than on mono-causal explanations. In the original version, Ragin (1987) emphasizes the deep knowledge gained through qualitative studies and the iterative process of assessing each case. However, the strong qualitative aspect has, in later applications (e.g., meta-studies, large-N QCA, and evaluation studies), tended to fade into the background, while the techniques and algorithms have been given a more prominent role (Collier, 2014; Thomann & Maggetti, 2020). In this article, the aim is to follow Ragin's original call to see QCA as a *qualitative* research approach (rather than solely as an inferential method (see also Thomann & Maggetti, 2020)). This means engaging in qualitative iteration and underlining the deep case knowledge (despite having a large number of cases).

I conduct a "fuzzy-set QCA" of 61 workplace case studies. Fuzzy-set QCA allows for partial membership of conditions and outcome in addition to the binary full and non-full membership (which is called crisp-set QCA). I include five conditions that are expected to influence the outcome of the analysis. For this purpose, QCA has three particular analytical strengths. First, it operates with equifinality (multiple solutions with non-exclusive pathways for the same phenomenon); second, it has conjunctural causality (conditions have an effect (only) in conjuncture with other conditions); and third, it also has asymmetric causality, where conditions explaining occurrence of the outcome can be different from conditions explaining non-occurrence (Ragin, 1987; Schneider & Wagemann, 2012). In public policy and regulation there are often multiple paths to the same outcome (equifinality) and conditions may have different impacts depending on the case in question and may work together in different manners (conjunctural causation) (Dunlop et al., 2012), highlighting the potential benefits of a QCA approach. Moreover, what explains compliance does not symmetrically explain non-compliance, and both compliance and non-compliance are therefore scrutinized in the analyses. Overall, the QCA approach condenses the in-depth *qualitative knowledge* gained from the substantial number of cases, helping to give a better understanding of compliance with reflexive regulation, and hence to show the limits of such regulation.

Research design and data collection

The research design is based on thorough qualitative insights from all 61 cases, in line with the original QCA approach discussed above. I therefore aim to identify the configurations of conditions that explain compliance, as well as non-compliance, with reflexive regulation, and to move beyond traditional variable-oriented research that seeks to assess the impact of single independent variables. The data was collected between 2012 and 2013 during a larger Danish research project on various policy instruments and their impact on OHS. It was collected two to three years after the reform, so that the companies had had time to adapt to the new legislation. A team of experienced researchers visited each company, where they conducted two to six interviews with key OHS personnel. The interviewees typically included an OHS manager/responsible, workplace and line management, OHS professionals, and worker representatives (typically the OHS representative, but also shop stewards). Additionally, field notes on work organization, OHS organization, etc. were taken during the visit, and afterwards a standardized case study report was produced for each case company.⁵

To improve the generalizability of the research project and to address potential sector variation, the project's case companies were equally distributed across five broad, key economic sectors of the Danish economy: the construction, care, service, manufacturing, and "knowl-

5 – The author took part in different stages of the data collection and assessment.

edge” industries. To further avoid selection biases, the cases were selected based on variation in terms of their OHS organization and performance. Finally, only companies with more than 35 employees were selected, although almost all had between 50 and 300 employees.⁶ While, according to most definitions, companies with fewer than 50 employees are considered small companies, I assume that these companies in the sample do not differ from my sample in general. All had close to 50 employees and did not share the main characteristics of typical small companies in the Danish context, for instance being run by an owner-manager and lacking an OHS committee and OHS representative. Some of the case workplaces are part of larger organizations (both public and private), but the single worksite/workplace is my final unit of analysis.

Calibration

Calibration (which in QCA terminology refers to attributing a set membership score to the cases) of the “raw” qualitative data is important in QCA and researchers must provide transparency on the processes (Ragin, 2008; Schneider & Wagemann, 2012). The standardized case reports were the main tool for calibrating the “raw” qualitative data. I calibrated the raw data qualitatively into a specified fuzzy QCA data set, based on the theoretical assumption and the empirical evidence in each case (cf. Ragin 2000, p. 150). I provide an overview of the scores used for calibrating the conditions and outcome, showing the two extremes (fully in/fully out) which the calibration is based upon. Two conditions and the outcome in my analysis are fuzzy (taking on a score between zero and one), while the other conditions are dichotomous – some by nature, such as public/private. For the fuzzy-set conditions and the outcome, the scores for “more in than out” and “more out than in” are also shown below. The thorough qualitative case studies made a qualitative calibration of the data more applicable than computer-driven calibrations. To assure quality and validity, all cases were calibrated by two researchers, and if divergence occurred, each case was re-analyzed by the author so as to arrive at the final calibration⁷, in line with the iterative approach in QCA (Ragin 1987, 2000).

The outcome: The companies’ compliance or non-compliance with reflexive regulation

I operationalize compliance into the effectuation of the legislative reform at company level. I am not examining whether the reform has led to improvements in the work environment (which would require a longitudinal design). The overall outcome I am seeking to explain is compliance and non-compliance with the 2010 Danish OHS policy reform, that is seen as a proxy for reflexive regulation. The qualitative assessment of whether or not the reform was complied with takes on four fuzzy scores: 0 (no compliance), 0.33 (“more out than in,” with only minor changes in the organization), 0.66 (“more in than out,” with several elements of the reform implemented, but often only formal requirements and without a clear integration of OHS into the organization), and finally, 1 (full compliance). For the outcome to be coded as fully occurring (score of 1), I focused on the integration of reflexive elements into the organization and structure of companies that incorporate OHS considerations in their daily operations and practices, emphasising the organisational elements (e.g. adaptation of OHS organisation and new organisational elements introduced by the reform, such as early OHS deliberations between employees and the company).

6 – As I mainly include companies with more than 50 employees, information on smaller companies is obviously missing. Smaller companies have greater difficulties in implementing and complying with legislation, particularly self-regulation in any form (Aalders & Wilthagen, 1997; Dawson et al., 1988; Fairman & Yapp, 2005, p. 494; Genn, 1993). Regulatory engagement with these companies thus remains one of the most important dimensions of compliance in relation to micro and small companies (Baldock et al., 2006; EU-OSHA, 2018).

7 – The calibrated data set is shown in the Technical Appendix.

Table 1: Calibration of outcome

Score	Fully out (Fuzzy score (Fs) =0)	More out than in (Fs=0.33)	More in than out (Fs=0.66)	Fully in (Fs=1)
Fuzzy	No changes and adaption in OHS organisation	Only minor changes due to the reform. No systematic follow-up or actions taken. For example, companies discussed the reform in meetings, but without the changes implied by the reform implemented.	The companies comply with several elements in the reform, but without fully incorporating these. OHS is not integrated into general management structures.	The reform is fully implemented, the companies work systematic with securing compliance and OHS is given a more prominent role in the organisation.

Source: The Author

Calibration of the conditions

Worker participation

In the qualitative assessment of whether the workers (or their representatives) were included, I include both direct and indirect worker participation. In Denmark, worker involvement in OHS is institutionalized with the compulsory election of an OHS representative in companies with more than nine employees. However, some cases were calibrated with 0 when there was an OHS representative who had no active involvement, so the involvement was merely formalistic without any substantive engagement by the workers.

Table 2: Calibration of worker participation

Score	Fully out (Fuzzy score (Fs) =0)	Fully in (Fs=1)
Crisp	No real involvement of workers or their representatives in OHS.	A high level of active involvement of workers and/or their representatives in OHS, including the compliance with the reform.

Source: The Author

Table 3: Calibration of professionalization of OHS

Score	Fully out (Fuzzy score (Fs) =0)	More out than in (Fs=0.33)	More in than out (Fs=0.66)	Fully in (Fs=1)
Fuzzy	No professionalization, and no staff allocated to OHS	Some contact with external OHS professionals, or some internal allocation, but ad hoc and irregularly and only as a side-job for other functions. If external consultants, they typically focus on adjusting to the minimal requirements	The company has regular contact with external OHS professionals or devotes OHS attention internally and has allocated some resources to internal professionals (such as HRM or line management), but without specific OHS professionals in the organization. External professionalization includes certification, or professionals from other parts of the organization (e.g. higher levels in the municipalities or from HQ).	The company employs OHS professionals (full or part-time, in some instance a full-time OHS representative), and work systematically with OHS. OHS is well-integrated into management systems.

Source: The Author

Table 4: Calibration of managerial commitment

Score	Fully out (Fuzzy score (Fs) =0)	More out than in (Fs=0.33)	More in than out (Fs=0.66)	Fully in (Fs=1)
Fuzzy	No managerial commitment to OHS and no integration into the operational and strategic level in the company. Management may even obstruct OHS improvements/developments	Management is attentive to OHS, but assume a passive role, and hence does not set any direction, nor allocate specific resources. A minimal compliance approach, where management is not blocking OHS initiatives.	Management is supportive of OHS, e.g. by allocating specific resources, but OHS is not fully integrated into management and the specific OHS actions are often in isolated functions. There may also be mismatches between top and line management, and these are not actively addressed, potentially resulting in organisational malfunctions.	Management is engaged and take active ownership of OHS, which is to a large degree integrated into daily operations. Management is setting the direction for OHS developments and there is managerial coherence between top- and lower-level management.

Source: The Author

Table 5: Calibration of external pressure

Score	Fully out (Fuzzy score (Fs) =0)	Fully in (Fs=1)
Crisp	No “extra-ordinary” external pressure, hence “everyday” pressure of markets and production that are perceived as “business-as-usual”.	The company is experiencing significant external pressure, which require organisational attention beyond daily operations. This for example includes take-overs, larger organisational changes, loss of huge market shares or major clients and significant/extraordinary budget restraints.

Source: The Author

Table 6: Calibration of public/private distinction

Score	Fully out (Fuzzy score (Fs) =0)	Fully in (Fs=1)
Crisp	Private entities	Public entities

Source: The Author

Empirical analysis⁸

QCA is based on certain *conditions* being either *necessary* or *sufficient* for the outcome to occur, so I start the QCA analysis by searching for conditions that may be *necessary* for compliance as well as for non-compliance. Since the assumption in QCA is that the explanations for the outcome and the negation of the outcome are not symmetric, I analyze compliance and non-compliance separately.

The results in Table 7 for compliance show that the absence of external pressure is the only condition that passes the consistency and coverage threshold suggested in the literature (e.g., Schneider and Wagemann 2012, p. 143, p. 146). However, the low relevance of necessity (0.215) in Table 7 shows that this is a trivial condition, explaining only very little when *not* present (see also Technical Appendix). Yet it is not surprising that the *absence* of external pressure is a trivial condition, and from a qualitative assessment of the data, it is clear that external pressure, as defined in this study, only plays a role when *present*. In the cases *without* external negative pressure, this does not explain much about compliance. I expected management support to be a necessary condition and this is also very close to the 0.9 threshold and hence necessary for compliance. Furthermore, both professionalization (0.84) and worker participation (0.85) are close to the 0.9 threshold of necessity, while the public-private condition is far from necessary (0.41).

8 – In conducting the QCA, I followed the enhanced standard procedure (Schneider and Wagemann 2012), using the software R (Core R team, 2019), and the software package “SetMethods” (Oana & Schneider, 2018). Moreover, I conducted the robustness tests suggested by Oana and Schneider (2021), along with other standard robustness checks (see Technical Appendix for further information).

Table 7: Necessary conditions for compliance

	Consistency Necessity	Coverage Necessity	Relevance of Necessity
Worker participation	0.853	0.597	0.469
Management support	0.894	0.726	0.676
Professionalization	0.842	0.783	0.787
External pressure	0.905	0.528	0.215
Public/private	0.410	0.497	0.728

Source: The Author

Next, I turn to the analysis of necessary conditions for non-compliance, which shows that none of the conditions are necessary for explaining why companies do not comply. However, external pressure is close to being necessary, which again is not so surprising (and this is still a trivial condition, as indicated by the low Relevance of Necessity).

Table 8: Necessary conditions for non-compliance

	Consistency Necessity	Coverage Necessity	Relevance of Necessity
Worker participation	0.615	0.403	0.373
Management support	0.644	0.490	0.529
Professionalization	0.485	0.423	0.581
External pressure	0.864	0.472	0.197
Public/private	0.443	0.503	0.730

Source: The Author

After analyzing the necessary conditions, I turn to identifying conditions or configurations of conditions that are *sufficient* for explaining the outcome, namely the companies' compliance (or non-compliance) with the reflexive regulation. This is done in QCA by producing a data presentation table, which is pivotal for the QCA analysis (the table is termed a "truth table" in QCA terminology; see Technical Appendix). I then search for the sufficient conditions or configurations by logically minimizing the truth table via Boolean logic (see e.g. Schneider and Wagemann, 2012 for details). This provides the final solution, which I report in Table 9 below.⁹

9 — I present here the enhanced intermediate solutions. This is often the preferred way to present final results in the literature (Ragin, 2008). However, see Technical Appendix for further discussion on different solutions.

Table 9: Solutions explaining compliance

	Solution	Consistency	Coverage raw	Coverage unique	PRI+
1	Worker participation*Management support *Professionalization * Absence of external pressure	0.899	0.662	0.220	0.846
2	Worker participation* Professionalization * Absence of external pressure*Private	0.815	0.474	0.032	0.757

1. *Denotes AND

2. PRI=proportional reduction in inconsistency

Source: The Author

None of the conditions are sufficient on their own for the outcome to occur, which highlights how the interaction between conditions (causal conjunctures) is significant for compliance. Yet different combinations of the conditions are sufficient for compliance. Solution 1, which has the significantly highest coverage – both raw and, in particular, unique¹⁰ – emphasizes how all the conditions (except public/private) are present in the companies complying with the reflexive regulation. Solution 2 also has high raw coverage (0.47), but low unique coverage; here, all conditions expect management support is present for private companies. In the next section I discuss these findings in more detail.

Again, I turn to what explains non-compliance, and accordingly present the results for companies *not* complying with the reform in Table 10 below.

Table 10: Solutions explaining non-compliance

	Solution	Consistency	Coverage raw	Coverage unique	PRI+
1	<i>Absence of worker participation* Absence of Professionalization * Absence of external pressure * Privat</i>	0.910	0.227	0.227	0.890
2	<i>Worker participation* Absence of management support* Absence of external pressure</i>	0.851	0.388	0.388	0.717
3	<i>Absence of worker participation* Absence of Professionalization * Absence of management support* Public</i>	1	0.080	0.080	1

1. *Denotes AND

2. PRI=proportional reduction in inconsistency

Source: The Author

10 – If I add a frequency threshold to the sufficiency test (of 2), then this is the only solution remaining.

The solutions for the companies *not complying* can broadly be characterized in either of two ways. Either they can be seen in terms of the lack of worker participation and professionalization in some conjunctural paths (solutions 1 and 3), or as cases where worker participation is not enough in the face of lacking management support, which may indicate that workers and management simply disagree (solution term 2). I conduct a within-case analysis – which Schneider and Wagemann (2012) argue is an important part of QCA – below in relation to solution term 2, to clarify whether it is management/employee conflict or simply lacking management support that explains the outcome.

For both the compliant and the non-compliant outcome, the important PRI (proportional reduction in inconsistency) parameter is high for all solutions, and while lower for solution 2 for both compliance and non-compliance, it is also above the rough guideline of 0.7 suggested in the literature, and clearly above the 0.5 which indicates a high degree of inconsistency (Greckhamer et al. 2018, 489). The PRI parameter gives the degree to which a condition is a subset of both the outcome and the negated outcome. This can occur because, in fuzzy sets, the same case can have partial membership in both the outcome and the negated outcome.

Before discussing the general implications of the results for public regulation and reflexive regulation in particular, in the final section I discuss the results in greater detail, as well as presenting some relevant within-case analyses.

Results

A main finding is that the reform had no impact *at all* on 12 companies (see Table 11), despite the presence of the shadow of hierarchy and the favorable institutional settings with strong social partners. Accordingly, the results show that there is a real risk that reflexive regulation may not be complied with *at all* in some companies, confirming some of the critique (Dawson et al., 1988; Lobel, 2005; Tombs & Whyte, 2013; Tucker, 2013). On the other hand, 14 companies were fully compliant with the reflexive regulation reform. A total of 17 companies were found by the research team to be “more out than in” in the set relation; these are compliant with only minor elements of the reform, but without any systematic general change. Finally, 18 companies were “more in than out” in the outcome – these had altered their practices in line with several elements of the reform, but were not fully compliant, in particular often lacking in terms of systematic compliance and the integration of OHS into management and core production structures. The variation in compliance illuminates the problems associated with reflexive regulation, which policymakers have to take into consideration when utilizing reflexive regulation and other forms of self-regulation.

Table 11: Overall results

Degree of compliance	No compliance (0)	Partial but only minor compliance (0.33)	Mostly compliant, but not on all dimensions (0.66)	Full compliance (1)
Companies	12	17	18	14

Source: The Author

While the research design ensured a sectoral sampling of the case companies, the data showed no clear sectoral patterns in the outcome. However, for one of the conditions, OHS profes-

sionalization, a pattern emerges. OHS professionalization mainly occurs in manufacturing and construction companies in the data set. However, this is in line with my expectations, since physical OHS issues are, on average, easier to address than psychosocial OHS challenges (Jespersen et al., 2016). I therefore expect manual labor-dominated industries to have gone further in OHS professionalization, while nevertheless being aware that some knowledge-based companies are moving in that direction as well, with HR departments concerned with well-being and OHS-adjacent topics, although these departments still played a minor role in most cases. This reflects the fact that HR departments typically do not see OHS regulation and organization of work environment as part of their domains, at least in the Danish context (Madsen, 2017).

Next, I look in more detail at the QCA results¹¹; first, at the solutions explaining the compliant cases and second at those explaining the non-compliant cases. While the two solutions for compliance show marked differences in coverage, solutions with low coverage may still imply substantive or theoretically important findings (Schneider & Wagemann, 2012). Nevertheless, the second solution for compliance (solution term 2 in Table 9) has a very low unique coverage and I therefore interpret it with some caution, since when applying a frequency threshold of two (as suggested by, e.g., Ragin 2008), this solution term is left out.

The main result (solution term 1, in Table 9) explaining the compliant cases has four of the five conditions present: worker participation, management support, professionalization, and no external pressure. This confirms the usefulness of a QCA approach that emphasizes the configurations of different conditions and underlines how several conditions are important for reflexive regulation to work. Moreover, this highlights the complexity of reflexive regulation, as each condition is insufficient on its own. Solution 2 (Table 9) has a high raw coverage, showing equifinality, which is important in the epistemological foundation of QCA, as Schneider and Wagemann (2012, 133) argue: “the same case can follow multiple paths toward the outcome”. This applies only to private companies where worker participation, management support, and the absence of external pressure can lead to the outcome. The unique coverage is, however, low, with only one company being covered. Another finding I highlight is the public-private distinction. While I expected public companies to be more attentive to reflexive regulation, due to an expected stronger attention to public regulation, this was not the case.

Explaining non-compliance

As to what explains non-compliant behavior, the analysis provides us with three solution terms, where the companies in two of them (solution 1 and 3, Table 10) lack professionalization and worker participation (in different conjunctures with lacking management support, external pressure and public/private ownership). This supports the findings from the cases that implemented the reform (keeping in mind that QCA does not provide symmetrical results). The final solution for non-compliance (solution 2, Table 10) has quite a high coverage and shows that worker participation is not enough in itself, particularly when management does not commit to compliance. This can be interpreted in two ways: either worker participation is not enough on its own in cases where management support is missing, or it can be interpreted as if OHS is a conflict area where the social partners disagree, or even a zero-sum game, as suggested by Nichols and Walters (2013). Within-case analyses revealed that, in the majority of the cases, there was no conflict over OHS; rather, there was a lack of management engagement for

11 – One strength of my analysis is that the final solutions are simple. QCA has been criticized for producing too many causal paths and hence muddling overall findings (Tanner, 2014).

various reasons. For instance, in one case company, there had been changes in management, which meant that the new management was not engaging in OHS as they were busy with other organizational adjustments. In another case, local management was rather apathetic toward OHS, feeling that the responsibility resided rather with higher-level management (which was not present at the worksite). I observed only a few cases of some conflict between management and workers, but these were mainly over industrial relations and organizational matters rather than specific disagreements related to OHS as such. This is also in line with the functioning of the consensual Danish labor market.

In general, I have encountered very little evidence that OHS is a conflictual area – at least in the context of this study. This may be due to the overall consensual approach to employer/management relations in Danish industrial relations (Andersen et al., 2014; Hasle & Sørensen, 2013); the strong worker involvement and enduring consensual understanding between workers and employers increases the odds that reflexive types of regulation are complied with (Ayres & Braithwaite, 1992; Lobel, 2005). However, this may also suggest that it is difficult to transfer the results to other industrial relations settings with more adversarial relations and weaker social partners (cf. Gunningham, 2008), where regulators cannot allocate the same importance to workers and worker representatives. Other research also highlights how national differences are important in explaining different regulatory outcomes (Guidi et al., 2020; Thatcher, 2007; Vogel, 2012).

Within-case analysis: external pressure

External pressure, which is a dichotomous category, was present in seven case studies (all of them public companies), and upon re-assessing these, I find that four companies did not comply with the reform (two at 0 and two at 0.33 (“more out than in”). In these four cases, external pressure was paramount and simply “crowded out” compliance, illustrating how external factors can simply overrule reflexive regulation. Two of these were public schools struggling with implementing new working-time regulations, which made management-worker relations problematic, and the other two case companies struggled severely with organizational changes and re-structuring. I note that two of the four cases had higher levels of professionalization and management support, but no worker participation/support, which can indicate that poor cooperation and disagreement over working time and organizational restructuring between management and workers obstructed implementation. Hence, I argue that external pressure can be a strong obstacle to reflexive regulation through simply moving the emphasis away from the policy reform (however, this applies *ceteris paribus* to most regulation and policy). Still, there were three deviant cases where companies facing external pressure managed to comply with the reform (one at 1, two at 0.66). In two cases, it was mainly the worker representatives who carried the compliance through, while in the final case there was no worker participation, but high management support and professionalization. These three deviant cases show how external pressure can be overcome, while also illustrating the multiple pathways to compliance or failure. Overall, I find that, in some cases, external pressure renders reflexive regulation ineffective, as these companies simply ignored the regulation due to problems that they felt were more pertinent.

In the final section I discuss the implications of my results in light of the broader literature on reflexive regulation.

Discussion and conclusion

A main result from this study is that a significant share of the case companies are *not* complying with the reflexive regulation. This is occurring despite a highly regulated national context with an active enforcement agent, which – in much of the literature – is found to be important for reflexive regulation to work. This has the strong policy implication that regulators must consider the risk that various forms of self-regulation (including reflexive regulation) may lead to non-compliance. Moreover, I argue that, for reflexive regulation to meet its targets in full, a regulatory strategy for apprehending the residual companies is needed, as suggested by Dawson et al. (1988) and Lobel (2005). This is particularly pertinent in dealing with regulation with strong human and societal implications, such as OHS, where lives and well-being are at risk.

Addressing the unresolved question of under which conditions companies comply or not with reflexive regulation, the overall findings show that reflexive regulation is a complex issue and that companies do not easily manage to be compliant. My results show how certain company-internal compliance-enhancing conditions and actors are important for reflexive regulation to succeed, as none of the conditions in the analysis are sufficient for compliance in themselves. Moreover, the QCA results show how different conjunctures of conditions explain the companies' degree of compliance, underlining the complex reality behind reflexive regulation. The company-internal conditions thus explain why some of the companies in the data set manage to comply with reflexive regulation, while others do not, confirming findings from previous studies that internal compliance dynamics play an important role in reflexive regulation (Gunningham & Rees, 1997; Parker & Gilad, 2011; Short & Toffel, 2010). When these internal conditions are not in place, reflexive regulation may be problematic – the companies may not be capable of complying with the regulators' requirements. This carries the policy implication that regulators should stress these capacities among the regulated entities. We must therefore understand reflexive regulation (and OHS management in general) as being embedded in, and dependent on, the context, with single factors very rarely explaining companies' performance. Accordingly, the combination of various elements, such as reflexive regulation, labor inspections, and information, is vital in securing a safe and healthy work environment (Ayres & Braithwaite, 1992; Gunningham & Rees, 1997; Hasle et al., 2017).

In this study, worker participation, professionalization, and management support are all very close to being necessary conditions for compliance and are also part of the final solutions with the highest coverage. In many companies, management support meant that OHS was given more strategic and operational attention, whereas it had earlier been left almost exclusively for the OHS cooperative committees to deal with. Thus, it fell somewhat outside of managerial priorities without the OHS cooperative committees having the necessary (managerial) means to deal with it. One could, in that sense, speak of OHS being mainstreamed into management (Dyreborg, 2011; Hasle et al., 2019). The results also verify previous accounts that professionalization is important for reflexive regulation to be successful (e.g., Aalders & Wilthagen, 1997; Dawson et al., 1988; Fairman & Yapp, 2005). The OHS staff institutionalize and mobilize internal compliance structures and hence fulfill some of the original intentions of reflexive regulation by creating "reflexion structures" (Teubner, 1983). Furthermore, if there are no professionals (such as OHS professionals) at the company level, the regulatory information may be drowned, or perceived as noise. A factor that may counter the lack of information and knowledge can be the impact from higher organizational levels (as seen in some of the cases) as a trickle-down effect of the reform when policy changes and legislative reforms receive more attention at the higher organizational levels. This was found, for instance, in the local municipi-

palities' organization. The analysis also emphasizes how worker involvement is an important element in well-functioning reflexive regulation (and OHS management). In the Danish case, workers are not only "shop-floor inspectors", but also active partners in negotiating and enforcing the intentions of reflexive regulation, a role often undertaken by the local OHS representative. Nevertheless, in some of the case companies, I found that management – and in some instances even the OHS representative – had difficulties in engaging the workers in OHS issues, potentially reducing the impact of worker participation.

In sum, I find that reflexive regulation is a complex endeavor for policy makers, and that the companies' degree of compliance is largely dependent on internal company conditions, particularly worker participation, professionalization, and management support. If these are not in place, reflexive regulation may result in non-compliant behavior, as argued by critics. While the article scrutinizes the specific policy field of OHS, the findings have implications for reflexive regulation beyond this policy field. Therefore, I urge that future research addresses the transferability of the results to other settings and policy areas.

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Technical appendix QCA-analysis

1. The calibrated data-set

The company names have been converted to case numbers below, since there may be sensitive information and because the actual identity of the companies is of less relevance to the reader here.

Case number	WOR	MAN	PRO	EXT	PUB/PRI	COM
1	1	0.66	1	1	0	0.66
2	0	0.66	0.33	1	0	0.33
3	1	0.33	0.33	1	0	0.33
4	0	1	0	1	0	0
5	1	0	0.33	1	0	0
6	1	1	0.66	1	1	0.66
7	1	1	1	1	0	1
8	1	1	1	1	1	0.33
9	1	0.66	0.33	1	1	0.33

10	1	0.33	0.33	0	1	0.66
11	1	0.66	1	1	0	0.66
12	0	0.66	0.66	1	0	0.66
13	1	0.66	1	1	0	0.66
14	0	0.66	0	1	0	0
15	1	1	1	1	0	1
16	1	0	0.33	0	1	0.66
17	1	0.66	0.33	1	1	0.33
18	1	1	1	1	1	1
19	1	0.33	0.33	1	0	0.33
20	1	1	1	1	0	1
21	0	0.33	0	0	1	0
22	1	0.66	1	1	0	1
23	1	1	1	1	0	1
24	1	1	0.66	1	1	1
25	1	1	0.66	1	0	1
26	1	0.66	0.66	1	1	0
27	1	0.66	0.33	1	1	0.33
28	0	0.66	1	1	0	1
29	1	1	1	1	0	0.66
30	1	0	0	1	0	0
31	1	0.66	0.33	1	1	0.66
32	1	1	0.33	1	0	0.33
33	0	0.66	0.66	0	1	0.33
34	1	1	1	1	0	1
35	1	0.66	1	1	0	1
36	0	0	0	1	0	0
37	0	0.33	0.33	1	0	0
38	0	0.33	0	1	1	0.33
39	1	0.66	1	1	0	0.66
40	1	0.33	1	1	0	0.66

41	1	0.66	1	1	0	0.66
42	1	1	0,33	1	1	0.66
43	1	0.66	1	1	0	0.66
44	1	0.66	0.33	1	1	0.66
45	1	0.66	0.33	1	1	0,33
46	1	1	0.66	1	1	0.33
47	1	1	0.33	1	0	0.66
48	0	0	0.33	0	1	0
49	1	0.33	0	1	1	0
50	1	0.33	0,33	1	0	0
51	1	0.33	0.33	1	1	0.66
52	1	0.66	0.66	1	1	1
53	0	0,66	0	1	0	0.33
54	1	0	1	1	1	0.33
55	0	1	1	0	1	1
56	0	0.33	0	1	0	0.33
57	1	1	0.66	1	1	1
58	0	0,66	0,33	1	0	0
59	1	0.66	0.66	1	0	0.66
60	0	1	0.66	0	1	0.33
61	0	0.33	0	1	0	0.33

2. QCA-analysis

Below various elements of the QCA-analysis are shown and discussed, in particular issues for which there is not room in the article is shown here in full length. So it includes the full analysis of both compliance and non-compliance and various robustness checks, including consistency and frequency thresholds, and remove a condition EXT, with a skewed distribution of cases.

In assessing the consistency and coverage for necessary conditions I apply the thresholds suggested in the literature for consistency of 0.9 (e.g. Schneider and Wagemann 2012, 143), and for the coverage the 0.5 suggested (Schneider and Wagemann 2012, 146). In line with the much of the QCA literature, I denote present conditions and outcomes in capital letters, and non-present ones in lower case. Additional “+” denotes OR and “*” denotes AND in the Boolean expressions.

2.1 Full analysis for Explaining Compliance

Testing for necessary conditions for the outcome (COM)

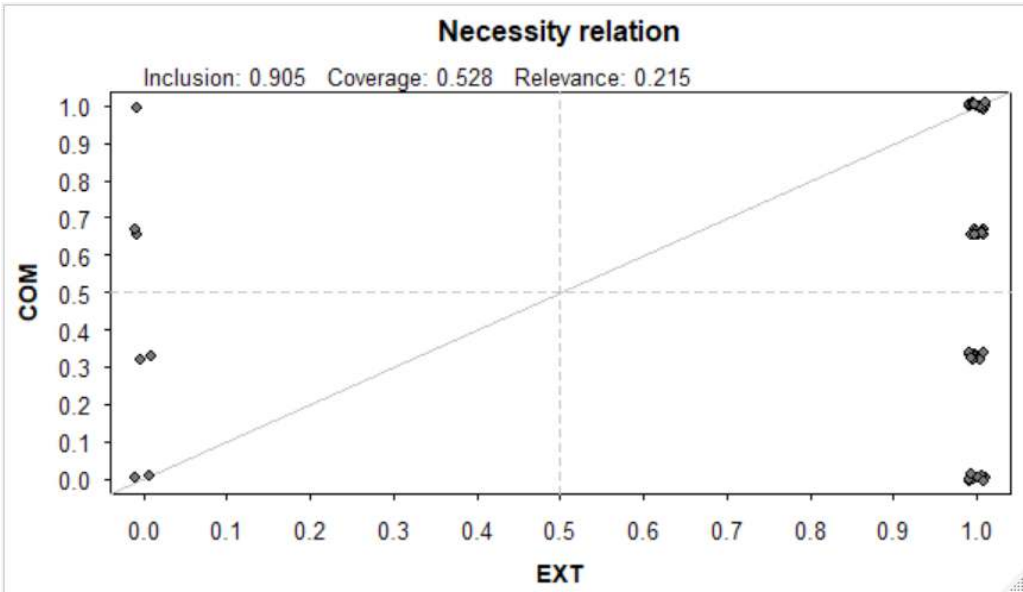
inclN RoN covN

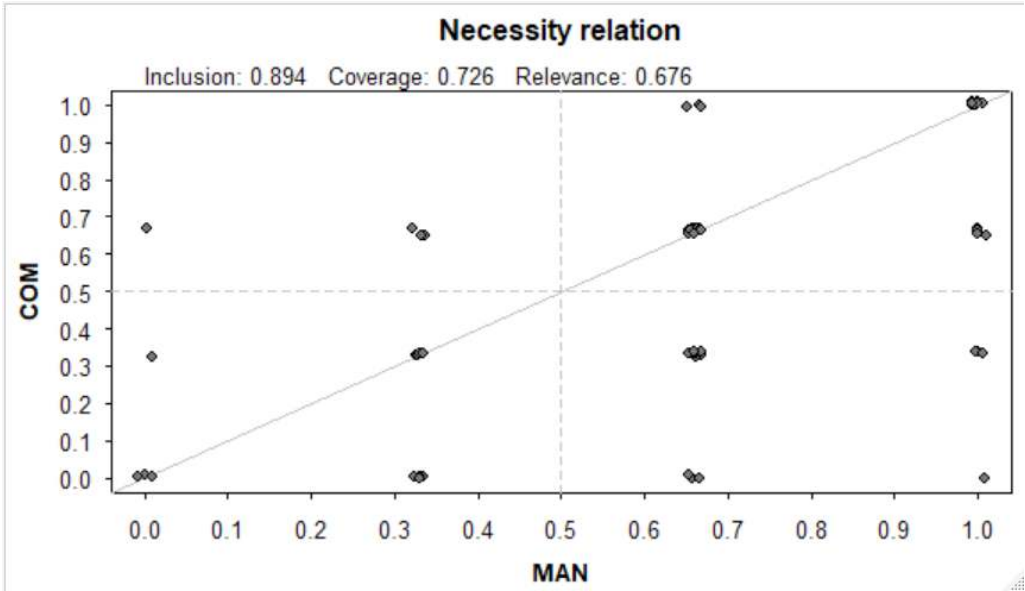
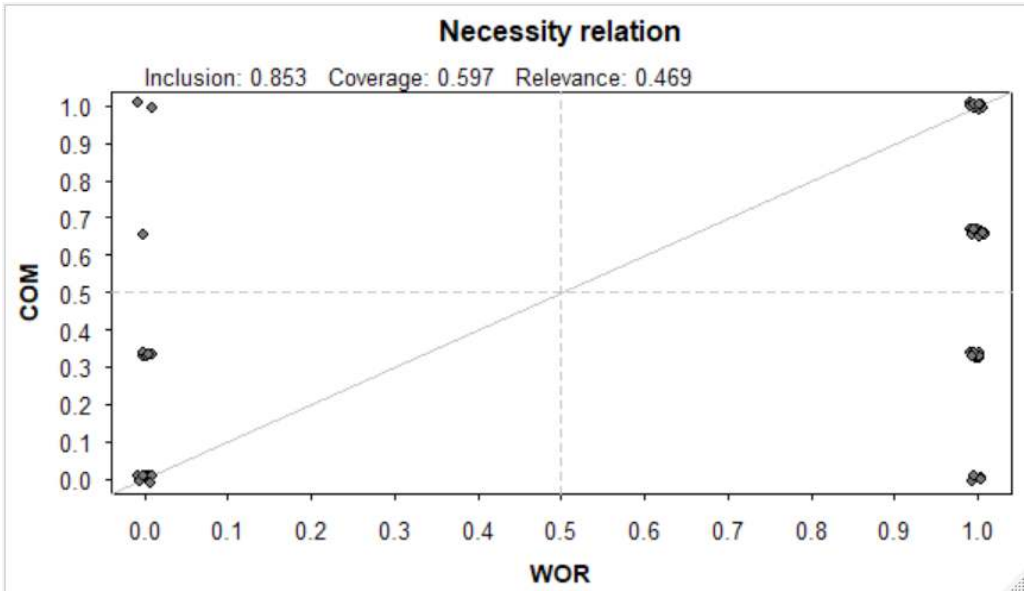
1 WOR	0.853	0.469	0.597
2 MAN	0.894	0.676	0.726
3 PRO	0.842	0.787	0.783
4 EXT	0.905	0.215	0.528
5 PUB.PRI	0.410	0.728	0.497

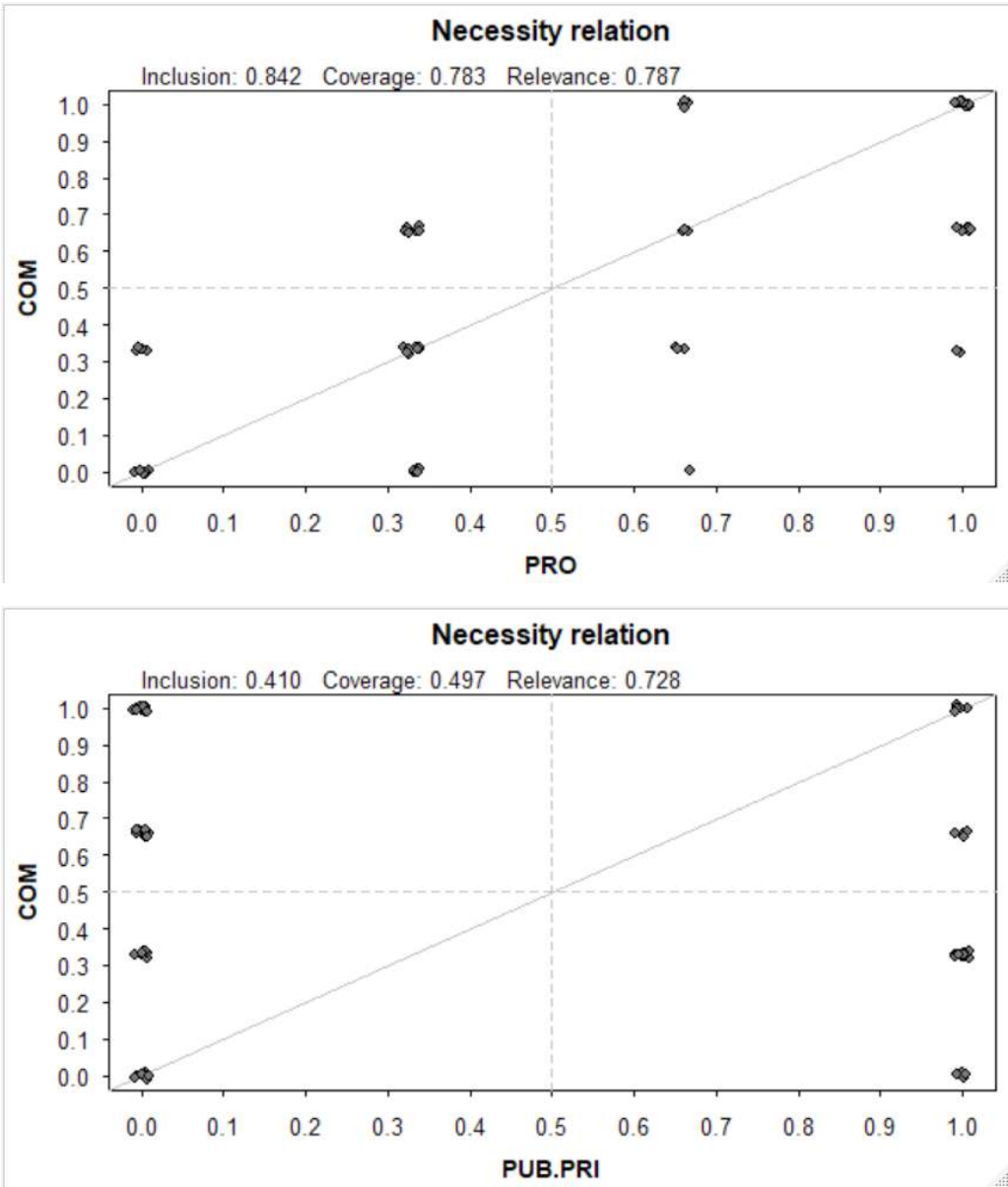
EXT as a trivial condition (COM)

While EXT has a high consistency (above the 0.9 threshold), the low Relevance of Necessity (RoN) (as well as the rather low coverage) indicates EXT it is a trivial condition and the XY-plot below indicates the same, with most cases clustering close to the right side axis (Schneider and Wagemann, 2012: 146).

XY-plots for necessary conditions (COM)







Testing for sufficiency (COM) (consistency 0.8)

In general the consistency level for truth table inclusion is 0.8, however this also depends on the research design (Kahwati and Kane, 2018: 114). It should hence not be just mechanically based on the “standard” in the literature (Schneider and Wagemann 2012, 128). Some yardsticks important for the design include Schneider and Wagemann’s (2012) stating that the more precise the theoretical expectations and the lower the number of cases, the higher the threshold. As I have quite a high number of cases and the theoretical assumptions are not rigorously set, I apply a 0.8 consistency level.

Truth table

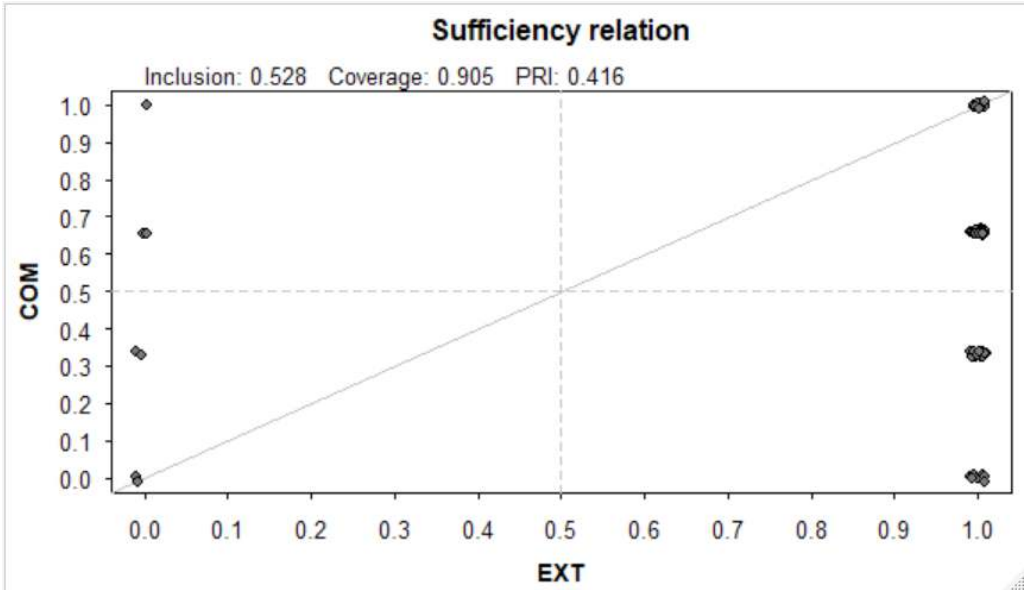
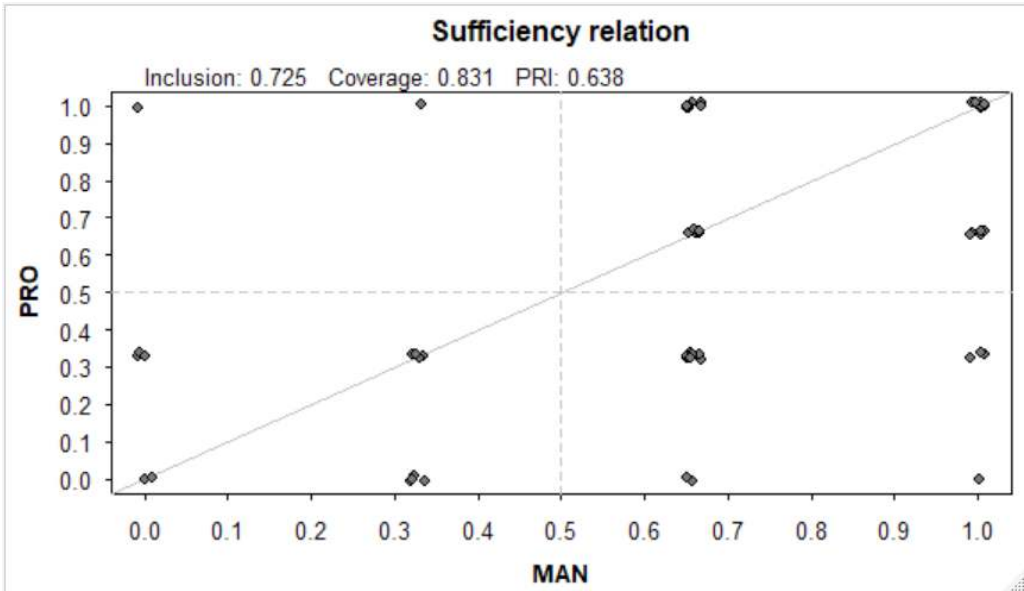
OUT: output value

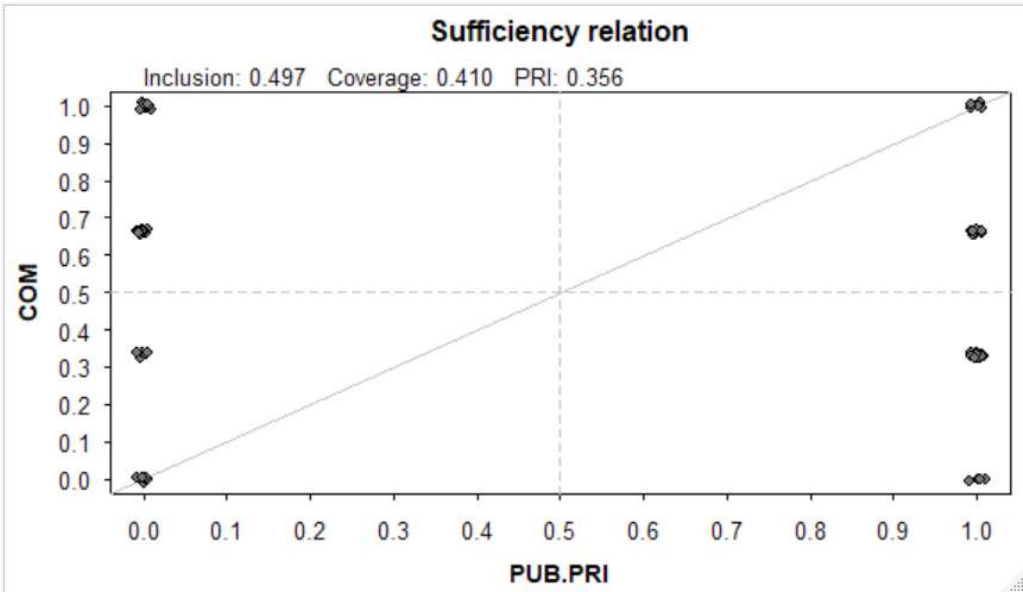
n: number of cases in configuration

incl: sufficiency inclusion score

PRI: proportional reduction in inconsistency

	WOR	MAN	PRO	EXT	PUB.	PRI	OUT	n	incl	PRI
18	1	0	0	0	1	1	2	0.985	0.970	
31	1	1	1	1	0	1	16	0.954	0.934	
23	1	0	1	1	0	1	1	0.867	0.599	
32	1	1	1	1	1	1	8	0.807	0.665	
27	1	1	0	1	0	0	2	0.796	0.493	
24	1	0	1	1	1	0	1	0.747	0.252	
20	1	0	0	1	1	0	2	0.739	0.384	
28	1	1	0	1	1	0	7	0.726	0.496	
14	0	1	1	0	1	0	3	0.716	0.602	
15	0	1	1	1	0	0	2	0.714	0.598	
4	0	0	0	1	1	0	1	0.493	0.000	
3	0	0	0	1	0	0	3	0.329	0.000	
11	0	1	0	1	0	0	5	0.287	0.000	
19	1	0	0	1	0	0	6	0.284	0.000	
2	0	0	0	0	1	0	2	0.196	0.000	
1	0	0	0	0	0	?	0	-	-	
5	0	0	1	0	0	?	0	-	-	
6	0	0	1	0	1	?	0	-	-	
7	0	0	1	1	0	?	0	-	-	
8	0	0	1	1	1	?	0	-	-	
9	0	1	0	0	0	?	0	-	-	
10	0	1	0	0	1	?	0	-	-	
12	0	1	0	1	1	?	0	-	-	
13	0	1	1	0	0	?	0	-	-	
16	0	1	1	1	1	?	0	-	-	
17	1	0	0	0	0	?	0	-	-	





Solution terms

There is some discussion in the literature over which solution to present; cf. the discussion between (Baumgartner and Thiem 2020) on one side, and (Dusa 2019a, 2019b) and (Schneider 2016) on the other side. In the article I present the enhanced intermediate solution, while the other terms are included here.

The conservative solution

First I find the conservative solution which does not include any simplifying assumptions based on the logical remainders.

n OUT = 1/0/C: 27/34/0

Total : 61

M1: WOR*MAN*PRO*EXT + WOR*PRO*EXT*pub.pri + WOR*man*pro*ext*PUB.PRI => COM

inclS PRI covS covU

1	WOR*MAN*PRO*EXT	0.899	0.846	0.662	0.220
2	WOR*PRO*EXT*pub.pri	0.815	0.757	0.474	0.032
3	WOR*man*pro*ext*PUB.PRI	0.985	0.970	0.042	0.042

M1 0.821 0.741 0.736

The parsimonious solution

Then the parsimonious solution is presented. Here I include all logical remainders, which contribute to making the Boolean expression as parsimonious as possible. The logical remainders here are called simplifying assumptions.

n OUT = 1/0/C: 27/34/0

Total : 61

Number of multiple-covered cases: 16

M1: WOR*ext + (WOR*MAN*PRO + WOR*PRO*pub.pri) => COM

M2: WOR*ext + (WOR*MAN*PRO + man*PRO*pub.pri) => COM

M3: WOR*ext + (WOR*PRO*pub.pri + MAN*PRO*EXT*PUB.PRI) => COM

	inclS	PRI	covS	covU	(M1)	(M2)	(M3)
1 WOR*ext	0.660	0.485	0.042	0.031	0.031	0.031	0.042
2 WOR*MAN*PRO	0.901	0.846	0.673	0.000	0.220	0.534	
3 WOR*PRO*pub.pri	0.815	0.757	0.474	0.022	0.032	0.474	
4 man*PRO*pub.pri	0.802	0.502	0.171	0.032	0.043		
5 MAN*PRO*EXT*PUB.PRI	0.807	0.665	0.220	0.000	0.220		
M1	0.802	0.717	0.736				
M2	0.854	0.779	0.747				
M3	0.802	0.717	0.736				

Simplifying assumptions (parsimonious solution)

\$M1

WOR MAN PRO EXT PUB.PRI

17	1	0	0	0	0
21	1	0	1	0	0
22	1	0	1	0	1
25	1	1	0	0	0
26	1	1	0	0	1
29	1	1	1	0	0
30	1	1	1	0	1

\$M2

WOR MAN PRO EXT PUB.PRI

5	0	0	1	0	0
7	0	0	1	1	0

17 1 0 0 0 0
21 1 0 1 0 0
22 1 0 1 0 1
25 1 1 0 0 0
26 1 1 0 0 1
29 1 1 1 0 0
30 1 1 1 0 1

\$M3

WOR MAN PRO EXT PUB.PRI

16 0 1 1 1 1
17 1 0 0 0 0
21 1 0 1 0 0
22 1 0 1 0 1
25 1 1 0 0 0
26 1 1 0 0 1
29 1 1 1 0 0
30 1 1 1 0 1

The intermediate solution

Finally I turn to the solution presented in the paper, the intermediate one. In the intermediate solution only logical remainders that are easy counterfactuals are included. The easy counterfactuals for the intermediate solution are defined via my theoretical expectations, where I expect all five conditions to have a positive effect on the outcome (as explained previously in the paper). Accordingly I use the code “dir.exp = c(1,1,1,1,1)” in SetMethods.

n OUT = 1/0/C: 27/34/0

Total : 61

From C1P1, C1P2, C1P3:

Number of multiple-covered cases: 16

M1: WOR*ext*PUB.PRI + WOR*PRO*EXT*pub.pri + (WOR*MAN*PRO*EXT) => COM

M2: WOR*ext*PUB.PRI + WOR*PRO*EXT*pub.pri + (WOR*MAN*PRO*PUB.PRI) => COM

inclS PRI covS covU (M1) (M2)

1 WOR*ext*PUB.PRI 0.660 0.485 0.042 0.031 0.042 0.031
2 WOR*PRO*EXT*pub.pri 0.815 0.757 0.474 0.032 0.032 0.474

```

-----
3 WOR*MAN*PRO*EXT  0.899 0.846 0.662 0.000 0.220
4 WOR*MAN*PRO*PUB.PRI 0.814 0.665 0.231 0.000    0.220
-----

```

```

M1          0.802 0.717 0.736
M2          0.802 0.717 0.736

```

Easy counterfactuals for intermediate solution

```

WOR MAN PRO EXT PUB.PRI
22 1 0 1 0 1
26 1 1 0 0 1
30 1 1 1 0 1

```

Prime implicant chart – Intermediate solution

```

18 23 31 32
WOR*ext      x - - -
WOR*MAN*PRO  - - x x
WOR*PRO*pub.pri - x x -
man*PRO*pub.pri - x - -
MAN*PRO*EXT*PUB.PRI - - - x

```

Enhanced standard solutions (ESA)

First I produce a truth table and ESA solutions

Enhanced truth table

OUT: output value

n: number of cases in configuration

incl: sufficiency inclusion score

PRI: proportional reduction in inconsistency

```

WOR MAN PRO EXT PUB.PRI  OUT  n  incl  PRI
18 1 0 0 0 1  1  2  0.985 0.970
31 1 1 1 1 0  1  16 0.954 0.934
23 1 0 1 1 0  1  1  0.867 0.599
32 1 1 1 1 1  1  8  0.807 0.665
27 1 1 0 1 0  0  2  0.796 0.493
24 1 0 1 1 1  0  1  0.747 0.252
20 1 0 0 1 1  0  2  0.739 0.384

```

28	1	1	0	1	1	0	7	0.726	0.496
14	0	1	1	0	1	0	3	0.716	0.602
15	0	1	1	1	0	0	2	0.714	0.598
4	0	0	0	1	1	0	1	0.493	0.000
3	0	0	0	1	0	0	3	0.329	0.000
11	0	1	0	1	0	0	5	0.287	0.000
19	1	0	0	1	0	0	6	0.284	0.000
2	0	0	0	0	1	0	2	0.196	0.000
1	0	0	0	0	0	0	0	-	-
5	0	0	1	0	0	0	0	-	-
6	0	0	1	0	1	0	0	-	-
7	0	0	1	1	0	?	0	-	-
8	0	0	1	1	1	?	0	-	-
9	0	1	0	0	0	0	0	-	-
10	0	1	0	0	1	0	0	-	-
12	0	1	0	1	1	?	0	-	-
13	0	1	1	0	0	0	0	-	-
16	0	1	1	1	1	?	0	-	-
17	1	0	0	0	0	0	0	-	-
21	1	0	1	0	0	0	0	-	-
22	1	0	1	0	1	0	0	-	-
25	1	1	0	0	0	0	0	-	-
26	1	1	0	0	1	0	0	-	-
29	1	1	1	0	0	0	0	-	-
30	1	1	1	0	1	0	0	-	-

Conservative enhanced solution

M1: WOR*MAN*PRO*EXT + WOR*PRO*EXT*~PUB.PRI -> COM

inclS PRI covS covU

1	WOR*MAN*PRO*EXT	0.899	0.846	0.662	0.220
2	WOR*PRO*EXT*~PUB.PRI	0.815	0.757	0.474	0.032

Parsimonious enhanced solution

M1: WOR*MAN*PRO*EXT + WOR*PRO*EXT*~PUB.PRI -> COM

M2: WOR*MAN*PRO*EXT + ~MAN*PRO*EXT*~PUB.PRI -> COM

M3: WOR*PRO*EXT*~PUB.PRI + MAN*PRO*EXT*PUB.PRI -> COM

inclS PRI covS covU (M1) (M2) (M3)

1 WOR*MAN*PRO*EXT 0.899 0.846 0.662 0.000 0.220 0.534
2 WOR*PRO*EXT*~PUB.PRI 0.815 0.757 0.474 0.022 0.032 0.474
3 ~MAN*PRO*EXT*~PUB.PRI 0.802 0.502 0.171 0.032 0.043
4 MAN*PRO*EXT*PUB.PRI 0.807 0.665 0.220 0.000 0.220

M1 0.813 0.733 0.694

M2 0.870 0.802 0.705

M3 0.813 0.733 0.694

Contradictory simplifying assumptions – Enhanced intermediate solution

The same logical remainder may in be included in the Boolean minimization for both the outcome and the negated outcome, this is in QCA called contradictory simplifying assumptions. I argue that there are no untenable LR in my design, since all conditions can theoretically and substantive be combined. I then test for CSA in R, but there are none for the intermediate that I emphasise (and present in the analysis).

Final Intermediate enhanced solution

The overall solution produced by the logical minimization (M1 in Table 2) has a consistency above 0.8, which typically is the cut for the overall solution, and the coverage is rather high

M1: WOR*MAN*PRO*EXT + WOR*PRO*EXT*~PUB.PRI -> COM

inclS PRI covS covU

1 WOR*MAN*PRO*EXT 0.899 0.846 0.662 0.220
2 WOR*PRO*EXT*~PUB.PRI 0.815 0.757 0.474 0.032

M1 0.813 0.733 0.694

Prime implicant chart – Enhanced intermediate solution

23 31 32

WOR*MAN*PRO*EXT - x x

WOR*PRO*EXT*~PUB.PRI x x -

2.2 Full analysis for Explaining Non-Compliance (com)

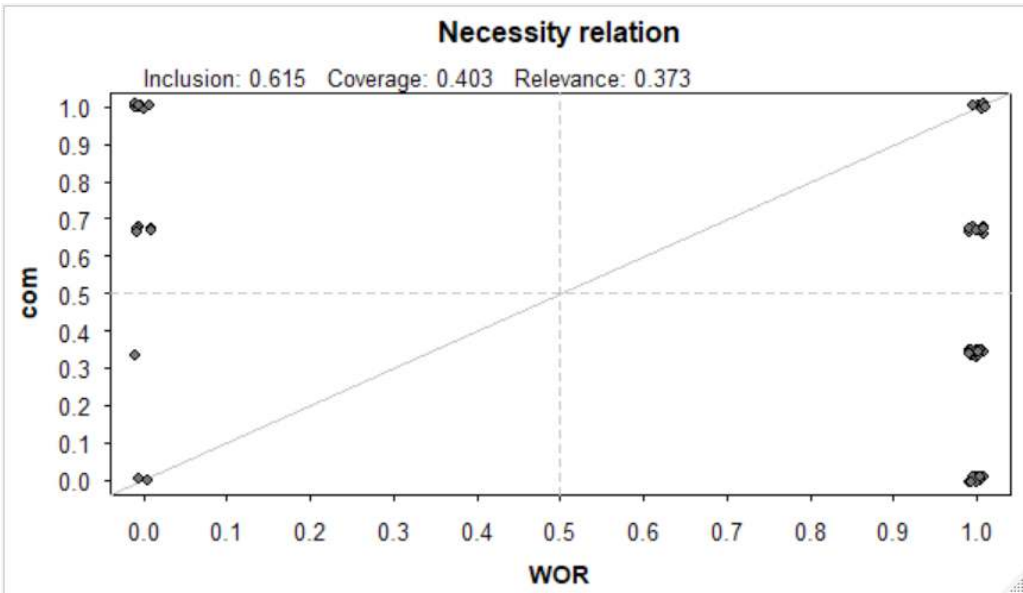
Testing for necessary conditions for the outcome (com)

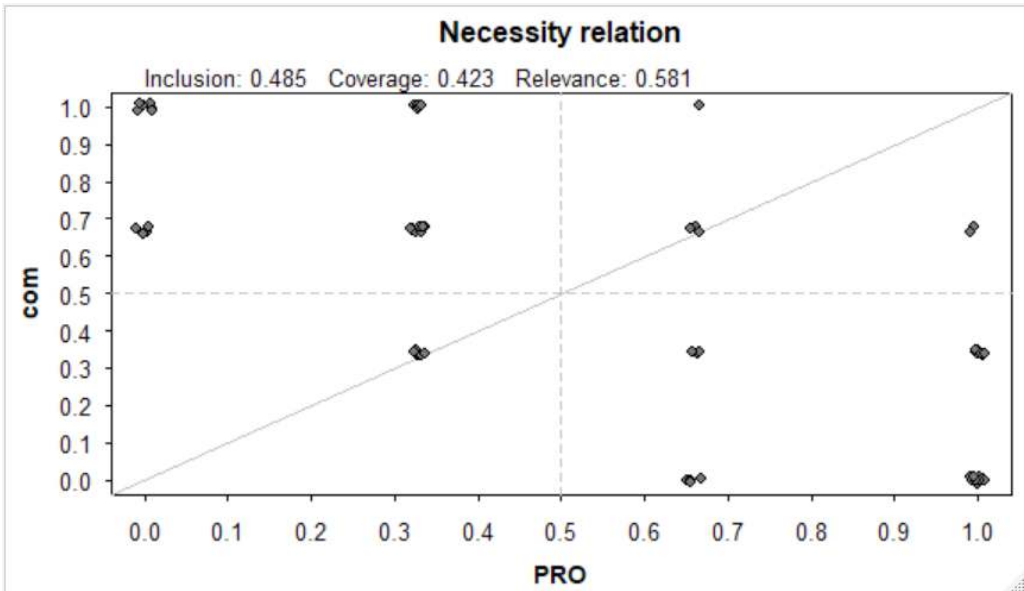
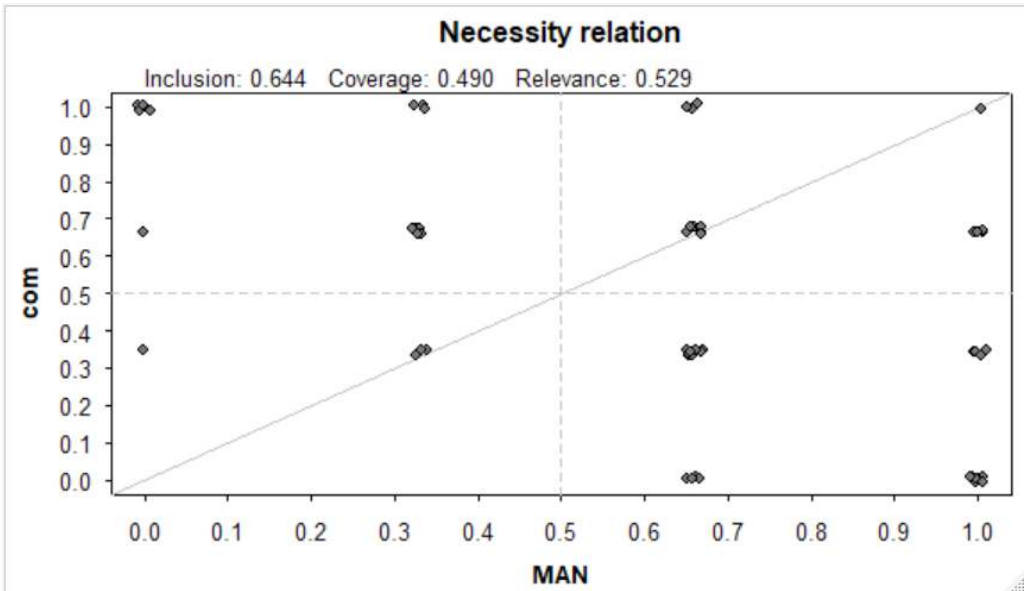
	inclN	RoN	covN
1 WOR	0.615	0.373	0.403
2 MAN	0.644	0.529	0.490
3 PRO	0.485	0.581	0.423
4 EXT	0.864	0.197	0.472
5 PUB.PRI	0.443	0.730	0.503

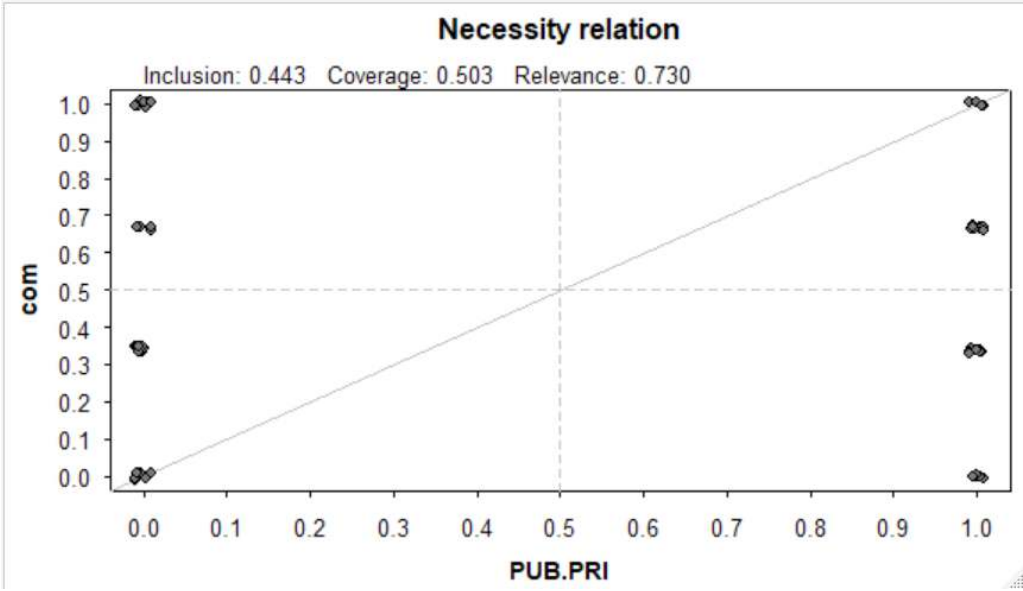
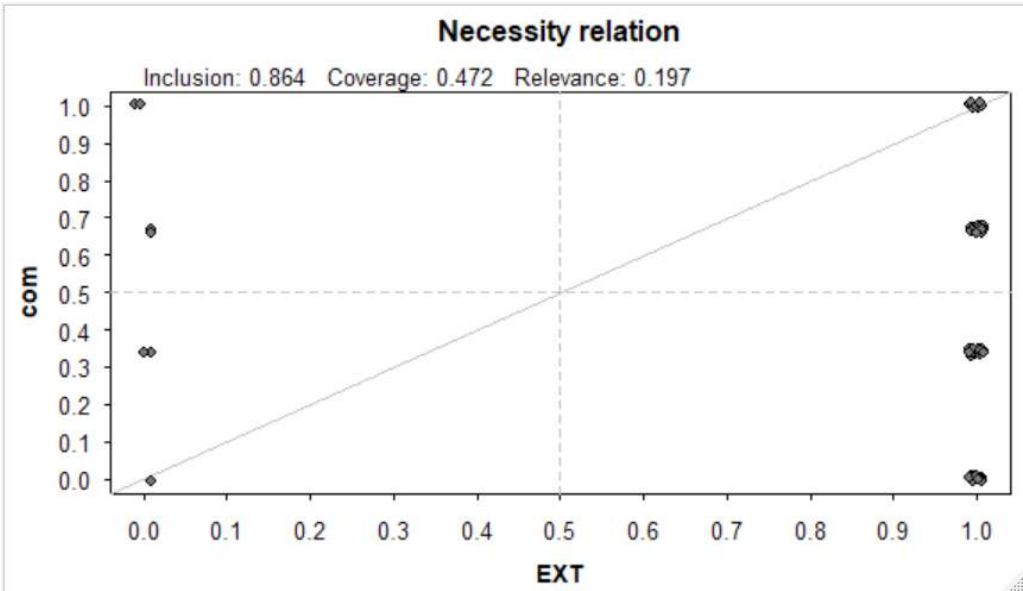
There are no conditions passing the 0.9 threshold of consistency, making the relevance measures (coverage and PRI) less relevant (Oana et al., 2021: 74)

XY-plots for necessary conditions (com)

XY-plots for necessary conditions (com, non-compliance)

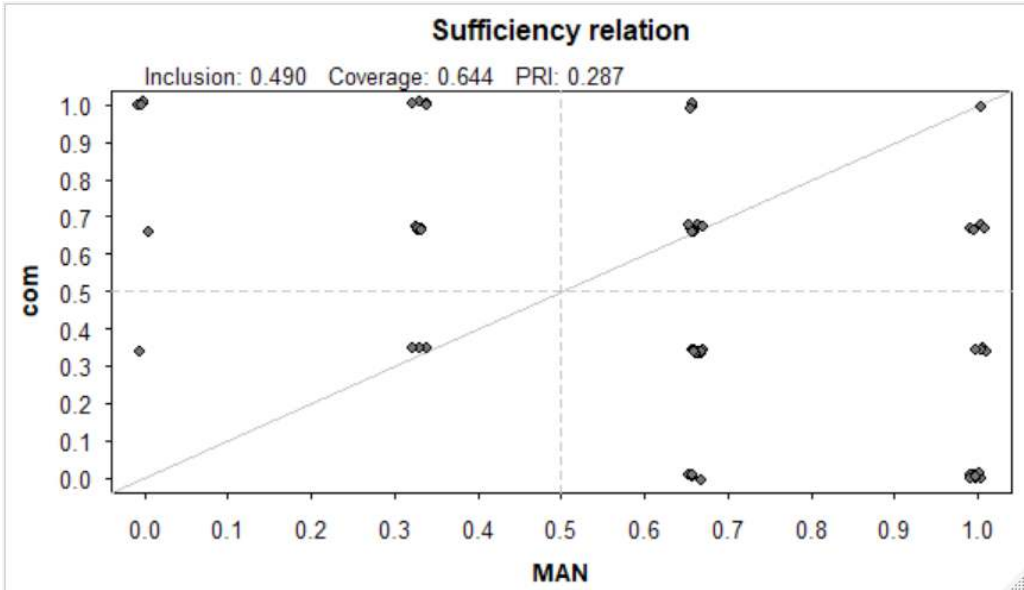
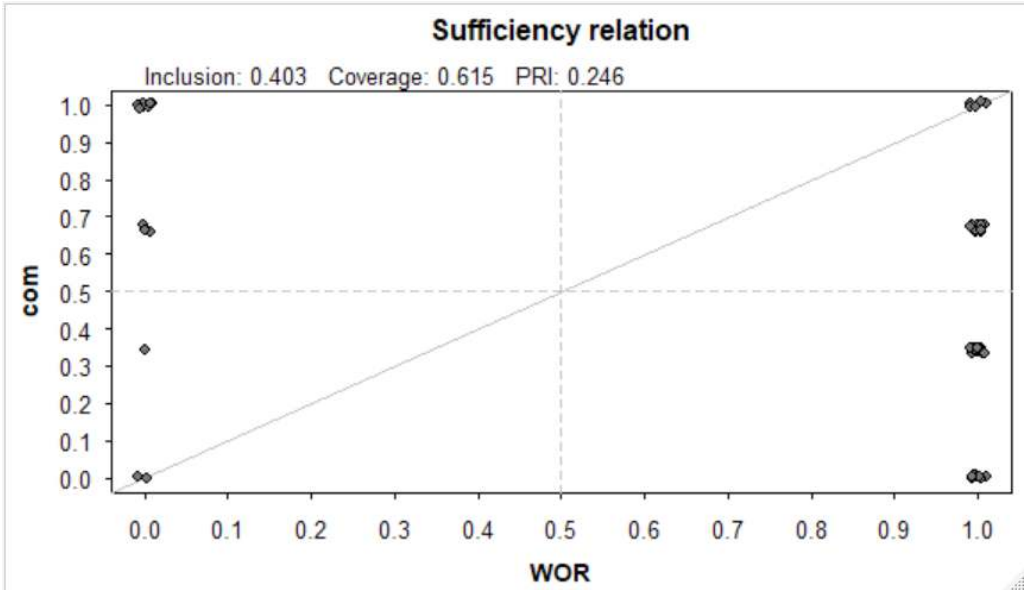


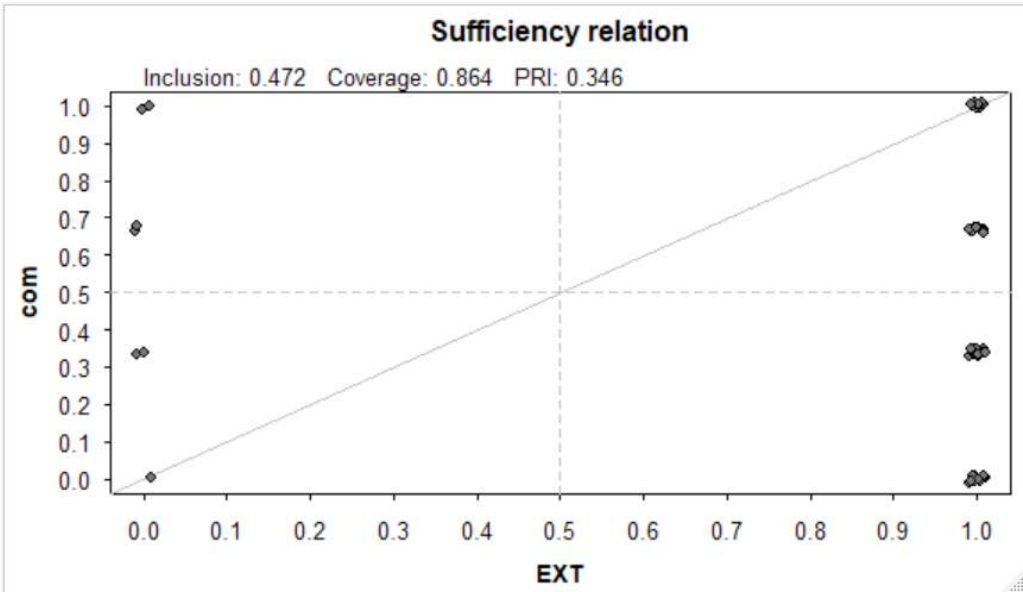
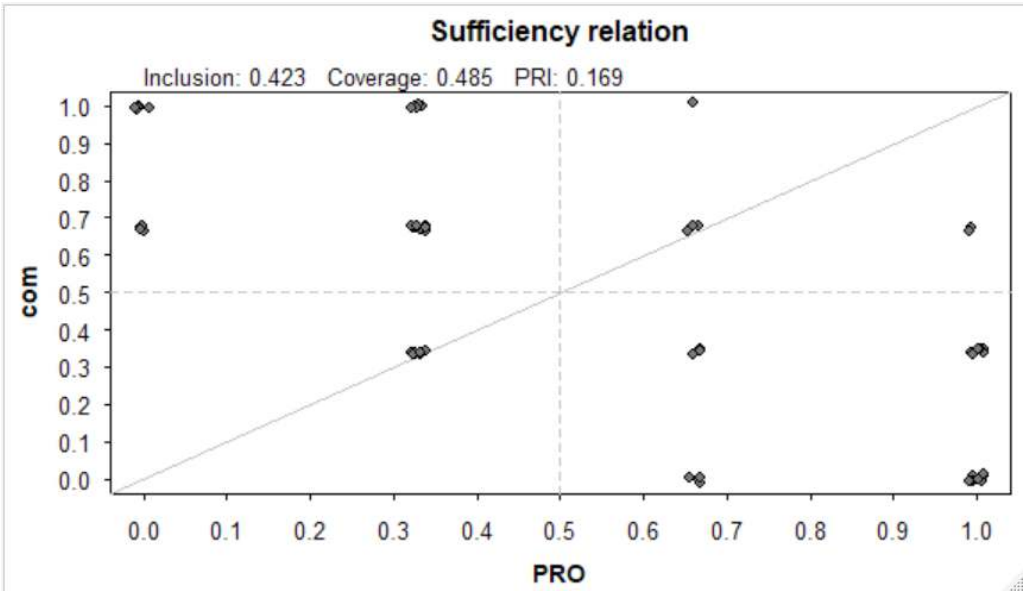


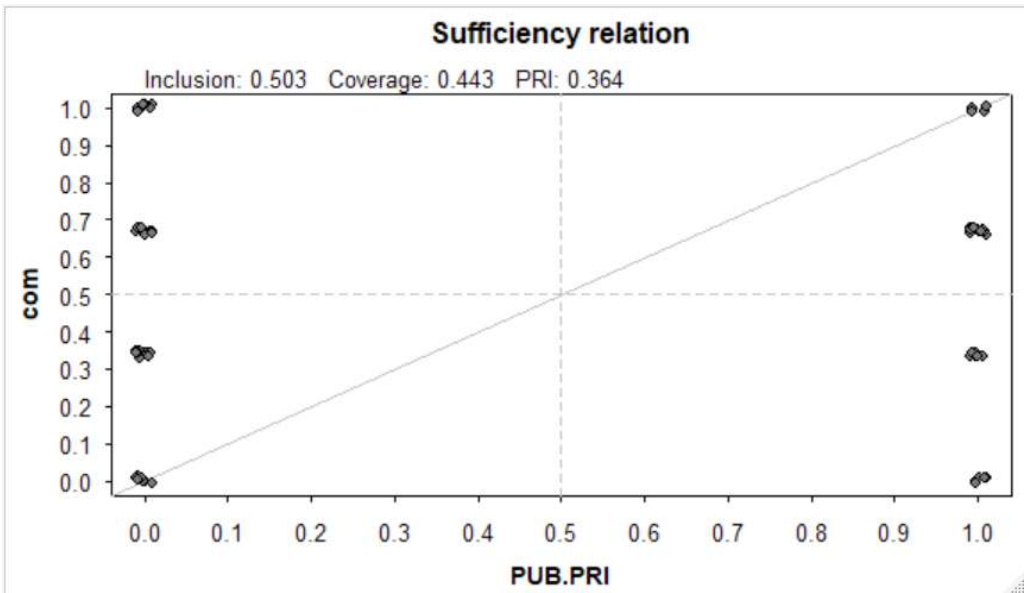


Testing for sufficiency (com) (consistency 0.8)

XY-Plots for sufficiency







Solution terms (com)

Truth table

OUT: output value

n: number of cases in configuration

incl: sufficiency inclusion score

PRI: proportional reduction in inconsistency

	WOR	MAN	PRO	EXT	PUB.PRI	OUT	n	incl	PRI
19	1	0	0	1	0	1	6	1.000	1.000
11	0	1	0	1	0	1	5	1.000	1.000
3	0	0	0	1	0	1	3	1.000	1.000
2	0	0	0	0	1	1	2	1.000	1.000
4	0	0	0	1	1	1	1	1.000	1.000
20	1	0	0	1	1	1	2	0.835	0.610
24	1	0	1	1	1	1	1	0.832	0.504
23	1	0	1	1	0	1	1	0.800	0.395
27	1	1	0	1	0	0	2	0.799	0.500
28	1	1	0	1	1	0	7	0.729	0.501
32	1	1	1	1	1	0	8	0.578	0.268
15	0	1	1	1	0	0	2	0.576	0.402

14	0	1	1	0	1	0	3	0.569	0.398
18	1	0	0	0	1	0	2	0.507	0.000
31	1	1	1	1	0	0	16	0.322	0.032
1	0	0	0	0	0	?	0	-	-
5	0	0	1	0	0	?	0	-	-
6	0	0	1	0	1	?	0	-	-
7	0	0	1	1	0	?	0	-	-
8	0	0	1	1	1	?	0	-	-
9	0	1	0	0	0	?	0	-	-
10	0	1	0	0	1	?	0	-	-
12	0	1	0	1	1	?	0	-	-
13	0	1	1	0	0	?	0	-	-
16	0	1	1	1	1	?	0	-	-
17	1	0	0	0	0	?	0	-	-
21	1	0	1	0	0	?	0	-	-
22	1	0	1	0	1	?	0	-	-
25	1	1	0	0	0	?	0	-	-
26	1	1	0	0	1	?	0	-	-
29	1	1	1	0	0	?	0	-	-
30	1	1	1	0	1	?	0	-	-

The conservative solution

n OUT = 1/0/C: 21/40/0

Total : 61

Number of multiple-covered cases: 0

M1: WOR*man*EXT + wor*man*pro*PUB.PRI + wor*pro*EXT*pub.pri => com
inclS PRI covS covU

1	WOR*man*EXT	0.851	0.717	0.388	0.388
2	wor*man*pro*PUB.PRI	1.000	1.000	0.080	0.080
3	wor*pro*EXT*pub.pri	0.910	0.890	0.227	0.227

M1 0.885 0.820 0.695

The parsimonious solution

n OUT = 1/0/C: 21/40/0

Total : 61

Number of multiple-covered cases: 4

M1: wor*pro + man*EXT => com

inclS PRI covS covU

1 wor*pro 0.907 0.882 0.329 0.169

2 man*EXT 0.873 0.776 0.548 0.388

M1 0.864 0.789 0.717

Simplifying assumptions (parsimonious solution)

\$M1

WOR MAN PRO EXT PUB.PRI

1 0 0 0 0 0

7 0 0 1 1 0

8 0 0 1 1 1

9 0 1 0 0 0

10 0 1 0 0 1

12 0 1 0 1 1

The intermediate solution

From C1P1:

M1: ~MAN*EXT + ~WOR*~MAN*~PRO + ~WOR*~PRO*~PUB.PRI -> ~COM

inclS PRI covS covU

1 ~MAN*EXT 0.873 0.776 0.548 0.388

2 ~WOR*~MAN*~PRO 1.000 1.000 0.217 0.057

3 ~WOR*~PRO*~PUB.PRI 0.910 0.890 0.227 0.090

M1 0.872 0.801 0.695

Easy counterfactuals (intermediate solution)

WOR MAN PRO EXT PUB.PRI

1 0 0 0 0 0

7 0 0 1 1 0
8 0 0 1 1 1
9 0 1 0 0 0

Prime implicant chart – Intermediate solution

2 3 4 11 19 20 23 24
wor*man x x x - - - -
wor*pro x x x x - - - -
man*PRO - - - - - x x
man*EXT - x x - x x x x
man*pub.pri - x - - x - x -
wor*EXT*PUB.PRI - - x - - - -

Enhanced solutions (com)

Enhanced conservative solution

n OUT = 1/0/C: 21/40/0
Total : 61
Number of multiple-covered cases: 0
M1: WOR*man*EXT + wor*man*pro*PUB.PRI + wor*pro*EXT*pub.pri => com
 inclS PRI covS covU

1 WOR*man*EXT 0.851 0.717 0.388 0.388
2 wor*man*pro*PUB.PRI 1.000 1.000 0.080 0.080
3 wor*pro*EXT*pub.pri 0.910 0.890 0.227 0.227

M1 0.885 0.820 0.695

Enhanced parsimonious solution

M1: ~WOR*~PRO + ~MAN*EXT -> ~COM
 inclS PRI covS covU

1 ~WOR*~PRO 0.907 0.882 0.329 0.169
2 ~MAN*EXT 0.873 0.776 0.548 0.388

M1 0.864 0.789 0.717

Contradictory simplifying assumptions – Enhanced intermediate solution

I then test for CSA (only for contradictory in R), and find the following:
[1] "1" "7" "8" "9" "10" "12"

New truth table after CSA

We see now that there three LR remainder rows less.

OUT: output value

n: number of cases in configuration

incl: sufficiency inclusion score

PRI: proportional reduction in inconsistency

	WOR	MAN	PRO	EXT	PUB.	PRI	OUT	n	incl	PRI
19	1	0	0	1	0	1	6	1.000	1.000	
11	0	1	0	1	0	1	5	1.000	1.000	
3	0	0	0	1	0	1	3	1.000	1.000	
2	0	0	0	0	1	1	2	1.000	1.000	
4	0	0	0	1	1	1	1	1.000	1.000	
20	1	0	0	1	1	1	2	0.835	0.610	
24	1	0	1	1	1	1	1	0.832	0.504	
23	1	0	1	1	0	1	1	0.800	0.395	
27	1	1	0	1	0	0	2	0.799	0.500	
28	1	1	0	1	1	0	7	0.729	0.501	
32	1	1	1	1	1	0	8	0.578	0.268	
15	0	1	1	1	0	0	2	0.576	0.402	
14	0	1	1	0	1	0	3	0.569	0.398	
18	1	0	0	0	1	0	2	0.507	0.000	
31	1	1	1	1	0	0	16	0.322	0.032	
1	0	0	0	0	0	?	0	-	-	
5	0	0	1	0	0	?	0	-	-	
6	0	0	1	0	1	?	0	-	-	
7	0	0	1	1	0	0	0	-	-	
8	0	0	1	1	1	0	0	-	-	
9	0	1	0	0	0	?	0	-	-	
10	0	1	0	0	1	?	0	-	-	
12	0	1	0	1	1	0	0	-	-	
13	0	1	1	0	0	?	0	-	-	
16	0	1	1	1	1	?	0	-	-	
17	1	0	0	0	0	?	0	-	-	

21	1	0	1	0	0	?	0	-	-
22	1	0	1	0	1	?	0	-	-
25	1	1	0	0	0	?	0	-	-
26	1	1	0	0	1	?	0	-	-
29	1	1	1	0	0	?	0	-	-
30	1	1	1	0	1	?	0	-	-

cases

Enhanced intermediate solution (after CSA)

n OUT = 1/0/C: 21/40/0

Total : 61

From C1P1:

Number of multiple-covered cases: 0

M1: WOR*man*EXT + wor*man*pro*PUB.PRI + wor*pro*EXT*pub.pri => com
inclS PRI covS covU

1	WOR*man*EXT	0.851	0.717	0.388	0.388
2	wor*man*pro*PUB.PRI	1.000	1.000	0.080	0.080
3	wor*pro*EXT*pub.pri	0.910	0.890	0.227	0.227

M1 0.885 0.820 0.695

Prime implicant chart – Enhanced intermediate solution

	2	3	4	11	19	20	23	24
WOR*~MAN*EXT	-	-	-	-	x	x	x	x
~MAN*~PRO*EXT	-	x	x	-	x	x	-	-
~WOR*~MAN*~PRO*PUB.PRI	x	-	x	-	-	-	-	-
~WOR*~PRO*EXT*~PUB.PRI	-	x	-	x	-	-	-	-

2.3 Standard robustness checks

Standard QCA robustness checks include changing the consistency threshold, re-calibration and potentially adding or removing cases (Schneider and Wagemann 2012; Oana and Schneider, 2021). I argue that the qualitative calibration secures a high validity of the calibration, but I tested for instance one case where the degree of worker participation was somewhat ambiguous; changing the calibration did not have a substantial effect on the findings. Further,

it can be argued that the high number of cases and the qualitative data calibration makes it highly difficult to decide meaningfully, which cases to remove, and the value of the “drop-one sensitivity” test has also been called into question (Krogslund and Michel 2014). I therefore left out this type of robustness test, and mainly checked robustness by altering the consistency threshold instead. I tested my results with the standard test values of a 0.75 threshold and 0.9 threshold (see below). Schneider and Wagemann (2012) suggest that findings are robust if the consistency and coverage (in the original and robustness test) can be substantially interpreted in the same way, which they can.

As an additional robustness test in line with Ragin’s suggestion (2008) of a frequency threshold for the outcome, I conducted the analysis with a frequency threshold of two and three cases, which did not substantially alter the results, but left out solution term 2 and 3 for COM, since both of these have low unique coverage (see below). The results of the robustness checks for non-compliance was a bit more murky (see below), but mainly concerned the public/private dimension, which does not alter my overall findings (given the low consistency of the necessity of this condition).

Consistency levels for COM

Results with 0.9: (enhanced intermediate solution)

M1: WOR*MAN*PRO*EXT*~PUB.PRI -> COM

inclS PRI covS covU

1 WOR*MAN*PRO*EXT*~PUB.PRI 0.954 0.934 0.442 -

M1 0.954 0.934 0.442

Results with 0.75: (enhanced intermediate solution)

n OUT = 1/0/C: 29/32/0

Total : 61

From C1P1, C1P2, C1P3, C1P4:

Number of multiple-covered cases: 1

M1: WOR*MAN*PRO*EXT + WOR*MAN*EXT*pub.pri + WOR*PRO*EXT*pub.pri +
WOR*man*pro*ext*PUB.PRI => COM

inclS PRI covS covU

1 WOR*MAN*PRO*EXT 0.899 0.846 0.662 0.220

2 WOR*MAN*EXT*pub.pri 0.899 0.859 0.473 0.032

3 WOR*PRO*EXT*pub.pri 0.815 0.757 0.474 0.032

4 WOR*man*pro*ext*PUB.PRI 0.985 0.970 0.042 0.042

M1 0.799 0.714 0.768

Consistency levels for com

Results with 0.9: (enhanced intermediate solution)

From C1P1:

M1: ~WOR*~MAN*~PRO*PUB.PRI + ~WOR*~PRO*EXT*~PUB.PRI +
~MAN*~PRO*EXT*~PUB.PRI -> ~COM
inclS PRI covS covU

1 ~WOR*~MAN*~PRO*PUB.PRI 1.000 1.000 0.080 0.080
2 ~WOR*~PRO*EXT*~PUB.PRI 0.910 0.890 0.227 0.090
3 ~MAN*~PRO*EXT*~PUB.PRI 1.000 1.000 0.296 0.159

M1 0.954 0.940 0.465

Results with 0.75: (enhanced intermediate solution)

From C1P1:

M1: WOR*~MAN*EXT + ~PRO*EXT*~PUB.PRI + ~WOR*~MAN*~PRO*PUB.PRI -> ~COM
inclS PRI covS covU

1 WOR*~MAN*EXT 0.851 0.717 0.388 0.229
2 ~PRO*EXT*~PUB.PRI 0.882 0.845 0.420 0.261
3 ~WOR*~MAN*~PRO*PUB.PRI 1.000 1.000 0.080 0.080

M1 0.854 0.773 0.729

Frequency Threshold (COM)

Results with a frequency threshold of 2

Enhanced intermediate solution

From C1P1:

M1: WOR*MAN*PRO*EXT -> COM
inclS PRI covS covU

1 WOR*MAN*PRO*EXT 0.899 0.846 0.662 -

M1 0.899 0.846 0.662

Results with a frequency threshold of 3 gives the same solution

Frequency Threshold (com)

Results with a frequency threshold of 2

From C1P1:

```
M1: ~WOR*~PRO*EXT*~PUB.PRI + WOR*~MAN*~PRO*EXT +
~WOR*~MAN*~PRO*~EXT*PUB.PRI -> ~COM
inclS PRI covS covU
```

```
-----
1 ~WOR*~PRO*EXT*~PUB.PRI 0.910 0.890 0.227 0.227
2 WOR*~MAN*~PRO*EXT 0.923 0.868 0.274 0.274
3 ~WOR*~MAN*~PRO*~EXT*PUB.PRI 1.000 1.000 0.057 0.057
-----
```

M1 0.925 0.893 0.557

Results with a frequency threshold of 3

From C1P1:

```
M1: ~WOR*~PRO*EXT*~PUB.PRI + ~MAN*~PRO*EXT*~PUB.PRI -> ~COM
inclS PRI covS covU
```

```
-----
1 ~WOR*~PRO*EXT*~PUB.PRI 0.910 0.890 0.227 0.090
2 ~MAN*~PRO*EXT*~PUB.PRI 1.000 1.000 0.296 0.159
-----
```

M1 0.945 0.930 0.386

2.4 Robustness protocol (Oana & Schneider, 2021)

Oana and Schneider (2021), argues that a consensus on robustness checks have emerged which mean that standard checks should include consistency threshold, frequency cut-offs, re-calibration and potentially adding or removing cases. All of these are dealt with in section 2.3 above. However, Oana and Schneider (2021) argue that we should further conduct three types of robustness checks, which can be said to be the frontier of robustness in QCA methodology (some of them overlap with the robustness tests conducted above, but still moves beyond).

The three tests suggested by Oana and Schneider are sensitivity ranges, fit-oriented tests and case-oriented. I'll go through each one of these below, conducted on my data set in R. Nonetheless, it is also important to underline that the tests should align with the set-theoretic approach rather than "*mimic robustness tests in regression analyses*" (Schneider and Wagemann, 2012; cf. Greckhamer et al., 2018).

I start the robustness protocol by producing my own initial solution (IS) (I use the enhanced intermediate solution presented in the article), which is then test against the other solutions in the protocol.

Sensitivity ranges

When testing the sensitivity ranges Oana and Schneider (2021) proposes three calculations: calibration anchors, raw consistency threshold and frequency cutoff. However, as they state (footnote 6, p. 28); “The sensitivity ranges of the calibration anchors do not work for qualitative data (e.g., interview transcripts)”, hence I only calculate the other two sensitivity ranges (raw consistency threshold and frequency cutoff).

Raw consistency threshold

The consistency threshold shows a sensitivity range 0.80, which can also be seen in the enhanced truth table, as there is a case (no 23) that have a consistency value of exactly 0.80.

My Raw Consistency Threshold.: Lower bound 0.8 Threshold 0.8 Upper bound 0.8

Frequency cutoff

N.Cut: Lower bound 1 Threshold 1 Upper bound 1

The frequency cutoff range shows that my results will change by if I change the cut-off by one case. This is very much in line with my expectations as well as the robustness tests above.

Step 3

Next step in the robustness check is: “*Produce Alternative Solutions, Taking Into Consideration the Sensitivity Range Analysis and Conceptually Plausible Changes in the Hard Test Range*”

Here produce two solutions (since I don’t have a calibration sensitivity range). First a test set (TS) TS1 with a consistency threshold of 0.75, and then a TS2 with a frequency cut-off of 2 (rather than 1)

These two TS joined into a TS-list, which are then compared to the “Robust core” (RC) below.

Parameter of fit for RC

Cons.Suf Cov.Suf PRI
Core fit 0.899 0.662 0.846

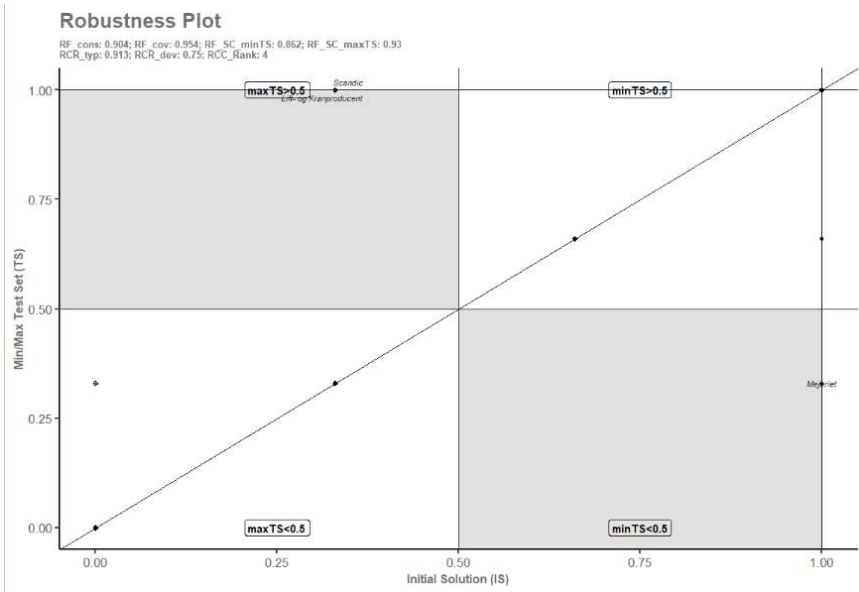
Robustness Fit-oriented tests

RF_cov RF_cons RF_SC_minTS RF_SC_maxTS
Robustness_Fit 0.954 0.904 0.862 0.93

As seen all the parameters for robustness fit (RFcov, RFcons, RFSCminTS, and RFSCmaxTS) are all less than one meaning a less than perfect overlap between IS and the RC nor IS and the minTS=maxTS. However the parameters are all close to one, indicating that there are no significant robustness issues identified here.

Case-oriented

Here I produce first the robustness plot below,



Robustness Case Parameters

	RCRtyp	RCRdev	RCC_Rank
Robustness_Case_Ratio	0.913	0.75	4

According to Oana and Schneider (2021: 23) the RCRtyp parameter can be understood as per cent of the cases that are robust. The figure in my analysis is 91.3 per cent of the cases are robust. 75 % of the deviant cases (RCRdev) are robust.

\$CaseTypes

Robust Typical Cases (IS*MIN_TS and Y > 0.5) :

Boolean Expression: EXT*MAN*PRO*WOR

Cases in the intersection/Total number of cases: 21 / 61 = 34.43 %

Cases in the intersection/Total number of cases Y > 0.5: 21 / 32 = 65.62 %

Robust Deviant Cases (IS*MIN_TS and Y < 0.5) :

Boolean Expression: EXT*MAN*PRO*WOR

Cases in the intersection/Total number of cases: 3 / 61 = 4.92 %

Cases in the intersection/Total number of cases Y < 0.5: 3 / 29 = 10.34 %

Shaky Typical Cases (IS*~MIN_TS and Y > 0.5) :

Boolean Expression: $EXT^* \sim MAN^* PRO^* \sim PUB.PRI^* WOR$

Cases in the intersection/Total number of cases: $1 / 61 = 1.64 \%$

Cases in the intersection/Total number of cases $Y > 0.5$: $1 / 32 = 3.12 \%$

Shaky Deviant Cases ($IS^* \sim MIN_TS$ and $Y < 0.5$) :

Boolean Expression: $EXT^* \sim MAN^* PRO^* \sim PUB.PRI^* WOR$

Cases in the intersection/Total number of cases: $0 / 61 = 0 \%$

Cases in the intersection/Total number of cases $Y < 0.5$: $0 / 29 = 0 \%$

Possible Typical Cases ($\sim IS^* MAX_TS$ and $Y > 0.5$) :

Boolean Expression: $EXT^* MAN^* \sim PRO^* \sim PUB.PRI^* WOR$

Cases in the intersection/Total number of cases: $1 / 61 = 1.64 \%$

Cases in the intersection/Total number of cases $Y > 0.5$: $1 / 32 = 3.12 \%$

Possible Deviant Cases ($\sim IS^* MAX_TS$ and $Y < 0.5$) :

Boolean Expression: $EXT^* MAN^* \sim PRO^* \sim PUB.PRI^* WOR$

Cases in the intersection/Total number of cases: $1 / 61 = 1.64 \%$

Cases in the intersection/Total number of cases $Y < 0.5$: $1 / 29 = 3.45 \%$

Extreme Deviant Coverage Cases ($\sim IS^* \sim MAX_TS$ and $Y > 0.5$) :

Boolean Expression: $\sim EXT + \sim WOR + \sim MAN^* \sim PRO + \sim MAN^* PUB.PRI + \sim PRO^* PUB.PRI$

Cases in the intersection/Total number of cases: $9 / 61 = 14.75 \%$

Cases in the intersection/Total number of cases $Y > 0.5$: $9 / 32 = 28.12 \%$

Irrelevant Cases ($\sim IS^* \sim MAX_TS$ and $Y < 0.5$) :

Boolean Expression: $\sim EXT + \sim WOR + \sim MAN^* \sim PRO + \sim MAN^* PUB.PRI + \sim PRO^* PUB.PRI$

Cases in the intersection/Total number of cases: $25 / 61 = 40.98 \%$

Cases in the intersection/Total number of cases $Y < 0.5$: $25 / 29 = 86.21 \%$

Interpreting the robustness.

The fit-oriented parameters were all quite close to one, and for the case – oriented parameters these are also indicating a high robustness degree, with only one case being a “shaky case”. Hence I conclude that the robustness protocol does not indicate any substantial robustness issues with the analysis.

2.5 Skewness

It is obvious from my data set and in line with my qualitative expectation and the initial analysis of the ‘raw’ data that the condition EXT (whether the company experience external pressure or not) is skewed. My expectation is that this condition will only be important for companies experiencing a high degree of external pressure (the condition is crips). A descriptive skewness check shows that 54 of the 61 cases (88.5 %) have full membership (since full membership is the absence of external pressure). If too many cases have a high or low degree of membership in a single condition this may affect the validity of the results (Schneider and Wagemann, 2012: 232-248; Thomann and Maggetti, 2020: 372). A rule of thumb is that the membership degree should not be > 20 %, which my condition is. However, it does seem like the impact of the skewness of this condition is of less relevance for my analysis. According to Schneider and Wagemann (2012: 232) skewness issues relate to two aspects; trivialness of necessary conditions and simultaneous subset relations. Addressing the issue of trivialness first, I argue that I have substantive and theoretical reasons to include the condition despite the trivialness (yet only if does not alter the overall results), based on the case knowledge. The presence of external pressure *does* in some of my case overrule the other conditions (see within case analysis in the article). Hence I expect the condition to be trivial for the occurrence of the outcome.

Then turning to the simultaneous subset relations Thomann and Maggetti (2020: 373) states that the proportional reduction in inconsistency measure (PRI) can help detect these (when substantive interpretability is emphasised). The PRI for the occurrence (COM) as well as non-occurrence are all high (see table 3 and 4 in the article) suggesting that the skewness problem may not be problematic for the overall results. Moreover applying the Enhanced standard analysis (ESA, as above and in the analysis see Schneider and Wagemann, 2012) precludes the simultaneous subset relations.

However, to further assess the degree to which the skewness of the condition EXT is a problem for my analysis I run the analysis without the condition to see how it affects my results.

Analysis without EXT (COM)

To test the implication of the skewness of the condition EXT I ran the analysis without the condition. This did not alter the overall results in a substantial way – the solution terms are largely the same as can be seen below, in particular for compliance, hence meeting the recommendations of Schneider and Wagemann, 2012) that the interpretations should not be significantly altered. Some of the fit and threshold changed, but not greatly. However, two of the solution terms for non-compliance did change, but only in the configurations, less so when assessed qualitatively. But some of the consistency values changed, but most of the overall results were not dramatically changed for non-compliance either.

There were no necessary conditions when conducting the analysis without EXT

Truth table (without EXT)

OUT: output value

n: number of cases in configuration

incl: sufficiency inclusion score

PRI: proportional reduction in inconsistency

WOR MAN PRO PUB.PRI OUT n incl PRI

15	1	1	1	0	1	16	0.954	0.934
11	1	0	1	0	1	1	0.867	0.599
16	1	1	1	1	1	8	0.814	0.665
10	1	0	0	1	1	4	0.800	0.546
13	1	1	0	0	0	2	0.796	0.493
12	1	0	1	1	0	1	0.783	0.252
14	1	1	0	1	0	7	0.738	0.496
8	0	1	1	1	0	3	0.716	0.602
7	0	1	1	0	0	2	0.714	0.598
1	0	0	0	0	0	3	0.329	0.000
5	0	1	0	0	0	5	0.287	0.000
9	1	0	0	0	0	6	0.284	0.000
2	0	0	0	1	0	3	0.281	0.000

Parsimonious enhanced solution (without EXT)

n OUT = 1/0/C: 29/32/0

Total : 61

Number of multiple-covered cases: 16

M1: WOR*MAN*PRO + WOR*man*pro*PUB.PRI + (WOR*PRO*pub.pri) => COM

M2: WOR*MAN*PRO + WOR*man*pro*PUB.PRI + (man*PRO*pub.pri) => COM

	inclS	PRI	covS	covU	(M1)	(M2)
1 WOR*MAN*PRO	0.901	0.846	0.673	0.136	0.136	0.449
2 WOR*man*pro*PUB.PRI	0.800	0.546	0.137	0.043	0.043	0.043
3 WOR*PRO*pub.pri	0.815	0.757	0.474	0.022	0.032	
4 man*PRO*pub.pri	0.802	0.502	0.171	0.032		0.043
M1	0.803	0.719	0.747			
M2	0.854	0.780	0.758			

Conservative enhanced solution (without EXT)

n OUT = 1/0/C: 29/32/0

Total : 61

Number of multiple-covered cases: 16

M1: WOR*MAN*PRO + WOR*PRO*pub.pri + WOR*man*pro*PUB.PRI => COM
inclS PRI covS covU

1 WOR*MAN*PRO 0.901 0.846 0.673 0.136
2 WOR*PRO*pub.pri 0.815 0.757 0.474 0.032
3 WOR*man*pro*PUB.PRI 0.800 0.546 0.137 0.043

M1 0.803 0.719 0.747

Intermediate enhanced solution (without EXT)

n OUT = 1/0/C: 29/32/0

Total : 61

From C1P1, C1P2:

Number of multiple-covered cases: 16

M1: WOR*MAN*PRO + WOR*PRO*pub.pri + WOR*man*pro*PUB.PRI => COM
inclS PRI covS covU

1 WOR*MAN*PRO 0.901 0.846 0.673 0.136
2 WOR*PRO*pub.pri 0.815 0.757 0.474 0.032
3 WOR*man*pro*PUB.PRI 0.800 0.546 0.137 0.043

M1 0.803 0.719 0.747

com-analysis without EXT

Parsimonious enhanced solution (without EXT) (com)

n OUT = 1/0/C: 19/42/0

Total : 61

Number of multiple-covered cases: 4

M1: wor*pro + man*PRO + man*pub.pri => com
inclS PRI covS covU

1 wor*pro 0.907 0.882 0.329 0.169
2 man*PRO 0.832 0.537 0.340 0.135
3 man*pub.pri 0.894 0.826 0.388 0.114

M1 0.875 0.796 0.715

Conservative enhanced solution (without EXT) (com)

n OUT = 1/0/C: 19/42/0

Total : 61

Number of multiple-covered cases: 4

M1: wor*man*pro + wor*pro*pub.pri + WOR*man*PRO + (WOR*man*pub.pri) => com

M2: wor*man*pro + wor*pro*pub.pri + WOR*man*PRO + (man*pro*pub.pri) => com

inclS PRI covS covU (M1) (M2)

1 wor*man*pro 1.000 1.000 0.217 0.080 0.080 0.080
2 wor*pro*pub.pri 0.910 0.890 0.227 0.090 0.090 0.090
3 WOR*man*PRO 0.827 0.444 0.272 0.135 0.135 0.216

4 WOR*man*pub.pri 0.880 0.785 0.251 0.011 0.114
5 man*pro*pub.pri 1.000 1.000 0.296 0.000 0.103

M1 0.897 0.830 0.692
M2 0.896 0.826 0.681

Intermediate enhanced solution after CSA (without EXT) (com)

n OUT = 1/0/C: 19/42/0

Total : 61

From C1P1, C1P2, C2P1, C2P2:

Number of multiple-covered cases: 10

M1: wor*man*pro + wor*pro*pub.pri + WOR*man*PRO + (WOR*man*pub.pri) => com

M2: wor*man*pro + wor*pro*pub.pri + WOR*man*PRO + (man*pro*pub.pri) => com

inclS PRI covS covU (M1) (M2)

1 wor*man*pro 1.000 1.000 0.217 0.080 0.080 0.080
2 wor*pro*pub.pri 0.910 0.890 0.227 0.090 0.090 0.090
3 WOR*man*PRO 0.827 0.444 0.272 0.135 0.135 0.216

4 WOR*man*pub.pri 0.880 0.785 0.251 0.011 0.114
5 man*pro*pub.pri 1.000 1.000 0.296 0.000 0.103

M1 0.897 0.830 0.692

M2 0.896 0.826 0.681

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