Using third party sustainability standards for reducing uncertainties in sustainable multi-tier supply chains

Philipp C. Sauer (philipp.sauer@uni-kassel.de)
University of Kassel, Chair of Supply Chain Management

Abstract

Raw material suppliers at the upstream end of the supply chain (SC) have been identified as sources of reputational and supply risks which induce substantial uncertainty in sustainable SCs. Adopting institutional theory, this systematic document analysis investigates the usefulness of third party sustainability standards for mineral resources from a multi-tier sustainable SC management perspective. The findings indicate that the reviewed standards can reduce institutional distance as well as supply and demand uncertainty in mineral SCs. Contrastingly, most of the standards fall short in supporting the integration of up- and downstream actors and establishing the multi-tier SC as an institutional field.

Keywords: Supply chain uncertainty, Sustainability standards, Institutional theory

Introduction

The selection and management of distant raw material suppliers such as iron ore mines in Brazil or Coltan supplies from the Democratic Republic of Congo is a difficult task. It is associated to a high degree of uncertainty as these suppliers sit at the upstream end of the SC where focal firms only have limited influence and knowledge about the suppliers (Hofmann et al., 2018). The resulting uncertainty, i.e. taking decisions with unclear consequences (van der Vorst & Beulens, 2002), affects buyer and supplier operations and thus the success of sustainable supply chain management (SSCM) which aims to efficiently and effectively manage the SC while meeting stakeholder requirements (Beske & Seuring, 2014).

From an institutional theory perspective, SC uncertainties are driven by the expectations of the SC stakeholders and uncertainty is a major driver for SC cooperation (Kauppi, 2013). Changing customer and stakeholder requirements can change accepted technologies and business practices, which then results in supply and demand uncertainty (Chen & Paulraj, 2004) and renders already conducted SSCM activities partially obsolete. The adoption of independent institutions such as third party sustainability standards provides legitimacy to the adopting SC and reduces the uncertainty related to customer or regulatory demands.

In the mineral resources sector, such standards have seen a dramatic growth following the issuing of the US-American Dodd-Frank Act on conflict minerals in SCs (Hofmann et al., 2018) and related European Union regulations becoming mandatory in 2022.

Building on institutional theory, this study aims to integrate multi-tier SSCM and SC uncertainties to answer the following research question:

- How can the adoption of third party sustainability standards mitigate SC uncertainties and enhance the effectiveness of multi-tier SSCM?

To answer this question, this study conducts a systematic document analysis (Seuring & Gold, 2012) and represents the most comprehensive review of sustainability standards for mineral resources. It contributes to the current discussions on the relevance of taking a SC perspective for driving the sustainability in the mineral resource sector (Hofmann et al., 2018), which is a fruitful avenue of extending the foci of SSCM to developing economies as well as social sustainability, which are core to the reviewed standards.

Conceptualization

Multi-tier sustainable supply chain management and supply chain uncertainty

In long and complex multi-tier SCs, focal firms face supply uncertainties like stability and quality of supply and the suppliers face demand uncertainties regarding demand requirements and volumes (Chen & Paulraj, 2004; Kauppi, 2013). Both uncertainties are further driven by the institutional distance between focal firm and supplier context (Busse et al., 2016; Sauer & Seuring 2018). Institutional distance is further differentiated into institutional difference, i.e. the homogeneity of institutions between focal firm and supplier context and institutional uncertainty, i.e. a lack of institutionalization of institutions in the countries which the SC spans (Busse et al., 2016). Institutional uncertainty affects the supplier's adherence to SC aims and processes and undermines the confidence of the SC stakeholders into the sustainability of the chain (Busse et al., 2016).

Multi-tier SSCM (MT-SSCM) addresses these uncertainties as it aims at efficiently ensuring the compliance of distant suppliers to the sustainability requirements of the focal firm in order to reduce reputational and supply risks in the SC (Tachizawa & Wong, 2014). MT-SSCM can be conducted either "directly", "indirectly" or via "third parties". Tachizawa & Wong (2014) defined contingency variables for the selection of management approaches which favor the use of the "third parties" approach for managing distant raw material suppliers over which focal firms typically lack power and knowledge.

Contrastingly, third parties and related sustainability standards have been found to be ideal for an efficient management of distant suppliers, as they join forces of the buying firms and enable the sharing of required sub-supplier management efforts (Tachizawa & Wong, 2014; Tate et al., 2011). Still, using a third party is only one possible approach in MT-SSCM but can be used complementarily to the others and represents at least a support to the aims of MT-SSCM (Tachizawa & Wong, 2014).

In effect, MT-SSCM is an extension of the classically dyadic SSCM to "any lower tier" (Tachizawa & Wong, 2014, p. 651). To dive deeper into the standards from an SSCM perspective, this study is using the SSCM for minerals framework by Sauer & Seuring (2017), which enlarged previous SSCM frameworks to the field of mineral resources. It defines 23 practices in 6 categories, which are used to classify the standards and which are explained in Table 3 in the findings chapter. Due to space reasons, Table 3 has been moved there as it also displays the coding results for the analysed documents.

Institutional theory

Institutions represent "cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour" (Scott, 1999, p. 33) and build the basis for attributing legitimacy, which "is a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995, p. 574).

An institutional field represents the unit of analysis, where the institutional pressures and processes work (DiMaggio & Powell, 1983). Its definition and conception has recently been debated with criticism of an oversimplification. This study thus adopts the definition of a multi-tier SC as an institutional field by Sauer and Seuring (2018, p. 15), which "is defined as a composition of multiple relational spaces, i.e., (1) the "SC space" covering the firms in the stream of material, capital and information as well as (2) the individual "firm spaces" encompassing the firm in the SC and its direct environment. There are as many firm spaces as SC tiers and their environments may overlap depending on geographical or cultural distance. The single spaces come into existence by means of interaction of space members and institutional pressures are exerted in the individual spaces. The institutional pressure coming from the spaces thus overlap at the actors. Actors which do not know each other can neither be part of the same space nor pressure each other. In effect, the relational spaces are essential for exerting institutional pressure and reducing SC uncertainty as they limit the influence of the FF and build up competing demands on the (sub-)supplier."

In case of high institutional distance, the pressured supplier can accommodate the requirements of both focal firm and its own direct environment or de-couple from one of them (Meyer & Rowan, 1977). In the latter option, a pressured supplier only makes cosmetic changes to acquire the legitimacy while failing to implement substantial technical or processual changes (Meyer & Rowan, 1977). The risk of de-coupling thus rises with institutional distance, which in turn renders the cooperation with such SC partners ambiguous and risky (Busse et al., 2016; van der Vorst & Beulens, 2002).

Third party sustainability standards

Within an industry, third party sustainability standards represent institutions which define a set of mutually accepted requirements. Third party standards are thus ideally governed by a multi-stakeholder group, which comes together to address a certain issue and define mutually agreed requirements and processes for addressing the issue (Kickler & Franken, 2017). In the case of mineral resources, there is a rising number of standards on the market and new ones are emerging. These represent a regulative structure which provide stability and meaning to social behaviour (Scott, 1999). In effect, there are three core potentials from an institutional perspective which third party sustainability standards offer in multi-tier SCs:

First, the structural establishment of an institutional field by enabling interaction among standard members. The reach of a standard is dependent on the coverage of SC stages as well as certified materials and processes, i.e. the number of potential buyers which force a supplier to adopt a standard (Tate et al., 2011). This coverage enables or restricts the interaction of SC actors and establishes an institutional field with the standards requirements as the formalization of the guiding institutions.

Second, the reduction of institutional distance by complementing local institutions and their institutionalization (Busse et al., 2016), which is achieved via the standards' requirements and processes, which are seen as legitimate by all stakeholders in the SC.

Third, reducing supply and demand uncertainty by defining sustainability criteria accepted by all relevant stakeholders (Kauppi, 2013). These can serve as a SC wide accepted baseline for supplier selection and development and can thus reduce the supply and demand uncertainty in the SC (Chen & Paulraj, 2004).

These three potentials guide the further analysis and are related to the SSCM for minerals practices by Sauer & Seuring (2017). The findings are then used to derive recommendations for the design of standards and the use of standards in MT-SSCM.

Methodology

This study represents a systematic content-analysis based document analysis as proposed by Seuring & Gold (2012). This analysis covers four steps, i.e. (1) material collection, (2) descriptive analysis, (3) category selection, and (4) material evaluation, which are derived from Mayring (2000). The application of content analysis "represents an effective tool for analyzing the sample of research documents in a systematic and rule-governed way" (Seuring and Gold, 2012, p. 546) and has gained substantial momentum in SSCM research. It is mainly applied for literature reviews, i.e. the analysis of scientific papers, but can be applied to "all sort of recorded communication" (Mayring, 2000, p. 2).

The **material collection** includes the definition of the research question and search parameters (Seuring & Gold, 2012). As a result a set of 20 sustainability standards for mineral resources (listed at the end of the paper) has been identified by combining an online search and scanning the scientific as well as grey literature on sustainability in mineral SCs. The used keywords were "standards for minerals", "sustainable schemes for minerals" and "standards for sustainable supply chain management". Subsequently the found standards were selected against their relevance to mineral SCs. The core documents of the standards were obtained from the standards' websites.

The **descriptive analysis** records the formal characteristics of the analyzed material, i.e. the certified minerals and SC stages. Its results are displayed in the findings chapter.

The **category selection** provides the codes for the deductive analysis of the material. It is closely guided by the concepts outlined in chapter 2. The core of the analysis is based on the SSCM for minerals framework by Sauer & Seuring (2017), supply and demand uncertainty (Chen & Paulraj, 2004) as well as institutional distance (Busse et al., 2016).

During the **material evaluation** the reviewed material is classified against the selected categories and codes. This enables both a qualitative and quantitative analysis of the contents (Mayring, 2000). Its results can be used to evaluate the state of the art in the analyzed material as well as outlining strengths and weaknesses of the material in comparison to the frameworks and concepts which are used for coding (Seuring & Gold, 2012). The results of the material evaluation are presented in the findings chapter.

Content analysis has the "pretension to be intersubjectively comprehensible" (Mayring, 2000, p. 3). Thus, reliability and validity checks need to be conducted. The validity of the analysis was ensured by using categories from well-established literature. These codes have been coded by one person, which requires to focus intra-coder reliability. This was enhanced by coding a quarter of the standards twice, before coding the remaining ones. Such a process ensures the development of a solid understanding of the codes before the second coding run, which delivered the results displayed here.

Findings: The potential of using third party standards in MT-SSCM

This chapter is divided in the descriptive analysis focussing on structural characteristics of the standards and the material evaluation investigating the practices applied by them, which delineates the processes prescribed by the standards.

Descriptive analysis: The structural potential of the reviewed standards

Third party standards can help to establish an institutional field by enabling an interaction of distant focal firms and (sub-)suppliers depending on their coverage of mineral resources as well as SC stages. These two parameters are thus analysed in this section.

First, Table 1 depicts the minerals addressed by the standards. It shows the clear focus of the industry on precious and valuable metals covering twelve of the 20 standards. Contrastingly, the mass metals Aluminium, Coal and natural Stones are focussed by only four ones and another four standards are generic for the sector.

Table 1 – Mineral focus of the reviewed standards (n=20)

Addressed minerals	Standards	Sum
All mineral resources	ICMM, IRMA, EITI, GRI	4
Aluminium	ASI	1
Coal	Bettercoal	1
Diamonds	RJC, DDI, KP	3
Elements of platinum, Gold	Fairmined, Fairtrade	2
Gold	ICMI, LBMA, WGC	3
3TG (Tin, Tantalum, Tungsten, Gold)	CTC, CFSP, RCM, iTSCi	4
Natural Stone	Fairstone, Xertifix	2

Looking at Table 2, which displays coverage of SC stages, four groups of standards become evident. The upper two groups focus on the extraction only or extend the focus until the boarder of the country. The latter practice is especially relevant in case of conflict minerals such as the 3TG or Diamonds. These are often mined in conflict affected areas and their sourcing represents a reputational risk for the SC and is thus required to be reported (Hofmann et al., 2018). A similar logic is applied when certifying to the smelter stage of the SC as the smelter represents an ideal bottleneck for monitoring global metal ore streams (Sauer & Seuring, 2017). Only the remaining seven standards establish a comprehensive SC coverage. Noticeably, these standards are very specific in terms of addressed minerals as well as focussing fair labour conditions. Only ASI and Bettercoal are more comprehensive in their coverage of sustainability parameters. They also represent industry wide associations and aim to drive the industry as a whole.

The latter two standards are thus focussing on a comprehensive coverage of the SC and actors in their industry. As the only standards on the respective mineral, they also represent a best case in terms of establishing an institutional field. Contrastingly, the first three groups of standards fail to include the focal firms into their labels.

Both parameters underline a current lack of generic guidelines and institutions. This forces producers of complex products to engage in a number of standards, which in turn limits the potential reduction of supply and demand uncertainty as the standards define different requirements and are only partially compatible. Participating companies can thus only sell certified products to focal firms engaging in the same standard, i.e. only a fraction of the total market for the mineral. This fractioning and limited interaction of actors also hinders the establishment of a comprehensive institutional field for sustainable minerals (Tate et al., 2011) as well as the potential reduction of supply and demand uncertainty as downstream SC actors are not engaged (Sauer & Seuring, 2018).

Table 2 – SC stages covered by the reviewed standards (n=20)

Covered SC stages	Related standards	Sum
Extraction only	WGC, ICMM, IRM, EITI, GRI	5
Extraction to export	CTC, RCM, ICMC, DDI, KP	5
Extraction to smelter	LBMA, CFSP, iTSCi	3
Entire SC	Xertifix, RJC, Fairtrade, Fairmined, Fairstone, ASI, Bettercoal	7

Material evaluation: The processual potential of the reviewed standards

The coding results are displayed in Table 3. Due to space constraints, this conference paper only outlines the core findings related to the research question.

Minerals are to a large extend mined in developing economies with lacking governance capacity and low-level or absent regulation on social and ecologic sustainability (Sauer & Seuring, 2017; Hofmann et al., 2018). All 20 standards reference **government interventions**, especially the *direct regulation* by defining national legislation as

minimum requirements and the need to obtain local mining or export licenses. Furthermore, eleven standards define individual upper limits for the age of child laborers and working hours (IRMA), corruption and discrimination measures (ASI), or rely on systems such as OECD Due Diligence Guidance (iTSCi) and ILO Conventions (ASI, Fairstone). These requirements and the national legislation thus become part of the certification requirements. This reduces institutional difference by altering minimum requirements and reduces institutional uncertainty as the control of rules and norms is complemented by the standards. Contrastingly, the remaining multi-stakeholder practices are largely bypassed, although they offer more potential for interaction and the establishment of an institutional field as well as the reduction of institutional distance.

Table 3 – Coding scheme and coding results (adapted from Sauer & Seuring (2017); n=20)

Categories, practices (frequencies)	**Description of the practices and interrelations**
Government interventions 1) Direct regulation (20) 2) Interactive regulation (2) 3) Facilitating self-regulation (2) 4) Government as consumer (2)	**Governments** intervene in SC operations by imposing legally binding **direct regulations**, **interacting** with and financing social society actors, and providing information to **facilitate self-regulation**. They can also aim to **consume** more sustainable products and services.
Orientation 5) Dedication to TBL (4) 6) Dedication to SCM (3)	**Orientation** centers on the strategic decisions of SC members to adopt **TBL** and **SCM** practices to realize a competitive advantages.
Continuity 7) SC partner development (16) 8) Long-term relationships (4) 9) SC partner selection (18)	Continuity draws on the SC structure and focuses on building **long-term relationships** with **selected SC partners**. Subsequent **development of** weak **partners** enhances overall SC performance.
Collaboration 10) Enhanced communication (19) 11) Technological integration (4) 12) Logistical integration (3) 13) Joint development (2)	Operational practices, such as **enhanced communication** and **joint development**, strengthen the **collaboration** among SC members, which is further facilitated by integrating **logistical** and **technological** structures.
Risk management 14) Standards and certification (7) 15) Selective monitoring (20) 16) Pressure groups (16) 17) Primary supply stability (0) 18) Governance gaps (9)	**Pressure groups** targeting unsustainable suppliers are major SC **risks**, which can be mitigated by **monitoring** suppliers and relying on **standards and certification**. Mineral SCs actors have to complement the often weak governance contexts they span. It is further important to **stabilize primary mineral supplies**, which have recently been very volatile and represent a supply risk.
Pro-activity management 19) Stakeholder management (19) 20) Learning (6) 21) Innovation (4) 22) Environmental pro activity (7) 23) Linkage development (14)	**Developing linkages** at the mine aims at sharing revenues with local **stakeholders**. **Managing stakeholders** enables **learning** effects, which stimulate SC **innovation**. **Environmental pro-activity** represents a further means to diversify from competitors and gain competitive advantages in mineral SCs.

The second category of **orientation** centres on the adoption of sustainability and SCM as strategic aims (Beske & Seuring, 2014). This category is largely bypassed and only ICMM and ASI explicitly push the orientation to SSCM and can thus be seen as helpful institutions in this category which help reducing institutional difference in the chain.

Both **orientation** and **government interventions** drive the creation of **continuity** in the SC. Only four of the reviewed standards address *long-term relations*. However, they propose to "establish, where practicable, long-term relationships with suppliers as opposed to short-term or one-off contracts in order to build leverage over suppliers",

which is a perfect fit to SSCM principles (Beske & Seuring, 2014). Surprisingly, only one of the four standards referring to the practice covers the entire SC (Fairtrade). *SC partner selection* is well represented and mainly linked to the establishment of a Chain of Custody, i.e. a full record on which companies owned the material. This practice is prevalent in 3TG standards, where reporting requirements on the material sources are in place (Hofmann et al., 2018). Moreover, some standards require the termination of relations to non-compliant suppliers in order to ensure fully certified SCs. *SC partner development* mainly refers to corrective action plans, trainings, prepayments and increasing performance goals. In effect, the standards are well equipped to enhance supplier sustainability or to be used as decision tools for selecting suppliers and thus reducing supply and demand uncertainty. Still, this could be strengthened by a stronger emphasize on *long-term relations*. However, buyer-(sub)supplier relations are limited by the often large cultural and physical distances in mineral SCs.

Collaboration is mainly driven by *enhanced communication*, which is established in all but one standard (MDS). *Enhanced communication* is described by the standards as "Coordination between industry members who share suppliers", "Cooperation between upstream and downstream companies", "Building partnerships with international and civil society organizations" (OECD, 2016, p. 64), but also sharing information in the context of Chain of Custody systems. Contrastingly, there is a lack of the other three practices in the category. Integration and joint development are important drivers of SSCM success (Beske & Seuring, 2014) and facilitate the reduction of supply and demand uncertainty as products are designed together. Still, such actions remain outside the scope of a third party standard as they encompass the link of actors in the material stream of the SC. Accordingly, four standards define online tools for sharing information, which fall under *technological integration*. *Logistical integration* is also associated to the Chain of Custody, but refers to the handling of certified materials. In effect, the standards excel in enhancing communication which drives the establishment of an institutional field by enabling interaction and reduces supply and demand uncertainty by providing information. Still, more integration could drive the efficiency of these processes and reduce institutional distance as well as supply and demand uncertainty by implementing similar processes and structures in the SC.

In the **risk management** category, all standards focus on the *selective monitoring* of the suppliers by defining auditing requirements, which are central to third party standards and thus unsurprising. Still, the 3TG standards, which do not cover the entire SC are "specifically designed to assist downstream customers with their compliance to Section 1502 of the Dodd-Frank Act" (CFSP, 2012a, p. 21). Another interesting practice is the handling of *pressure groups*, which encompass in the minerals sector mainly the state and customer, both mentioned by six standards and to a lesser extent NGOs (referenced by three standards only). This lacking outreach to NGOs is surprising, as many NGOs are represented in the boards of standard organizations (Kickler & Franken, 2017). Seven standards focus on *standards and certificates* by requiring the definition and enforcement of codes of conduct. The final practice of closing *governance gaps* is closely associated with the lacking enforcement capabilities of state actors. This responsibility has thus to be taken over by private actors as single distant focal firms might be not powerful enough, this can be delegated to third parties which join the power of all buyers they represent (Tachizawa & Wong, 2014). They thus excel in reducing institutional distance.

Finally, the **pro-activity management** category is dominated by *stakeholder management* practices which encompasses the inclusion of stakeholders into the standards' governance bodies and supporting local stakeholders. The latter is mainly covered by grievance mechanisms, pro-actively informing stakeholders, considering

indigenous people and planning for a sustainable mine closure. This is complemented by *building linkages*, i.e. enhancing local infrastructure and education but also making tax payments transparent and building local governance capacities. This category thus addresses the supplier context and reduces institutional distance as well as supply and demand uncertainty by enhancing the supplier sustainability. Still, the environmental focus can be strengthened to achieve triple bottom line (TBL) performance.

Discussion and conclusion

The findings underline the strengths and weaknesses of current standards for mineral resources for establishing the multi-tier SC as a comprehensive institutional field, and reducing institutional distance as well as supply and demand uncertainty in the SC. Moreover, the SSCM for minerals practices by Sauer & Seuring (2017) are related to these issues, which contribute to their theoretical grounding. Especially the high frequency of codes for the practices which Sauer & Seuring (2017) added to the original framework by Beske & Seuring (2014) is supporting their work. Moreover, the use of third party standards as an efficient approach for ensuring a sustainable multi-tier SC as proposed by Tachizawa & Wong (2014) is grounded in institutional theory and the definition of the multi-tier SC as an institutional field by Sauer and Seuring (2018).

This study is the first to apply this definition to empirical data and finds, that third party standards can connect SC actors and facilitate the establishment of a comprehensive field as called for by Sauer and Seuring (2018). Additionally, multiple standards for one mineral fragment the market and reduce thus the pressure on single suppliers to engage in SSCM practices as put forward by Tate et al. (2011).

Enhancing the applicability of these standards is beneficial to both the minerals sector and the downstream industries, which use the mineral resources to produce and run their products. However, this study provides evidence that the standards fall short in driving the integration of up-and downstream SC actors, which is one of the major barriers for more sustainability in the sector (Sauer & Seuring, 2017). This underlines the need for a further alteration of the standards. Especially the relational aspect of SSCM can be strengthened by emphasizing strategic values, enhanced *integration* and *long-term relations* among SC partners, which have been put forward by Beske & Seuring (2014) as crucial enablers of SSCM effectiveness.

Moreover, this study provided evidence on the usefulness of the standards in the sector to mitigate supply risks regarding sustainability as well as reducing the demand uncertainty for the minerals sector. This supports the trend for comprehensive certification of the sector, which is still increasing (Kickler & Franken, 2017). It further answers the call by Kauppi (2013) for applying these uncertainties in (S)SCM research as they build the link to institutional theory which also aims at reducing uncertainty.

Still, there is the need to focus more on ecological concerns to enhance the usefulness of the standards for SSCM. This would enable the standards to certify TBL performance which is called for by SSCM scholars (Beske & Seuring, 2014) and western regulators (Hofmann et al., 2018). Contrastingly, the results support prior findings on a strong focus on social issues in the minerals sector, while the environmental dimension is substantially less represented (Sauer & Seuring, 2017). This contrasts current SSCM priorities and offers an opportunity for SSCM to balance its sustainability foci.

Turning to the SC domain, there is a growing body of standards which cover the entire SC. SCM considerations are generally gaining traction in the sector, which is traditionally decoupled from downstream industries (Sauer & Seuring, 2017). This trend enhances the usefulness of the standards for MT-SSCM both for passively mitigating risks and pro-actively driving sustainability. The reviewed standards can thus be seen as a first step

towards less uncertainty in mineral SCs as well as the formation of a more uniform and institutionalized set of sustainability requirements in the sector. This institutionalization facilitates the implementation of SSCM and mitigates the risk of paradoxical SC sustainability risks outlined by Busse et al. (2016).

Following current calls, the study further added empirical evidence on the handling of SSCM issues in a developing economy context. This contrast the current focus of SSCM on industrial economies, although the major sustainability hotspot lie at the upstream SC parts which often span developing economies (Sauer & Seuring, 2018).

This study has three major limitations. First, it is bound to a single SSCM framework, which limits the generalizability of results to SSCM. Second, the study is single-authored and the codings are subjectively influenced. Although the study was designed considering validity and reliability concerns, other authors might find different conclusions. Third, large parts of the analysed material have not been designed from a SC perspective and can thus not adhere to all SSCM concepts. Still, the findings underline the relatively large overlap with SSCM practices of the standards, which justifies the use of the framework.

Nevertheless the limitations lead over to future research opportunities. These encompass an empirical validation with actors involved in the sectors, such as interviewing certified mines, traders and focal firm to investigate their perception of the uncertainties and potential alteration of the standards. Moreover, the influence of institutional distance can be evaluated by investigating certified actors in similar contexts, such as mines and focal firms in the US or European Union. Still, the latter suggestion is again biased by an industrial economy perspective, but entire SCs in developing economies are scarce in the sector.

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References

Beske, P. and Seuring, S. (2014), "Putting sustainability into supply chain management", *Supply Chain Management: An International Journal*, Vol. 19, No. 3, pp. 322–331.

Busse, C.; Kach, A. P. and Bode, C. (2016), "Sustainability and the False Sense of Legitimacy". How Institutional Distance Augments Risk in Global Supply Chains, *Journal of Business Logistics*, Vol. 37, No. 4, pp. 312–328.

Chen, I. J. and Paulraj, A. (2004), "Towards a theory of supply chain management: the constructs and measurements", *Journal of Operations Management*, Vol. 22, No. 2, pp. 119–150.

DiMaggio, P. J. and Powell, W. W. (1983), "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields", *American Sociological Review*, Vol. 48, No. 2, pp. 147–160.

Hofmann, H.; Schleper, M. C. and Blome, C. (2018), "Conflict Minerals and Supply Chain Due Diligence: An Exploratory Study of Multi-tier Supply Chains", *Journal of Business Ethics*, Vol. 147, No. 1, pp. 115–141.

Kauppi, K. (2013), "Extending the use of institutional theory in operations and supply chain management research", *International Journal of Operations & Production Management*, Vol. 33, No. 10, pp. 1318–1345.

Kickler, K. and Franken, G. (2017), *Sustainability Schemes for Mineral Resources: A Comparative Overview*. Edited by Bundesanstalt für Geowissenschaften und Rohstoffe. Bundesanstalt für Geowissenschaften und Rohstoffe. Available online at https://www.namiro-projekt.org/app/download/14121012824/Sustainability+Schemes+for+Mineral+Resources_BGR_2017.pdf?t=1502356587, checked on 10/27/2017.

Mayring, P. (2000), "Qualitative Content Analysis", *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, Vol. 1, No. 2. Available online at http://www.qualitative-research.net/index.php/fqs/article/view/1089/2386, checked on 10/18/2016.

Meyer, J. W. and Rowan, B. (1977), "Institutionalized Organizations". Formal Structure as Myth and Ceremony, *American Journal of Sociology,* Vol. 83, No. 2, pp. 340–363.
Sauer, P. C. and Seuring, S. (2017), "Sustainable supply chain management for minerals", *Journal of Cleaner Production,* Vol. 151, pp. 235–249.
Sauer, P. C. and Seuring, S. (2018), "The role of the sub-supplier's direct environment for choosing multi-tier sustainable supply chain management practices", Manuscript submitted for publication.
Scott, W. R. (1999), *Institutions and organizations*, Thousand Oaks, CA, SAGE.
Seuring, S. and Gold, S. (2012), "Conducting content-analysis based literature reviews in supply chain management", *Supply Chain Management: An International Journal,* Vol. 17, No. 5, pp. 544–555.
Suchman, M. C. (1995), "Managing Legitimacy". Strategic and Institutional Approaches, *Academy of Management Review*, Vol. 20, No. 3, pp. 571–610.
Tachizawa, E. M. and Wong, C. Y. (2014), "Towards a theory of multi-tier sustainable supply chains: a systematic literature review", *Supply Chain Management: An International Journal,* Vol. 19, No. 5/6, pp. 643–663.
Tate, W. L.; Dooley, K. J. and Ellram, L. M. (2011), "Transaction Cost and Institutional Drivers of Supplier Adoption of Environmental Practices", *Journal of Business Logistics,* Vol. 32, No. 1, pp. 6–16.
van der Vorst, J. G. and Beulens, A. J. (2002), "Identifying sources of uncertainty to generate supply chain redesign strategies", *International Journal of Physical Distribution & Logistics Management,* Vol. 32, No. 6, pp. 409–430.

Reviewed standards including abbreviation, number of revision, and date of issuance

1. Alliance for Responsible Mining (ARM): Fairmined Standard for Gold from Artisanal and Small-scale Mining, including Precious Metals (v2, Apr. 2014)
2. Aluminum Stewardship Initiative (ASI): Performance Standard (v2, May 2017) and Chain of Custody Standard (v1, Draft 4, May 2017)
3. Bettercoal: Bettercoal Code (v1, Jun. 2013)
4. Certified Trading Chains (CTC): Manual for the Certification of Ores in the Tin Industry in the DRC - Principles, Guidelines and Standards (v0, Feb. 2011)
5. Conflict-Free Smelter Program (CFSP): 1.Smelter Introductory Training and Instruction Document (rev, Jul. 2012); 2. Gold Supply Chain Transparency Smelter Audit Standard and Instruction (rev, Jun. 2012); 3. Supply Chain Transparency Smelter Audit Procedure for a) Tin and Tantalum (rev, Jan. 2014) and b) Tungsten (rev, Nov. 2013); 4.Supply Chain Transparency Smelter Audit Protocol for a) Tin and Tantalum (rev, Nov. 2013) and b) Tungsten (rev, Nov. 2013)
6. Diamonds Development Initiative (DDI): Maendeleo Diamond Standards (Apr. 2016)
7. Extractive Industries Transparency Initiative (EITI): Extractive Industries Transparency Standard (Feb. 2016)
8. FairTrade International: FairTrade Standard for Gold and Associated Precious Metals for Artisanal and Small-Scale Mining (Fairtrade) (v1.2, Nov. 2013)
9. Global Reporting Initiative (GRI): Global Reporting Initiative Mining and Metals Sector Disclosures (May 2013)
10. The Mineral Certification Scheme of the International Conference on the Great Lakes Region (ICGLR): ICGLR Regional Certification Mechanism (RCM) - Certification Manual (Sep. 2014)
11. International Council on Mining and Metals (ICMM): Sustainable Development Framework (May 2008)
12. International Cyanide Management Institute (ICMI): Cyanide Management Code (Dec. 2016)
13. ITRI Tin Supply Chain Initiative (iTSCi): a) iTSCi Programme Review 2014 (Dec. 2014) and b) OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas incl. supplements on Tin, Tantalum and Tungsten as well as Gold (v.3, 2016)
14. Kimberley Process (KP): KP Certification Scheme (2003)
15. Initiative for Responsible Mining Assurance (IRMA): Standard for Responsible Mining (Draft v2.0, Apr. 2016)
16. Responsible Jewellery Council (RJC): Code of Practices (Nov. 2013)
17. The London Bullion Market Association (LBMA): Responsible Gold Guidance (v6, Aug. 2015)
18. WiN=WiN: Fair Stone Handbook - International Standard for the Natural Stone Industry (Fairstone) (v6, May 2016)
19. World Gold Council (WGC): Conflict Free Gold Standard (Oct. 2012)
20. Xertifix: XertifiX Contract Draft (2016)