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Review

Does green procurement pay off? Assessing the practice–performance link employing meta-analysis

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A R T I C L E I N F O

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A B S T R A C T

The need for a shift to environmentally friendly economies is undisputed. Procurement responsibility is the steering of upstream supply chains; therefore, it is a main source for sustainable development, according to the Natural Resource-Based View. Recent studies examine the adoption of green procurement practices and highlight implementation barriers; the foremost seem to be reservations regarding the perceived cost of sustainable services. Extant research measures the impact of organisations' sustainable procurement on their overall economic performance. To contribute to the literature, this study adds three different performance measures to examine 22 empirical studies. We employ a meta-analytical methodology, adding operational, market, and financial measures. The results demonstrate that the introduction of green procurement practices has a positive effect in each of these areas and ultimately on organisations' overall economic performance.

1. Introduction

Green procurement (GP) is the practice of making purchasing decisions based on environmental factors in addition to traditional supplier selection criteria such as price, quality, and availability (Mahammadzadeh, 2012). The emergence of GP is fuelled by growing ecological concerns and the imperative for sustainable development (Appolloni et al., 2022). GP aims to reduce the environmental impact by encouraging the use of products and services that consume fewer resources, generate less waste, and cause fewer emissions (Münch et al., 2022). A seminal study by McKinsey et al., (2021) claims that approximately two-thirds of the average company's sustainable footprint can be attributed to its suppliers. Hence, GP is thought to drive innovation by pushing suppliers to develop more eco-friendly products. Actively applying GP also mitigates regulatory risks across the supply chain as companies increasingly face stringent environmental laws and mandates Wilhelm and Villena (2021); Germany's 2021 Supply Chain Act, for example, mandates due diligence checks of large companies' supply chains for any human rights and environmental abuses. Companies failing to comply risk financial penalties and exclusion from contracts. Similar legislative frameworks are emerging across Europe, such as France's 'Duty of Vigilance Law', which requires companies to establish and implement a vigilance plan to identify risks and prevent severe violations of human rights and environmental laws. Additionally, multinational corporations should meet global standards such as ISO 14001. While these are not laws, they function as de facto requirements for doing business in multiple regions and require a systematic approach to environmental management, including that of procurement.

On the one hand, as the United Nations Environment Programme (UNEP, 2022) pointed out, the perceived high cost of sustainable products is one of the biggest barriers to their procurement. Other researchers have come to the same conclusion, such as Vejaratnam et al.'s (2020) literature review, Simion et al.'s (2019) study of the Romanian construction sector, and Palm and Backman's (2017) study of Swedish municipalities that avoided electric vehicle procurement. Procurers in China (Geng and Doberstein, 2008) and Saudi Arabia (Islam et al., 2017a) also felt that high costs led to less preference for green products and services in public procurement. Similar results were found in international surveys done by Brammer and Walker (2011) as well as Leal et al. (2019). On the other hand, GP is also thought to enhance corporate image, providing a competitive edge in attracting consumers and investors concerned about sustainability (Nadvi and Raj-Reichert, 2015). This theory is stated by Hart (1995) in his Natural Resource-Based View (NRBV), which extends the Resource-Based View (RBV) and establishes a link between the management of natural resources through GP practices and economic objectives. NRBV encourages organisations to consider environmental practices (e.g. life-cycle costing, waste

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Abbreviations

EP	Economic performance
FP	Financial performance
GP	Green procurement
GPP	Green Public Procurement
GSCM	Green Supply Chain Management
IQ	Intelligence quotient
MP	Market-based performance
NRBV	Natural Resource-Based View
OP	Operational performance
RBV	Resource-Based View
SSCM	Sustainable supply chain management
UNEP	United Nations Environment Programme

prevention, and the promotion of sustainable development) not merely as a regulatory obligation but as a strategic opportunity for innovation and long-term competitiveness. In summary, GP is not merely an ethical choice but a strategic one, blending environmental stewardship with business objectives (Arora et al., 2020). Therefore, it is necessary to widen the focus from cost to financial performance and maybe even further to the overall economic performance of an organisation.

In academic research, the field of GP is predominantly interpreted in the context of a triple-bottom-line (profit, people, and planet). John Elkington coined this term in the mid-1990s to describe the shared, overriding importance of economic, social, and environmental objectives (Elkington, 1997). Concurrently, academic scholars are intensifying their focus on the interdependencies of the objectives, i.e. how GP can improve the performance and competitive advantage of organisations (Islam et al., 2017b). The present study is in line with these efforts.

A closer look at the results of those studies reveals incongruent empirical findings related to the impact of GP on a firm's economic performance (EP) and competitiveness. Rao and Holt (2005) identify significant benefits in competitiveness and EP, while Zhu et al. (2007) refute any notable economic gains. Galeazzo et al. (2021) investigated the relationship between GP and financial performance in the tourism sector and found a positive influence only when adding two moderators (long-term orientation and price-green-quality inference). Similar studies examine the role of contextual factors, such as industry type or geographic location, in mediating the relationship between GP and EP. Moreover, GP is sometimes not discussed as an individual unit of analysis but is put into the broader context of Green Supply Chain Management (GSCM). GSCM refers to the integration of environmental considerations into traditional supply chain management processes, from product design and material sourcing to manufacturing and product distribution (Srivastava, 2007). It focuses on the involved supply chain partners and takes a network perspective on adopting green practices rather than a company or organisational level. Thus, better evidence for the GP practice–performance link is required. As Balin and Sari (2023) stated in a recent study, 'All of these examples show that providing empirical evidence about the effect of GPP [Green Public Procurement] on FP [financial performance] is crucial […]'. Hence, this study addresses the following research question (RQ).

RQ. How do GP practices affect the economic performance of buying organisations?

The study commences by reviewing this practice–performance link and conceptualising it through the lens of the NRBV to establish a theoretical foundation. The core of the paper employs a meta-analysis to systematically analyse studies offering empirical evidence into the practice–performance link in the context of GP. Meta-analysis has been described as the highest stage of evidence-based research (Reay et al., 2009). It offers a statistically rigorous technique to aggregate results (Phan et al., 2015), thereby providing an understanding of the relationship between GP practices and EP, amongst others. In the case of GP, a meta-analytical summary of results using various EP measures, as well as an indication of their variability across studies seems to be lacking in current research. The paper concludes by synthesising the meta-analytic findings, offering practical implications for buying organisations, and suggesting avenues for future research.

2. Understanding the practice–performance link in green procurement

2.1. Specification of the concepts of 'green procurement practice' and 'economic performance'

Overall, procurement practices are defined as a set of 'activities that relate to the interface between the supply base and purchasing' (Narasimhan and Das, 2001, p. 594). They are aimed at altering EP measures such as cost, quality, and delivery (Das and Narasimhan, 2000). GP practices may entail designing a supply chain according to social, ecological, and economic aspects and integrating sustainability criteria into the supplier selection process (Mahammadzadeh, 2012). It is thus important to implement specific criteria in the supplier selection processes for green contracts in accordance with the organisational culture and strategy (Geroski, 1990). Focusing on the environmental dimension of sustainability, 'GP practice' may entail the integration of green criteria into purchasing strategies and procedures (Koplin, 2006).

To implement GP practices in the procurement process, the environmental goals described by the company should be incorporated into a defined reference strategy (Koplin et al., 2007). This strategy serves as a GP guideline for the procurers on an order-by-order basis. One of the most important process steps in sustainable supply chain management (SSCM) is the selection and evaluation of environmentally friendly suppliers and services (D'Agostini et al., 2017). These are important factors for cooperation and (thus) the procuring company's performance (Münch et al., 2022; Song et al., 2017; Yu et al., 2017). Bids and suppliers are evaluated according to predefined environmental criteria. These include recycling and reuse, eco-labels, quality labels (e.g. 'Blue Angel', 'EU Ecolabel', 'Nordic Swan'), and the application of life-cycle cost analysis (Igarashi et al., 2015).

After calculating life-cycle costs, a distinction can be made between a conventional and an environmentally friendly product and the extent to which the green variant performs economically better overall than the conventional one (Jenssen and de Boer, 2019). The company's production methods, such as external costs in the event of negative externalities, should also be included in the evaluation (D'Agostini et al., 2017). This study aims to bridge or solidify the findings from the procurement research on GP prerequisites and the GSCM research on the positive relationship of green practices with EP measures. How these are defined and configured depends on the organisation's individual needs. The final step reviews achievements and learns from the results (Zimmer et al., 2016).

2.2. Natural resource-based view as an underpinning of the economic performance and the green procurement practice-performance link

The influence of sustainability-related resources and capabilities on the competitive advantage of a buying institution is explained by the NRBV in various supply chain and procurement-focused studies (AlNuaimi et al., 2021; Andersén, 2021; Münch et al., 2022; Ngo, 2021). The concept of NRBV was first introduced by Hart (1995). It is an extension of Wernerfelt's (1984) RBV, which states that the combination of different resources, as well as the way they are managed, influences the capabilities of the company. Companies get a competitive advantage when resources are valuable and hardly imitable (i.e. there is no equivalent substitute). In this context, not only cost advantages are understood as an increase in performance but also other factors that lead to competitive advantages, such as pre-emption and future position. Procurement practice is understood as a capability that can help companies collaborate and share key attributes (Barnes and Liao, 2012). This contributes to the development of unique traits that are costly to replicate and thus lead to a competitive advantage (Fig. 1).

Against this backdrop, the RBV helps explain performance differences using various performance measures based on sourcing practices (Knudsen, 2003; Zimmermann and Foerstl, 2014). The impact of GP practices on performance is also supported by the RBV (Peng and Lin, 2008; Wu et al., 2008), with the performance measure being specifically tied to cost–benefit results (Christmann, 2000) or competitive advantages (Chen et al., 2006; Chiou et al., 2011). However, in Hart's (1995) view, the RBV ignores the challenges and constraints imposed by the natural environment that should be considered when developing new resources and capabilities. From the perspective of the NRBV proponents, the acceleration in the scale and scope of human activities and their potential for irreversible environmental damage requires a connection between the environmental challenge and firm resources. Following these considerations, Hart (1995) proposed the NRBV, which assumes that future competitive advantage will be based on 'capabilities that enable ecologically sustainable economic activity' (p. 991). Research has repeatedly confirmed this link, meaning that supply chain processes have direct impacts on the natural environment and that practices to manage and reduce these impacts can develop capabilities to improve performance (Guang Shi et al., 2012; Vachon and Klassen, 2008). According to Hart (1995), the NRBV includes three interrelated strategic capabilities to achieve economic and environmental sustainability and create a competitive advantage for the buying institution: pollution prevention, product stewardship, and sustainable development (Table 1).

Guang Shi et al. (2012) interpret GP practices as a socially complex resource, requiring agreements between multiple supply chain members. To ensure reliable and interactive environmental collaboration, frequent and open communication between the buyers and their suppliers is needed. According to Zhu et al. (2008) and Carter and Carter (1998), GP focuses on cooperating with suppliers to develop environmentally sustainable products, which contributes to sustainable development. According to Carter et al. (2000), Min and Galle (2001), and Zsidisin and Siferd (2001), life-cycle assessments are particularly useful in the selection of products and packaging. This encourages partners to participate in product design and packaging that reduces waste in the supply chain and facilitates reuse and recycling without compromising the properties or quality of raw materials. This contributes to product stewardship. Song et al. (2017) divided GP practices into two

Table 1
Natural resource-based view according to Hart (1995).

Strategic Capability	Environmental Driving Force	Key Resource	Competitive Advantage
Pollution Prevention	Minimise emissions, effluents, and waste	Continuous improvement	Lower costs
Product Stewardship	Minimise life-cycle cost of products	Stakeholder integration	Pre-empt competitors
Sustainable Development	Minimise environmental burden of firm growth and development	Shared vision	Future position

dimensions. The first is a product-related GP. This concerns sourcing and processing environmentally friendly materials that meet standards such as low energy consumption and recyclability and contribute to pollution prevention. The second is process-oriented GP, which aims to ensure the sustainability of procurement through green processes and management behaviours, for example, assessing suppliers' ability to protect the environment or implementing green projects. The entire process of supplier management also includes the investigation, selection, training, and evaluation of suppliers, which again contributes to sustainable development.

Additionally, costs must be reduced, competitors pre-empted, and future positions strengthened to remain competitive. Fig. 2 combines the interrelationships of NRBV with the underlying proposition ('GP Practices have a positive impact on the economic performance of a buying organisation') and forms the conceptual framework.

2.3. Collecting evidence on the practice–performance link in green procurement

Some studies have included the link to environmental sustainability, or GSCM (e.g. D'Agostini et al., 2017; Fang and Zhang, 2018; Geng et al., 2017; Golicic and Smith, 2013). These same researchers, including Zimmermann and Foerstl (2014), also conducted some meta-analyses on the practice–performance link in purchasing and supply chain management. All of these studies provide valuable evidence of the positive practice–performance relationship from a supply chain perspective. In addition, moderating effects of factors such as relationships with suppliers (Zimmermann and Foerstl, 2014), organisational size (Geng et al., 2017), industry, culture, and certification (Fang and Zhang, 2018) were found. However, these studies measured performance indicators without a focus on GP. Existing meta-analyses on GP tend to focus on the influencing factors behind the adoption of GP practices (e.g. Zaremohzzabieh et al., 2021; Zhuang et al., 2021) rather than the

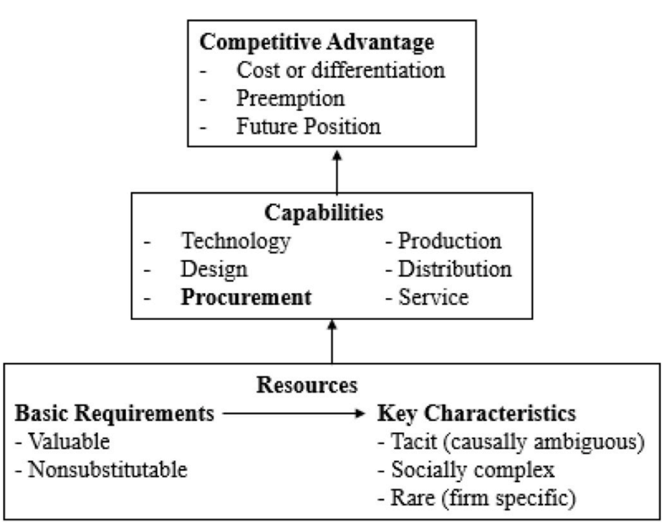

Fig. 1. Presentation of the resource-based view following Hart (1995).

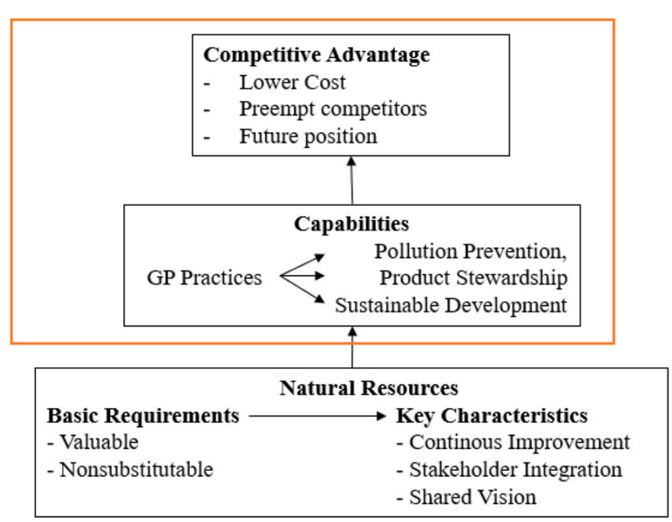

Fig. 2. Conceptual framework.

practice–performance link. There is still uncertainty about the implementation of performance measurement (Bocken et al., 2013). Seuring and Müller (2008) particularly emphasise the role of supply chain actors, including the service provider, customer, and supplier. Only by considering them is appropriate performance measurement possible (Saeed and Kersten, 2020). To meet the interests of different stakeholders, various researchers have used different categories of performance management (Table 2).

Some researchers (e.g. D'Agostini et al., 2017; Geng et al., 2017; Fang and Zhang, 2018) have delineated Green et al.'s (2012) four categories of performance measurement for sustainability: environmental, economic, organisational, and operational. In the environmental category, emissions, water, or material savings can be measured. The economic category ensures the organisation's survival and is designed to reduce costs. The organisational category encompasses market performance in the context of reputation and customer satisfaction. In the operational category, scrap rates, quality requirements, and process efficiency can be measured. However, as D'Agostini et al. (2017) and Zhu et al. (2013) have argued, these are interconnected. Operational performance is closely related to cost reduction, environmental aspects, and the impacts of production processes. In other words, operational performance represents EP and environmental performance. Finally, organisational performance results from financial performance and market performance, compared with the average of the industrial sector in which the organisation operates (Green et al., 2012). In this performance category, the influence of the other performance categories is also noteworthy. First, a better corporate image and reputation achieved through environmental performance can increase the company's participation in the market. Second, cost reductions achieved through EP can contribute to an organisation. Finally, improving customer satisfaction through operational performance can contribute to organisational performance as a whole.

For these reasons, this study focuses on EP, which, following the contributions of Golicic and Smith (2013), Zimmermann and Foerstl (2014), and Younis et al. (2020), is composed of financial performance (FP), operational performance (OP), and market-based performance (MP). Despite the blurred boundaries between these performance categories, this research identifies the benefits and advantages of each separately so that organisations can target their practices toward intended economic outcomes. According to Zimmermann and Foerstl (2014), 'OP' includes quality, capacity utilisation, flexibility, and speed of delivery; 'MP' includes market share and customer satisfaction; and concerning 'FP', financial indicators such as return on investment, earnings before interest, tax, depreciation, and amortisation, or profit, in general, are used. The construct definitions can be seen in Appendix A. These performance categories go hand in hand with the achievement of competitive advantages, according to Hart (1995), as, even if the boundaries are blurred, lower costs improve FP, and OP and MP include indicators for competitor comparison and future positions.

3. Methodology

3.1. Overall research design

The term meta-analysis was first introduced in 1976 by Gene V. Glass, who describes it as 'the analysis of analyses' (Glass, 1976). The core intention of meta-analysis is to create an overview of research by integrating primary research based on empirical criteria. This incorporates the critical findings of previous studies and potential future research to provide a deeper definition of the problem (Glass et al., 1981). To produce a meta-analysis, all the empirical primary investigations included must have conceptual comparability and a common research question (Drinkmann, 1990). To make the research results of the original study comparable, this paper uses the method of correlation-based bare-bones meta-analysis, according to Hunter and Schmidt (2004), which primarily uses the correlation coefficient *'r'* as an effective measure for further investigation. This analysis aims to calculate a population effect size and free it from interfering influences by

Table 2
Evidence on practice–performance link in existing meta-analyses.

Author	Year	Practice	Performance	n	Effect	Learning
Golicic and Smith	2013	GSCM practices (upstream supplier-facing, design, production, downstream customer-facing)	Operational, market & accounting performance	89	positive	Companies should consider environmental aspects when developing new products or processes and when contracting suppliers.
Zimmermann and Foerstl	2014	Supplier-facing and internal purchasing and supply management practices	Operational, market & financial performance	99	positive	Practices related to suppliers based on mutual efforts yield stronger benefits than activities not based on relationships.
D'Agostini et al.	2017	Sustainable operations practices (eco-design, GSCM, cleaner production, reverse logistics)	Environmental, economic, operational, and organisational performance	37	positive	Contingency influences the relationship.
Geng et al.	2017	GSCM (intra-organisational management, supplier integration, eco-design, customer cooperation, reverse logistics)	Environmental, economic, operational, and social performance	50	positive	Industry affiliation, company size, ISO certification, and export orientation moderate some relationships between GSCM practices and performance.
Fang and Zhang	2018	GSCM (green purchasing, customer cooperation, investment recovery, eco-design)	Environmental, economic, and operational performance	54	positive	Industry type, ISO certification, export orientation, and the cultural dimension of uncertainty avoidance have moderating effects.
Qorri et al.	2018	GSCM (upstream supplier-facing, eco-design, green manufacturing, downstream consumer facing)	Environmental. Social, operational, and economic performance	85	positive	Geographical region, industry type, and firm size moderate the relationship.
Govindan et al.	2020	SSCM (environmental supply chain practices, socially sustainable supply chain practices, sustainable supply chain practices)	Operational, and financial-based performance	129	positive	Findings suggest a stronger relationship between sustainability-firm performances in manufacturing industries than in service industries.
Qorri et al.	2021	SSCM (internal sustainable management, sustainable purchasing, sustainable product design, sustainable manufacturing, sustainable distribution and packaging, customer sustainable cooperation, reverse logistics, employee social practices)	Environmental, social, operational, economic	145	positive	Geographical region, data measurement type, and evolution moderate the relationship.
Fu et al.	2023	GSCM (internal environmental management)	Environmental Performance	65	positive	Market environment, industry type, regional culture, and sampling area moderate the relationship.

correcting potential errors and biases to make an overall statement about the effect under consideration at the end. The procedure of bare-bones meta-analysis can be roughly divided into five steps (Stamm and Schwarb, 1995), apart from formulating the research question, as follows.

(1) Clarification of prerequisites for conducting a meta-analysis.
(2) Literature analysis and preparation of a meta-analytical overview.
(3) Statistical evaluation of the primary studies.
(4) Correction of potential errors and biases.
(5) Calculation of the population effect size and discussion.

3.2. Prerequisites for conducting meta-analysis

In the literature on the methodological prerequisites of meta-analyses, the following four issues are listed most frequently (Card, 2012; Eisend, 2009; Sharpe, 1997).

(1) The 'apples and oranges' problem refers to the literature search and preparation of the meta-analytic balance. When searching for literature on the desired effect sizes, finding identical replication studies is usually impossible. This leads to a mixture of studies that differ in terms of operationalisations, samples, or evaluation methods. Comparability between studies is thus hampered (Sharpe, 1997). The results of meta-analyses that focus on narrowly defined effect sizes (only 'apples') are biased by the addition of other effects ('oranges') (Card, 2012). However, combining multiple effect sizes ('apples and oranges') can be useful for meta-analyses that use different effect sizes for multiple hypotheses. Thus, 'Indeed the approach does mix apples and oranges, as one would necessarily do in studying fruit' (Smith et al., 1980, p. 47). Two approaches to meta-analysis can be derived from this. The first approach is used primarily in the natural sciences and requires the exclusive use of perfect replications. The second approach allows the use of imperfect replications by explaining heterogeneity based on moderator variables while still allowing an interpretable result to be determined. To minimise the biases, some measures and criteria were taken for the inclusion of studies in the meta-analytical balance sheet. Nevertheless, a balance should be struck between broad and narrow research. For example, too narrow research could lead to distorted conclusions about the broader research (Kulik et al., 1990). Regarding the 'apples and oranges' problem, both content-related and statistical criteria were established. A simple criterion used in most clinical trials was checking that the topic of the meta-analysis was included in the title of the article, or exactly examining the relevant effect (Sharpe, 1997). Accordingly, this meta-analysis only considers studies that examine the link between GP and EP. The statistical criterion for minimising the problem would be to consider only the Bravais–Pearson correlation coefficient. Sharpe (1997) argued that pooling would be justified if it could be shown that the effect sizes from comparable studies are of approximately the same magnitude and thus appear to estimate the same effect size parameter.
(2) The 'garbage in—garbage out' problem refers to the quality of the included studies. In addition to the different effect sizes of primary studies, the quality of the empirical methods used in the studies also differs, and the quality of the individual studies influences the variability of meta-analytical results (Kock, 2009). Combining studies with different methodological qualities can lead to misleading results, called 'garbage in—garbage out' (Sharpe, 1997). To avoid this problem, the number of studies can be limited based on defined quality characteristics (Borenstein, 2009). Guzzo et al. (1987) note that there is little agreement on which studies should be considered qualitative and which should be considered non-qualitative. Thus, it is difficult to differentiate between 'good' and 'bad'. However, as already mentioned, quality characteristics can be established as inclusion criteria. For instance, the studies considered must have a larger sample size than 10. Nevertheless, no further quality characteristics are to be used. According to Fricke and Treinies (1985), methodological quality plays a role in the interpretation of results and should not lead to the significant exclusion of studies in advance.
(3) 'Publication bias' is considered one of the greatest threats to the validity of meta-analyses. It occurs when summarised published research results do not represent all studies, and a different overall result emerges when all research is considered. Significant results are often promoted, while non-significant results are often not published and are instead assigned to grey literature. This creates an underreporting of primary studies, which are difficult or impossible to include in meta-analyses (Eisend, 2009). Publication bias was visualised with the help of a funnel plot.
(4) The 'non-independent effects' or 'multiple effect sizes' problem refers to the fact that several effect sizes within a study (with the same sample size) are not statistically independent. Possible solutions could be to select only the most important effect sizes per study or to summarise the effect sizes through median or mean value formation (Döring and Bortz, 2016). The 'practice–performance link' between GP and EP is quantified by meta-analysis using a population effect size. To avoid multiple effect sizes, some methods can be applied in the literature. In the case of multivariate effects, it is common to conduct several meta-analyses on one relationship (Cheung, 2019). For example, Abramovitch et al. (2018) differentiated the intelligence quotient (IQ) score of obsessive-compulsive disorder patients into the full-scale IQ, the verbal IQ, and the performance IQ and thus conducted three separate meta-analyses. Another possibility would be to average the effect sizes and select one effect size per study (Cheung, 2019), which was used in this meta-analysis.

3.3. Data collection and preparation

A literature review must be conducted to collect relevant data for the meta-analysis. Exclusion criteria can be divided into two categories (Table 3). First, formal exclusion criteria are examined without specifically addressing the content of the studies. This is followed by content-related criteria, which must be fulfilled to include studies in the meta-analytical review. The methodological quality criterion must not be considered to create a representative overview. Methodological quality plays a role in interpreting the results (Fricke and Treinies, 1985). It is possible to establish further exclusion criteria. However, as the data collection has to be as comprehensive as possible, no further restrictions are imposed on regional affiliation or company size.

Table 4 shows the applied search terms, search term combinations,

Table 3
Exclusion criteria for the present meta-analysis.

Category	Criteria
Formal Exclusion Criteria	• The primary studies must have an effect size. • The effect size must be a Bravais–Pearson correlation coefficient. • Studies must have been published after 2000. • The studies must be written in English or German. • The sample size of the study under consideration must be > 10.
Content-Related Criteria	• The primary studies must include the investigated effect of the 'practice–performance link' between GP measures and company performance. • The GP measures investigated only include those referred to as such in the literature. • For EP, at least one of the three EP measures must be used as a variable.

Table 4
Search strings.

Category	Keywords
Sustainability	Green, Sustainable, Sustainability, Environmentally
Green Procurement	Green Procurement, Green Purchasing, Green Supply Management, Green Supply Chain Management, Sustainable Procurement, Green Management, Green Procurement Practices, Green Practices
Economic Performance	Performance, Corporate, Performance, Firm Performance, Market Performance, Financial Performance, Operational Performance, Company Performance, Organisational Performance, Competitive Advantage
Study Type:	Study, Primary Study, Quantitative Study, Journal Study, Research, Analysis

Search Combination: Practice–Performance Link; Green Procurement/Purchasing, Study; Research; Analysis; Green Procurement/Purchasing, Performance; Green Procurement/Purchasing.

and keywords of data collection.

EconBiz, Google Scholar, Emerald, DeepDyve, Science Direct, and Wiley Online Library were used as databases. For improved transparency and visualisation of the research process, the creation of a flow chart is recommended. The 'PRISMA Checklist' created a flow chart (DeSimone et al., 2020). It aims to improve the search for systematic reviews and meta-analyses (Moher et al., 2010). The flow chart for this meta-analysis was modified because the literature search is based exclusively on the databases mentioned above; that is, an extended search from other sources is omitted in the identification phase. A total of 1686 studies were identified by entering the search strings (Fig. 3). Other databases can also be consulted. Regarding publication bias, researchers must list the exact databases. However, Laird (1990) adds that an exhaustive search for all published and unpublished studies is 'one of life's mistakes that we only make once'. The identification, analysis, and abstraction of data are way more important. Furthermore, Cook et al. (1993) indicate that an unbiased selection is more important than a search for every existing study. Given the numerous duplications of studies in the databases, this was the only selection made.

One of the most common reasons for conducting a meta-analysis is that a collection of studies has a higher statistical power than individual studies (Cohn and Becker, 2003). Regarding this, it is useful to consider the statistical power of the collected studies. Scholars conducting a meta-analysis should therefore be interested in examining the likelihood

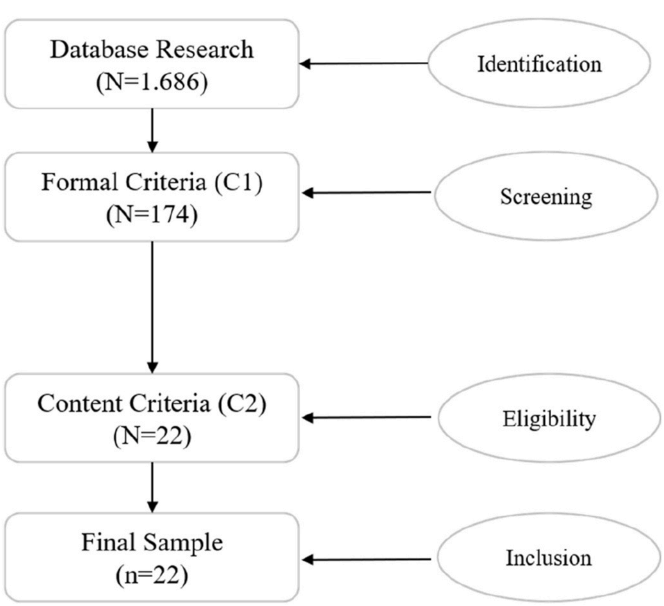

Fig. 3. Data collection protocol.

that the research question is answered by a sufficient body of quantitative analyses. In other words, researchers can estimate the statistical power of the planned meta-analysis. This meta-analysis uses the methods of Valentine et al. (2010) to estimate the prospective statistical power for the fixed effects mean effect.

Assumptions about the characteristics of the typical study within the meta-analysis are essential for calculating statistical power. Valentine et al. (2010) argue that to estimate the variance of the average total effect size, researchers can use their estimates about the number of studies that will meet the inclusion criteria and their estimate of the typical sample size within a study. Valentine et al. (2010) suggest the following equation:

$$v = \frac{n+n}{(n)(n)} + \frac{\overline{ES}^2}{2(n+n)} \quad (1)$$

$\boldsymbol{v}$ is the value for the typical study's effect size variance. While $\boldsymbol{n}$ is the typical within-study sample size and $\overline{\boldsymbol{ES}}$ is the typical weighted mean effect.

With the estimated number of studies $\boldsymbol{k}$, it is now possible to determine the weighted mean effect size variance $\boldsymbol{v_o}$.

$$v_o = \frac{v}{k} \quad (2)$$

The mean is given by λ, and the variance is 1. The value (λ) is known as the non-centrality parameter and gives the extent to which a null hypothesis is false.

$$\lambda = \frac{\overline{ES - 0}}{\sqrt{v_0}} \quad (3)$$

To ultimately calculate the prospective power of a weighted mean effect size $\boldsymbol{p}$, the following formula can be used:

$$p = 1 - \varphi(c_\alpha - \lambda) \quad (4)$$

$\boldsymbol{c_\alpha}$ is the $\mathbf{100} - (\mathbf{1} - \boldsymbol{\alpha})$ critical value for the standard normal distribution and $\boldsymbol{\varphi}(\boldsymbol{x})$ is the standard normal cumulative distribution function. Following the conventions, the Type I error rate of $\boldsymbol{\alpha} = \mathbf{0,05}$ is used, and for a one-tailed test $\boldsymbol{c_\alpha} = \mathbf{1,64}$ is accordingly used. To calculate the prospective power of a weighted mean effect size, we used the assumption that $\boldsymbol{n} = \mathbf{30}$ and $\boldsymbol{k} = \mathbf{22}$. Zhou and Shen (2022) argue that a meta-analysis with a within-study sample size of <30 and an estimated number of studies ≤ 5 should be interpreted with caution. Should both cases occur, definite conclusions should be avoided. The strength of a meta-analysis can largely be diminished if the meta-analytic effects are dominated by a single study, as examples by Zhou and Shen (2022) show.

Positive correlations are relevant for this meta-analysis but should not be set too high. For this reason, $\overline{\boldsymbol{ES}} = \mathbf{0,15}$ is still relevant for consideration concerning the research question. The calculation is as follows:

$$v = \frac{30+30}{(30)(30)} + \frac{0,15^2}{2(30+30)} = 0,0668 \quad (5)$$

$$v_0 = \frac{0,0668}{22} = 0,003 \quad (6)$$

$$\lambda = \frac{0,15}{\sqrt{0,003}} = 2,74 \quad (7)$$

$$p = 1 - \varphi(1,64 - 2,74) = 1 - \varphi(-1,1) = 1 - 0,123 = 0,877 \quad (8)$$

The estimated statistical power for the test, for the overall effect size not being zero, is approximately 0.877. This suggests that a meta-analytic test would correctly reject the false null hypotheses about 87.7% of the time if the mean effect size was greater than zero (Valentine et al., 2010). This also means that 22 studies would be sufficient for this meta-analysis (Table 5).

3.4. Data analysis and validation

According to Hunter and Schmidt (2004), the weighted bare-bones meta-analysis is used to estimate the population correlation. If the population correlation is assumed to be constant across studies, it is advisable to estimate this correlation not by a simple calculation of the mean but by weighting it with the number of samples. The associated variance is the frequency-weighted average squared deviation:

$$\bar{r} = \frac{\sum[N_i\, r_i]}{\sum N_i} \tag{9}$$

$$s_r^2 = \frac{\sum\left[N_i\,(r_i - \bar{r})^2\right]}{\sum N} \tag{10}$$

An analysis by Hunter and Schmidt (2004) shows that, in exceedingly rare cases, unweighted analyses are better than weighted ones. Moreover, the question arises whether transforming the correlation coefficient into Fisher's z would be preferable. Such a transformation leads to distortions, as larger correlations are weighted more than smaller ones, and thus the population correlation is more positive overall (Hunter and Schmidt, 2004). From the observed variance s_r^2, the variation of the population correlation, on the one hand, and the variation of the sample correlation, due to sampling errors, on the other, can be taken. Thus, the variance of the population correlation could be estimated by correcting the sampling errors of the observed variance s_r^2. For each study, a true population correlation p can thus be estimated, which can be compared with the study correlation r. The difference between the two correlations is the sampling error e:

$$e = r - pr = p + e \tag{11}$$

If one ignores minor distortions of the correlation coefficient, the average sampling error is 0, and the standard deviation depends on the sample size; consequently, if one calculates the variance of the study correlation, then this is the sum of the variance of the population correlation and the variance of the sampling errors:

$$\sigma_r^2 = \sigma_p^2 + \sigma_e^2 \tag{12}$$

The equation consists of three variances. If only two are known, the third variance can be calculated. From the available data, the variance of the study correlations and the variance of the sampling errors can be calculated to calculate the variance of the population correlation at the end. For the calculation of the variance of the sampling errors, Hunter and Schmidt derive the following equation as an approximation:

$$\sigma_e^2 = \left(1 - \bar{r}^2\right)^2 \Big/ (\overline{N} - 1) \tag{13}$$

Here, $\bar{r}^2$ denotes the squared empirical mean and $\overline{N}$ the average sample size. If equation (4) is converted to σ_p^2 and equation (5) is substituted into equation (4), the equation is:

$$\sigma_p^2 = \sigma_r^2 - \left(1 - \bar{r}^2\right)^2 \Big/ (\overline{N} - 1) \tag{14}$$

The individual effect sizes could be corrected for measurement errors. The correction requires reliability in the form of Cronbach's Alphas (Grief et al., 2017). The reliabilities are estimated with the help of Cronbach's Alpha coefficient as a measure of the internal consistency of a scale. This meta-analysis applies to the independent variable 'GP' and the dependent variable 'EP'. In most studies, the reliabilities can be taken as Cronbach's Alpha or 'composite reliability'. Following the examples of Younis et al. (2020) and Song et al. (2017), the lowest acceptable reliability can be set at 0.7. The equation by Hunter and Schmidt (2004) can be used to correct measurement errors:

$$r_c = \frac{r_{xy}}{\sqrt{r_{xx}}\,\sqrt{r_{yy}}} \tag{15}$$

Here, r_c denotes the corrected effect size, r_{xy} the uncorrected effect between the two variables under consideration, and r_{xx} and r_{yy} the respective reliabilities, measured by Cronbach's Alpha:

$$r_c = \frac{r_{xy}}{\sqrt{\alpha_{GP}}\,\sqrt{\alpha_{EP}}} \tag{16}$$

By including the reliabilities, the weighting of the studies in equation (1) can also be adjusted. A simple weighting, as in equation (1), does not consider the information quality of the different studies; studies with high reliability should be weighted higher than studies with lower reliability. The equation for the new weighting is therefore:

$$w_i = N_i A_i^2 \quad with\ A_i^2 = \alpha_{GP}\alpha_{EP} \tag{17}$$

Here, w_i describes the new weighting, A_i^2 the squared composite 'Artefact Attenuation Factor', which is the product of Cronbach's Alpha coefficients of the 'GP' variable and the 'EP' variable. N_i is replaced by w_i in all the equations mentioned.

4. Results

For the meta-analytical summary, the studies were classified by author and year, the journal, the consideration of the 'EP' within the studies, the region, the sample size N, and the effect size. All of the included studies report at least one of the three performance measures. GP practices are defined differently. Green et al. (2012) collected data from a survey after the definition of Zhu et al. (2008) and Carter and Carter (1998), who define GP as a focus on cooperating with suppliers to develop environmentally sustainable products. Wongtongchai and Saenchaiyathon (2019) base their understanding of GP on Carter et al. (2000), Min and Galle (2001), and Zsidisin and Siferd (2001), according to whom life-cycle assessment should be undertaken in the selection of products and packaging to encourage partners to reduce waste in the supply chain. GP thus involved working with and assessing, auditing, and certifying partners, which led to a research population of industrial firms in Thailand that have already been certified with the ISO 14000 standard. Song et al. (2017) conducted a more extensive literature review for the definition of the construct and divided GP into the already mentioned two dimensions in their study: product-related GP and process-oriented GP. The studies were sorted in ascending order from top to bottom in terms of their effect size; the Bravais–Pearson correlation coefficient was used as the effect size. In the case of 'multiple effect sizes', the mean of the relevant effects was formed. Table 6 presents the sample.

The individual reliability data and the corrected effects according to the procedure described in 3.4 can be found in Table 7.

Before the effect sizes are further processed during the meta-analysis, the results of the meta-analytic balance sheet can already be classified concerning GP and EP. When looking at the studies in the meta-analytic balance sheet, one can note that every study has a positive effect. Based on this data, it can be determined relatively early on that the population correlation must also be positive in this case. However, the strength of the correlation remains to be determined. Accordingly, it can be assumed that the already described measures (Chapter 2.1) of the GP can be considered to have a generally positive impact on EP.

For better comparability, both uncorrected and corrected effects were calculated. The uncorrected population correlation is

Table 5
Justification of sample size.

Within-Study Sample Size	Number of Studies to Be Included	Effect Size to Detect	Power
30	22	0.15	0.877

Table 6
Meta-analytic balance sheet.

Author (Year)	Journal	EP	Region	Effect size	N
Zhu et al. (2011)	Journal of Industrial Ecology	F	China	0.189	396
Kalyar et al. (2019)	Sustainability Acc., Management and Policy Journal	F	Pakistan	0.223	387
Najmi et al. (2020)	Int. J. Business Perf. and Supply Chain Modelling	F, M, O	Pakistan	0.245	207
Tan et al. (2019)	Int. J. Sustainable Strategic Management	F, O	Malaysia	0.262	122
Yildiz Çankaya et al. (2019)	J. of Manufacturing Technology Management	F, O	Turkey	0.274	281
Abdallah and Al-Ghwayeen (2019)	Business Process Management Journal	F, M, O	Jordan	0.287	215
Gosh (2019)	J. of Manufacturing Technology Management	F, M, O	India	0.315	80
Lee et al. (2012)	Industrial Management & Data Systems	F, O	South Korea	0.315	223
Namagembe et al. (2019)	Int. J. Management of Environmental Quality	O	Uganda	0.325	200
Yu et al. (2014)	Int. J. Supply Chain Management	F, O	China	0.365	126
Jawaad and Zafar (2020)	Sustainable Development	F, O	Pakistan	0.366	272
Choi et al. (2018)	Int. J. Logistics Management	M, O	South Korea	0.373	300
Song et al. (2017)	Int. J. Logistics Management	F, O	China	0.374	206
Ismail et al. (2019)	Int. J. Logistics Systems and Management	F, M	Jordan	0.386	79
Mishra et al. (2019)	Theoretical Economic Letters	F, M, O	India	0.389	374
Green et al. (2012)	Int. J. Supply Chain Management	F, M, O	USA	0.436	159
Younis et al. (2020)	IIMB Management Review	F, O	UAE	0.549	12
Li et al. (2019)	Int. J. Managing Projects in Business	O	China	0.552	159
Chan et al. (2012)	Industrial Marketing Management	F	China	0.62	194
Green et al. (2014)	Management Research Review	F, M	USA	0.62	225
Wongthongchai and Saenchaiyathon (2019)	J. of Industrial Engineering and Management	F, M, O	Thailand	0.638	286
Dubey et al. (2013)	Int. J. Procurement Management	F, M	India	0.64	55

approximately 0.374, while the corrected population correlation is higher, approximately 0.435. Using the data collected within the meta-analytical balance sheet, the variances of the study correlation and the variances of the sampling errors could be calculated for the variances of the population correlation from the difference. The respective standard deviations could then be calculated from the variances (Table 8).

The corrected standard deviations σ_p and σ_{p_c} can now be compared with the empirical mean values $\bar{r}$ and $\overline{r_c}$:

$$\text{For } \bar{r} \text{ applies}: \frac{0.374}{0.125} = 2.994* \quad \text{For } \overline{r_c} \text{ applies}: \frac{0.435}{0.162} = 2.687*$$

*The calculations are based on the unrounded figures (for reasons of precision), rounded to three decimal places for better visualisation. This may result in slight deviations.

This means that the empirical mean of the uncorrected effects, rounded up, is 3.00 standard deviations above 0; for the corrected effects, the value is 2.70. If all study correlations are normally distributed, the probability that another correlation is zero or below zero is also zero. Therefore, the population correlation is positive in all studies for both the uncorrected and the corrected effects. As already assumed when looking at the meta-analytic balance sheet and now calculated, it can now be concluded that the population correlation is positive in the case of a normal distribution. Concerning the practice–performance link, this means that GP measures lead to an overall improvement in EP.

The individual effect sizes can also be multiplied by the number of EP measures used. The effect sizes of studies that include all three measures are thus weighted more heavily than those of studies that include only two or one measure. Thus, the following applies to r:

$$r_{i_g} = r_i \times \frac{\sum [EPM_i]}{3} \tag{18}$$

Here, r_{i_g} stands for the weighted effect size and EPD_i for the number of 'EP' measures included in the respective study. There is no weighting between the three measures, so all of them are weighted equally. The results of the weighted population effects $\overline{r_g}$ and $\overline{r_{c_g}}$ are as follows:

$$\overline{r_g} = 0.255 \quad \overline{r_{c_g}} = 0.298$$

The two results of the weighted population effects are positive and thus show a correlative relationship. The correlation between GP practices and EP sought within the conceptual framework can thus be quantified. It can thus be concluded that GP practices have a positive

Table 8
Uncorrected and corrected effects.

Uncorrected Effects	Corrected Effects
$\bar{r} = 0.374$	$\overline{r_c} = 0.435$
$\sigma_r^2 = 0.020$	$\sigma_{r_c}^2 = 0.030$
$\sigma_e^2 = 0.005$	$\sigma_{e_c}^2 = 0.004$
$\sigma_p^2 = 0.016$	$\sigma_{p_c}^2 = 0.026$
$\sigma_p = 0.125$	$\sigma_{p_c} = 0.162$

Table 7
Table of results (Cronbach's Alpha and composite reliability).

Author (Year)	α GP	α EP	r	r_c	Author (Year)	α GP	α EP	r	r_c
Zhu et al. (2011)	0.91	0.89	0.189	0.21	Choi et al. (2018)	0.775	0.679	0.373	0.514
Kalyar et al. (2019)	0.92	0.79	0.223	0.262	Song et al. (2017)	0.7	0.7	0.374	0.534
Najmi et al. (2020)	0.852*	0.813*	0.245	0.294	Ismail et al. (2019)	0.768	0.604	0.386	0.567
Tan et al. (2019)	0.895*	0.886*	0.262	0.294	Mishra et al. (2019)	0.809	0.936	0.389	0.447
Yildiz Çankaya et al. (2019)	0.792	0.91	0.274	0.323	Green et al. (2012)	0.953	0.938	0.436	0.461
Abdallah and Ai-Ghwayeen. (2019)	0.809	0.878	0.287	0.34	Younis et al. (2020)	0.7	0.7	0.549	0.784
Gosh (2019)	0.836	0.856*	0.315	0.372	Li et al. (2019)	0.958	0.959	0.552	0.576
Lee et al. (2012)	0.891	0.914	0.32	0.355	Chan et al. (2012)	0.81*	0.91*	0.62	0.722
Namagembe et al. (2019)	0.85	0.86	0.325	0.38	Green et al. (2014)	0.97	0.915	0.62	0.658
Yu et al. (2014)	0.791	0.842	0.365	0.447	Wongthongchai and Saenchaiyathon (2019)	0.835*	0.837*	0.638	0.763
Jawaad and Zafar (2020)	0.916	0.816	0.366	0.423	Dubey et al. (2013)	0.831	0.834	0.64	0.769

effect on EP.

5. Discussion

5.1. Theoretical implications

From a total of 1686 originally identified studies, 22 were included in the meta-analytical review. From the selected studies, the relevant effect sizes of the 'practice–performance link' under consideration could be extracted. In addition, almost all studies provided Cronbach's Alpha as a reliability coefficient. All effect sizes were positive, and two positive overall effects ($\overline{r_g} = 0.255$; $\overline{r_{c_g}} = 0.298$) can be presented as meta-analytical results. Applying the rule of thumb (Kosfeld et al., 2016) for interpreting the Bravais–Pearson correlation coefficient, the weighted, corrected population effect describes a weak positive correlation, while the corrected population affects a medium positive correlation. Looking at the meta-analyses already carried out (Table 2), this meta-analysis fits in and also finds an overall positive effect in the considered practice–performance link. For comparison, the meta-analysis conducted by Golicic and Smith (2013) on the correlation between environmental supply chain practices and market-based ($\bar{r} = 0.317$), operational-based ($\bar{r} = 0.301$), and finance-based ($\bar{r} = 0.283$) performance shows comparably positive effects regarding the introduction of green measures.

Concerning the linkage between the corporate environmental strategy and the NRBV discussed by Hart (1995), there was a lack of empirical support at the time (Guang Shi et al., 2012). This meta-analysis suggests that the adoption of GP practices contributes to business performance at different levels. This result should increase confidence in the implementation of GP practices as a profitable environmental strategy to reduce environmental impacts while increasing EP. The positive and significant results support the NRBV theses, particularly in terms of value creation from upstream production variables and their performance improvement at multiple levels—financial, operational, and market. A differentiation of the three interwoven strategies in Hart's (1995) NRBV product stewardship, pollution prevention, and sustainable development would be of interest for future research to be able to draw concrete conclusions.

Guang Shi et al. (2012) also draw on Institutional Theory in their conceptualisation of a natural resource-based GSCM, as research assumes that an organisation's motivation to adopt GP practices is also influenced by regulatory and market pressures (Arora and Cason, 1995). Accordingly, companies are not only profit-oriented but also strive to achieve social legitimacy (Suchman, 1995). Government policies, such as the EU's Integrated Product Policy, drive green consumption by setting guidelines and regulations that encourage companies to produce green products and facilitate coordination with consumer groups. The basic assumption of the NRBV, that organisations particularly strive for competitive advantages, is also interpreted in a more differentiated manner and is based on the inclusion of political influences.

5.2. Practical implications

Political ambitions to foster a sustainable transition currently abound. The Sustainable Development Goals, the European Green Deal, and the Circular Economy Action Plan are just a few examples. This meta-analysis revealed the importance of the purchasing institution and the significance of ecological considerations and measures within the company. This study is in line with the definition of early-stage sustainability as found in the Brundtlandt Report of the World Commission on Environment and Development (WCED, 1987). The report was concerned with sustainable and intergenerational development in the member states of the United Nations, in which economic, social, and ecological development goals were to be harmonised. The development of a member state was considered sustainable if it could meet the needs of today without jeopardising the ability of future generations to meet their needs.

This is also reflected in more recent research contributions, such as Sjåfjell and Wiesbrock (2016), who argue in favour of a balance between all three dimensions. Wurster and Ladu (2022) developed a generic indicator concept for the circular economy: the composite Triple C indicator concept consists of 20 elements that cover all three pillars of sustainability (environmental, social, and economic). It is to be integrated into a software program that will make it easier for purchasers in Germany to decide in favour of circular and sustainable products. In addition to the three performance indicators analysed, several others also lead to an increase in competitive advantages from the NRBV perspective. These include, for example, brand loyalty and innovation. By utilising GP practices, companies can position themselves more sustainably overall. Increasing environmental performance must also always be considered in order not to defeat the purpose of implementing GP measures.

However, questions arise, first as to the extent of the influence of GP on EP when studies still show barriers to the implementation of GP (Ansari et al., 2023; Igarashi et al., 2015), and second, how and when GP should be encouraged. Hsueh et al. (2020) found that the presence of a formal policy has a significant impact on actual implementation. For an actual change, political ambitions may need to set even higher or stricter requirements. Further, to be able to implement GP in a more targeted manner, it would make sense to differentiate between the practices and their impact. The calculation of life-cycle costs, for example, is a key tool for GP, even after Hart's (1995) NRBV, which indicates a positive impact on financial performance. However, the use of life-cycle costing is also not yet widespread (Iraldo et al., 2016). It is therefore important to actively tackle other barriers in addition to the perception of higher costs and, in particular, to start with the implementation phase of target-oriented GP practices (UNEP, 2022).

5.3. Methodological limitations

The present results are only preliminary. There is a lack of replication in procurement and supply chain management research. To create a better starting point, other researchers have already called for more replications in the first step (Pagell, 2021; Wynstra et al., 2019) and additional meta-analyses in the second step (Van Weele and Van Raaij, 2014). Nevertheless, methods were employed to overcome these deficiencies within the framework of the present study. For instance, the selected studies for the 'apples and oranges' problem were not perfect replications as each had a different framework within which research was conducted. However, given the two approaches that have arisen, perfect replications are not mandatory for conducting a meta-analysis, provided that the individual effect sizes of the respective studies are weighted differently, the foundations for which were laid in Section 3.4.

Formal and substantive exclusion criteria were established to avoid the 'garbage in–garbage out' problem (3.3). Although poor-quality studies could be excluded, this is associated with a high loss of information; using Cronbach's Alpha allows qualitative differences to be considered by correcting measurement errors (Grief et al., 2017). Some studies showed Cronbach's Alpha reliabilities below 0.7. In most existing literature, a threshold value of $\alpha = 0.8$ is described as good, but values of $\alpha = 0.6$ are still used for shorter scales. Cronbach's Alpha coefficient for the work ranged from 0.604 to 0.97. Some studies had multiple relevant effect sizes within the research results.

Potential publication bias is a central problem in meta-studies. All of the included studies show positive effects, which could indicate a partiality for desired outcomes. As in other fields, sustainability and climate protection studies have indicated a tendency to publish particularly positive results (Michaels, 2008; Reckova and Irsova, 2015). Michaels (2008) pointed out the close interconnection between research findings and policymaking based on potential biases. The resulting synergy between publication bias, public perception, scientific consensus, and policy is described as worrying, especially if these biases are not considered or even corrected.

Finally, the problem of 'multiple effect sizes' was solved by averaging, as done in previous studies. However, minor bias cannot be prevented by averaging, and there are limitations and potential biases in the bare-bones meta-analysis approach. Hunter and Schmidt's (2004) methods of bare-bones meta-analysis were used to correct for sampling errors, and attenuations due to measurement errors were corrected by specifying the reliabilities within the studies. However, biases in the results could still arise as the bare-bones meta-analysis does not correct all artefacts (Hunter and Schmidt, 2004). Thus, a bare-bones meta-analysis forms the basis for an extended investigation if the data from the selected studies are sufficient and meet the increased requirements.

6. Conclusion

We conclude that a positive correlation exists between the introduction of GP measures and organisational performance. This study arrived at this finding by conducting a bare-bones meta-analysis that compared the standard deviations with the empirical mean values, establishing that the probability of a correlation of zero or below zero must be zero. Existing studies and meta-analyses already show positive results for green supply chain practices (D'Agostini et al., 2017; Fang and Zhang, 2018; Golicic and Smith, 2013). The results of this study extend the literature to explicitly identify the impact of each of the three additional factors involved in EP increases should an organisation introduce GP measures. We employed a meta-analytical methodology, adding operational, market, and financial measures. We confirm that if both ecological and economic dimensions improve, the goal of company growth is achieved (Balaceanu and Apostol, 2014).

This study has several limitations, which present future research opportunities. Our meta-analysis was imbalanced in that most of the studies were regionally based in Asia, with few studies extending to North America and Central Europe. Given the increasing climate awareness and the possible pioneering role of the European Union in climate protection (Wurzel et al., 2019), further quantitative studies of the 'practice–performance link' in Europe between green purchasing and sourcing practices and business performance are needed to improve our universal understanding. Within the results, it could also be established that the variation of the individual effect sizes is not just due to sampling errors; the moderator variables must also be present. The exact moderator variables can be determined in further research; for instance, as it can be assumed that the region in which the studies were conducted is a possible moderator variable, additional studies from Europe could have an increased positive or negative influence on the result.

Furthermore, studies on the green practice–performance link within public procurement are scarce and would be particularly interesting against political implementation pressure. Moreover, UNEP (2022) attested that the perception of higher prices and, thus, the fear of economic profitability is the biggest hurdle, especially in the public sector. Based on the meta-analytical results and the finding of a positive correlation of the considered 'practice–performance link', further research should investigate which specific GP measures improve company performance and how strong the influences of the individual measures and instruments are. Identifying moderator variables that explain the differences between the studies could also be particularly important for an extended analysis. For this purpose, 'credibility intervals', as defined by Golicic and Smith (2013), can be used. Possible variables include the intensity of collaboration between buyer and supplier, which is needed for a successful GP (Guang Shi et al., 2012), as well as the duration of collaborations and the development of the GP performance over time. In summary, further and more comprehensive empirical studies and analyses are necessary to consolidate the data. Such consolidation can improve the informative value of further meta-analyses on the 'practice–performance link' under consideration to show that green measures in the area of procurement and purchasing are consistent with EP and even improve it.

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Alessa Kozuch: Conceptualization, Visualization, Writing – original draft, Writing – review & editing. **Maurice Langen:** Investigation, Methodology, Writing – original draft. **Christian von Deimling:** Conceptualization, Supervision, Writing – original draft, Writing – review & editing. **Michael Eßig:** Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix. Detailing the concepts of the practice–performance link

Deductive Codes	Definition
Green Purchasing/ Procurement	An environmental purchasing initiative that aims to ensure purchased products and materials meet with environmental objectives set by the purchasing firm, such as reducing sources of waste, encouraging recycling, reuse, and substituting materials.
Operational Performance	The organisation's capabilities to more efficiently produce and deliver products to customers with improved quality and reduced lead times lead to improving its position in the marketplace and increasing its chances of selling its products into international markets.
Market Performance	Market-based performance centres on financial indicators reflecting market goals concerning meeting customer needs, including market share, competitive advantage, customer loyalty, brand equity, etc.
Financial Performance	Financial performance refers to profitability, as indicated by return ratios, earnings, and profit.

References

Abdallah, A., Al-Ghwayeen, W., 2019. Green supply chain management and business performance. Bus. Process Manag. J. 26 (2), 489–512.

Abramovitch, A., Anholt, G., Raveh-Gottfried, S., Hamo, N., Abramowitz, J.S., 2018. Meta-analysis of intelligence quotient (IQ) in obsessive-compulsive disorder. Neuropsychol. Rev. 28 (1), 111–120.

AlNuaimi, B.K., Singh, S.K., Harney, B., 2021. Unpacking the role of innovation capability: exploring the impact of leadership style on green procurement via a natural resource-based perspective. J. Bus. Res. 134, 78–88.

Andersén, J., 2021. A relational natural-resource-based view on product innovation: the influence of green product innovation and green suppliers on differentiation advantage in small manufacturing firms. Technovation 104, 102254.
Ansari, H., Nurdin, N., Tahir, I., Maryani, D., 2023. Policy implementation green public procurement in sustainable development in South Kalimantan Province. Journal Eduvest 3 (1), 278–296.
Appolloni, A., Chiappetta Jabbour, C., DAdarno, I., Gastaldi, M., Settembre-Blundo, D., 2022. Green recovery in the mature manufacturing industry: the role of the green-circular premium and sustainability certification in innovative efforts. Ecol. Econ. 193, 107311.
Arora, A., Arora, A.S., Sivakumar, K., Burke, G., 2020. Strategic sustainable purchasing, environmental collaboration, and organizational sustainability performance: the moderating role of supply base size. Supply Chain Manag. 25 (6), 709–728.
Arora, S., Cason, T.N., 1995. An experiment in voluntary environmental regulation: participation in EPA's 33/50 Program. J. Environ. Econ. Manag. 28 (3), 271–286.
Balaceanu, C., Apostol, D., 2014. The perspective of concept sustainability. Procedia Soc. Behav. Sci. 116, 2257–2261.
Balin, A., Sari, K., 2023. The effect of green purchasing practices on financial performance under the mediating role of environmental performance: evidence from Türkiye. Sustainability 15 (4), 1–15.
Barnes, J., Liao, Y., 2012. The effect of individual, network, and collaborative competencies on the supply chain management system. Int. J. Prod. Econ. 140 (2), 888–899.
Bocken, N., Morgan, D., Evans, S., 2013. Understanding environmental performance variation in manufacturing companies. Int. J. Prod. Perform. Manag. 62 (8), 856–870.
Borenstein, M., 2009. Introduction to Meta-Analysis. John Wiley & Sons, Chichester U.K.
Brammer, S., Walker, H., 2011. Sustainable procurement in the public sector: an international comparative study. Int. J. Oper. Prod. Manag. 31 (4), 452–476.
Card, N.A., 2012. Applied Meta-Analysis for Social Science Research. The Guilford Press, New York.
Carter, R.C., Carter, J.R., 1998. Interorganizational determinants of environmental purchasing: initial evidence from the consumer products industry. Decis. Sci. J. 29 (3), 28–38.
Carter, C.R., Kale, R., Grimm, C.M., 2000. Environmental purchasing and firm performance: an empirical investigation. Transport. Res. E Logist. Transport. Rev. 36 (3), 219–228.
Chan, R., He, H., Chan, H., Wang, W., 2012. Environmental orientation and corporate performance: the mediation mechanism of green supply chain management and moderating effect of competitive intensity. Ind. Market. Manag. 41, 621630.
Chen, Y.-S., Lai, S.-B., Wen, C.-T., 2006. The influence of green innovation performance on corporate advantage in taiwan. J. Bus. Ethics 67 (4), 331–339.
Cheung, M.W.-L., 2019. A guide to conducting a meta-analysis with non-independent effect sizes. Neuropsychol. Rev. 29, 287–396.
Chiou, T.-Y., Chan, H.K., Lettice, F., Chung, S.H., 2011. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. Transport. Res. E Logist. Transport. Rev. 47 (6), 822–836.
Choi, S.-B., Min, H., Joo, H.-Y., 2018. Examining the inter-relationship among competitive market environments, green supply chain practices, and firm performance. Int. J. Logist. Manag. 29 (3), 1025–1048.
Christmann, P., 2000. Effects of "best practices" of environmental management on cost advantage: the role of complementary assets. Acad. Manag. J. 43, 663–680.
Cohn, L.D., Becker, B.J., 2003. How meta-analysis increases statistical power. Psychol. Methods 8, 243–253.
Cook, D.J., Guyatt, G.H., Ryan, G., Clifton, J., Buckingham, L., Willan, A., McIlroy, W., Oxman, A.D., 1993. Should unpublished data be included in meta-analyses? Current convictions and controversies. J. American Med. Assoc. 269, 2749–2753.
D'Agostini, M., Goncalves Tondolo, V.A., Camargo, M.E., dos Santos Dullius, A.I., Da Rosa Portella Tondolo, R., Leitao Russo, S., 2017. Relationship between sustainable operations practices and performance: a meta-analysis. Int. J. Prod. Perform. Manag. 66, 1030–1042.
Das, A., Narasimhan, R., 2000. Purchasing competence and its relationship with manufacturing performance. J. Supply Chain Manag. 36 (2), 17–28.
DeSimone, J., Brannick, M., O'Boyle, E., Ryu, J., 2020. Recommendations for reviewing meta-analysis in organizational research. Organ. Res. Methods 1, 1–24.
Döring, N., Bortz, J., 2016. Forschungsmethoden und Evaluation in den Sozial- und Humanwissenschaften. Springer, Berlin/Heidelberg.
Drinkmann, A., 1990. Methodenkritische Untersuchungen zur Metaanalyse. Heidelberg, Univ., Diss. Weinheim: Dt. Studien-Verl.
Dubey, R., Bag, S., Venkatesh, V., 2013. Green purchasing is key to superior performance: an empirical study. Int. J. Procure. Manag. 6 (2), 187–210.
Eisend, M., 2009. Metaanalyse. In: Baumgarth, C., Eisend, M., Evanschitzky, H. (Eds.), Empirische Mastertechniken. Gabler, Wiesbaden, pp. 433–456.
Elkington, J., 1997. Cannibals with Forks: the Triple Bottom Line of 21st Century Business. Capstone, Oxford.
Fang, C., Zhang, J., 2018. Performance of green supply chain management: a systematic review and meta analysis. J. Clean. Prod. 183, 1064–1081.
Fricke, R., Treinies, G., 1985. Einführung in die Metaanalyse, third ed. Verlag Hand Huber, Bern.
Fu, L., Yang, D., Liu, S., Mei, Q., 2023. The impact of green supply chain management on enterprise environmental performance: a meta-analysis. Chin. Manag. Stud. 17 (2), 274–289.
Galeazzo, A., Ortiz-de-Mandojana, N., Delgado-Ceballos, J., 2021. Green procurement and financial performance in the tourism industry: the moderating role of tourists' green purchasing behaviour. Curr. Issues Tourism 24 (5).
Geng, Y., Doberstein, B., 2008. Greening government procurement in developing countries: building capacity in China. J. Environ. Manag. 88 (4), 932–938.
Geng, R., Mansouri, S.A., Aktas, E., 2017. The relationship between green supply chain management and performance: a meta-analysis of empirical evidences in Asian emerging economies. Int. J. Prod. Econ. 183, 245–258.
Geroski, P.A., 1990. Procurement policy as a tool of industrial policy. Int. Rev. Appl. Econ. 4 (2), 182–198.
Glass, G.V., 1976. Primary, secondary, and meta-analysis of research. Educ. Res. 5 (10), 3–8.
Glass, G.V., McGaw, B., Smith, M.L., 1981. Meta-Analysis in Social Research. Sage Publications, Beverly Hills.
Golicic, S.L., Smith, C.D., 2013. A meta-analysis of environmentally sustainable supply chain management practices and firm performance. J. Supply Chain Manag. 49 (2), 78–95.
Gosh, M., 2019. Determinants of green procurement implementation and its impact on firm performance. J. Manuf. Technol. Manag. 30 (2), 462–482.
Govindan, K., Rajeev, A., Padhi, S., Pati, R. Supply chain sustainability and performance of firms: a meta-analysis of the literature. Transport. Res. Part E, 137..
Green Jr., K., Zelbst, P.J., Meacham, J., Bhadauria, V.S., 2012. Green supply chain management practices: impact on performance. Supply Chain Manag. 17 (3), 290–305.
Green Jr., K., Toms, L., Clark, J., 2014. Impact of market orientation on environmental sustainability strategy. Manag. Res. Rev. 33 (1), 217–238.
Grief, L., Altmann, M., Bogaschewsky, R., 2017. The Impact of Sustainable Supply Chain Management Practices on Performance Metrics – A Meta-Analysis. Working Paper Series of the Institute of Business Management, University of Würzburg, Würzburg.
Guang Shi, V., Koh, S.C.L., Baldwin, J., Cucchiella, F., 2012. Natural Resource Based Green Supply Chain Management. School of Management, The University of Sheffield.
Guzzo, R., Jackson, S., Katzell, R., 1987. Meta-analysis analysis. Organ. Behav. 9, 407–442.
Hart, S.L., 1995. A Natural-resource-based view of the firm. Acad. Manag. Rev. 20, 986–1014.
Hsueh, L., Bretschneider, S., Stritch, J., 2020. Implementation of sustainable public procurement in local governments: a measurement approach. Int. J. Public Sect. Manag. 33 (6–7), 697–712.
Hunter, J., Schmidt, F., 2004. Methods of Meta-Analysis, second ed. Sage Publications Inc., London.
Igarashi, M., De Boer, L., Michelsen, O., 2015. Investigating the anatomy of supplier selection in green public procurement. J. Clean. Prod. 108, 442–450.
Islam, M., Murad, M., McMurray, A., Abalala, T., 2017a. Aspects of sustainable procurement practices by public and private organisations in Saudi Arabia: an empirical study. Int. J. Sustain. Dev. World Ecol. 24 (4), 289–303.
Islam, M., Turki, A., Murad, W., Karim, A., 2017b. Do sustainable procurement practices improve organizational performance? Sustainability 9, 2281.
Ismail, L., Alawamleh, M., Aladwan, K., Alragheb, A., 2019. The relationship between green SCM practices and organisational performance: evidence from Jordanian pharmaceutical manufacturers. Int. J. Logist. Syst. Manag. 2, 172–192.
Iraldo, F., Nucci, B., De Giacomo, M., 2016. The relevance of life cycle costing in green public procurement. Econ. Pol. Energy Environ. 1, 91–109.
Jawaad, M., Zafar, S., 2020. Improving sustainable development and firm performance in emerging economies by implementing green supply chain activities. Sustain. Dev. 28 (1), 25–38.
Jenssen, M.M., De Boer, L., 2019. Implementing life cycle assessment in green supplier selection: a systematic review and conceptual model. J. Clean. Prod. 229, 1198–1210.
Kalyar, M., Shoukat, A., Shafique, I., 2019. Enhancing firms' environmental performance and financial performance through green supply chain management practices and institutional pressures, 2019 Sustain. Account. Manag. Policy J. 11 (2), 451–476.
Knudsen, D., 2003. Aligning corporate strategy, procurement strategy and e-procurement tools. Int. J. Phys. Distrib. Logist. Manag. 33 (8), 720–734.
Kock, A., 2009. A Guideline to Meta-Analysis, vol. 2. TIM Working Paper Series.
Koplin, J., 2006. Nachhaltigkeit im Beschaffungsmanagement: Ein Konzept zur Integration von Umwelt- und Sozialstandards. Deutscher Universitäts-Verlag, Wiesbaden.
Koplin, J., Seuring, S., Mesterharm, M., 2007. Incorporating sustainability into supply management in the automotive industry – the case of the Volkswagen AG. J. Clean. Prod. 15, 1053–1062.
Kosfeld, R., Eckey, H., Türck, M., 2016. Deskriptive Statistik, sixth ed. Springer Fachmedien, Wiesbaden.
Kulik, J.A., Kulik, C.C., Bangert-Drowns, R.L., 1990. Is there better evidence on mastery learning? A response to Slavin. Rev. of Education. Res. 60, 303–307.
Laird, N.M., 1990. A discussion of the aphasia study. In: Wächter, K.W., Straf, M.L. (Eds.), The Future of Meta-Analysis, pp. 47–52.
Leal, W., Skouloudis, A., Brandli, L.L., Salvia, A.L., Avila, L.V., Rayman-Bacchus, L., 2019. Sustainability and procurement practices in higher education institutions: barriers and Drivers. J. Clean. Prod. 231, 1267–1280.
Lee, S., Kim, S., Choi, D., 2012. Green supply chain management and organizational performance. Ind. Manag. Data Syst. 112 (8), 1148–1180.
Li, Y., Xu, L., Sun, T., Ding, R., 2019. The impact of project environmental practices on environmental and organizational performance in the construction industry. Int. J. Manag. Proj. Bus. 13 (2), 367–387.
Mahammadzadeh, M., 2012. Unternehmen und Nachhaltigkeitsmanagement. Institut der Deutschen Wirtschaft Köln. In: Auf dem Weg zu mehr Nachhaltigkeit - Erfolge und Herausforderungen 25 Jahre nach dem Brundtland-Bericht. Institut der Deutschen Wirtschaft Köln, Köln, pp. 99–114.

McKinsey, Company, Cherel-Bonnemaison, C., Erlandsson, G., Ibach, B., Spiller, P., 2021. Buying into a More Sustainable Value Chain.
Michaels, P.J., 2008. Evidence for "Publication bias" concerning global warming in Science and Nature. Energy Environ. 19 (2), 287301.
Min, H., Galle, W.P., 2001. Green purchasing practices of US firms. Int. J. Oper. Prod. Manag. 21, 1222–1238.
Mishra, M., Choudhury, D., Venu Gopal Rao, K., 2019. Impact of SMEs green supply chain practice adoption on SMEs firm and environmental performance. Theor. Econ. Lett. (9), 1901–1919.
Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2010. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Int. J. Surg. 8 (5), 336–341.
Münch, C., Benz, L.A., Hartmann, E., 2022. Exploring the circular economy paradigm: a natural resource-based view on supplier selection criteria. J. Purch. Supply Manag. 28 (4), 100793.
Nadvi, K., Raj-Reichert, G., 2015. Governing health and safety at lower tiers of the computer industry global value chain. Regulation & Governance 9, 243–258.
Najmi, A., Maqbool, H., Ahmed, W., Rehman, S., 2020. The influence of greening the suppliers on environmental and economic performance. Int. J. Bus. Perform. Supply Chain Model. 11 (1), 69–90.
Namagembe, S., Ryan, S., Sridharan, R., 2019. Green supply chain practice adoption and firm performance: manufacturing SMEs in Uganda. Manag. Environ. Qual. 30 (1), 5–35.
Narasimhan, R., Das, A., 2001. The impact of purchasing integration and practices on manufacturing performance. J. Op. Manag. 19 (5), 593–609.
Ngo, Q.-H., 2021. The impact of environmental regulation on environmental performance: a focus on third party logistics service providers in an emerging country. Uncert. Supply Chain Manag. 9 (4), 857–866.
Palm, J., Backman, F., 2017. Public procurement of electric vehicles as a way to support a market: examples from Sweden. Int. J. Electr. Hybrid Veh. (IJEHV) 9 (3), 253–268.
Pagell, M., 2021. Replication without repeating ourselves: addressing the replication crisis in operations and supply chain management research. J. Op. Manag. 67, 105–115.
Peng, Y.-S., Lin, S.-S., 2008. Local responsiveness pressure, subsidiary resources, green management adoption and subsidiary's performance: evidence from Taiwanese manufactures. J. Bus. Ethics 79 (1–2), 199–212.
Phan, K., Tian, D.H., Cao, C., Black, D., Yan, T.D., 2015. Systematic review and meta-analysis: techniques and a guide for the academic surgeon. Ann. Cardiothorac. Surg. 4 (2), 112–122.
Qorri, A., Mujkic, Z., Gashi, S., Kraslawski, A., 2018. Green supply chain management practices and company performance: a meta-analysis approach. Procedia Manuf. 17, 317–325.
Qorri, A., Gashi, S., Kraslwaski, A., 2021. Performance outcomes of supply chain practices for sustainable development: a meta-analysis of moderators. Sustain. Dev. 29, 194–216.
Rao, P., Holt, D., 2005. Do green supply chains lead to competitiveness and economic performance? Int. J. Oper. Prod. Manag. 25 (9), 898–916.
Reay, T., Berta, W., Kazman Kohn, M., 2009. What's the evidence on evidence-based management? Acad. Manag. Perspect. 23, 5–18.
Reckova, D., Irsova, Z., 2015. Publication Bias in measuring anthropogenic climate change. Energy Environ. 26 (5), 853–862.
Saeed, M.A., Kersten, W., 2020. Supply Chain sustainability performance indicators - a systematic literature review. Logist. Res. 13 https://doi.org/10.23773/2020_6.
Seuring, S., Müller, M., 2008. From a literature review to a conceptual framework for sustainable supply chain management. J. Clean. Prod. 16 (15), 1699–1710.
Sharpe, D., 1997. Of apples and oranges, file drawers and garbage: why validity issues in meta-analysis will not go away. Clin. Psychol. Rev. 17 (8), 881–901.
Simion, C., Nicolescu, C., Vrincut, M., 2019. Green Procurement in Romanian Construction Projects. A Cluster Analysis of the barriers and enablers to green procurement in construction projects from the Bucharest-Ilfov region of Romania. Sustainability 11, 6231.
Sjåfjell, B., Wiesbrock, A., 2016. Why should public procurement be about sustainability? In: Sjåfjell, B., Wiesbrock, A. (Eds.), Sustainable Public Procurement under EU Law: New Perspectives on the State as Stakeholder. Cambridge University Press, Cambridge.
Smith, M., Glass, G.V., Miller, T., 1980. The Benefits of Psychotherapy. John Hopkins University Press, Baltimore.
Song, H., Yu, K., Zhang, S., 2017. Green procurement, stakeholder satisfaction and operational performance. Int. J. Logist. Manag. 28 (4), 1054–1077.
Srivastava, S.K., 2007. Green supply-chain management: a state-of-the-art review. Int. J. Manag. Rev. 9 (1), 53–80.
Stamm, H., Schwarb, T.M., 1995. Metaanalyse. Eine einführung. German journal of human resource management: zeitschr. Personalforsch 9 (1), 5–27.
Suchman, M.C., 1995. Managing legitimacy: strategic and institutional approaches. Acad. Manag. Rev. 20 (3), 571–610.
Tan, C., Zailani, S., Tan, S., Yeo, S., 2019. Green supply chain management: impact on environmental performance and firm competitiveness. Int. J. Sustain. Strat. Manag. 7, 91–112.
UNEP, 2022. Sustainable Public Procurement Global Review. UNEP, Paris.
Vachon, S., Klassen, R.D., 2008. Environmental management and manufacturing performance: the role of collaboration in the supply chain. Int. J. Prod. Econ. 111 (2), 299–315.
Valentine, J.C., Pigott, T.D., Rothstein, H.R., 2010. How many studies do you need? A primer on statistical power for meta-analysis. J. Educ. Behav. Stat. 35 (2), 215–247.
Van Weele, A., Van Raaij, E., 2014. The future of purchasing and supply management research: about relevance and rigor. J. Supply Chain Manag. 50 (1), 56–72.
Vejaratnam, N., Mohamad, Z., Chenayah, S., 2020. A systematic review of barriers impeding the implementation of government green procurement. J. Public Procure. 20 (4), 451–471.
WCED (World Commission on Environment and Development, 1987. Our Common Future. Oxford University Press, Oxford.
Wernerfelt, B., 1984. A Resource-based view of the firm. Strat. Manag. J. 2, 171–180.
Wilhelm, M., Villena, V., 2021. Cascading sustainability in multi-tier supply chains: when do Chinese suppliers adopt sustainable procurement? Prod. Oper. Manag. 30 (11), 4198–4218.
Wongthongchai, J., Saenchaiyathon, K., 2019. The key role of institution pressure on green supply chain practice and the firm's performance. J. Ind. Eng. Manag. 12 (3), 432–446.
Wu, S.J., Melnyk, S.A., Calantone, R.J., 2008. Assessing the core resources in the environmental management system from the resource perspective and the contingency perspective. IEEE Trans. Eng. Manag. 55 (2), 304–315.
Wurster, S., Ladu, L., 2022. Triple-C: a tridimensional sustainability-oriented indicator for assessing product circularity in public procurement. Sustainability 14 (21).
Wurzel, R.K.W., Liefferink, D., Torney, D., 2019. Pioneers, leaders and followers in multilevel and polycentric climate governance. Environ. Polit. 28 (1), 1–21.
Wynstra, F., Suurmond, R., Nullmeier, F., 2019. Purchasing and supply management as a multidisciplinary research field: unity in diversity? J. Purch. Supply Manag. 25, 100578.
Yildiz Çankaya, S., Sezen, B., 2019. Effects of green supply chain management practices on sustainability performance. J. Manuf. Technol. Manag. 30 (1), 98–121.
Younis, H., Sundarakani, B., O'Mahony, B., 2020. Investigating the relationship between green supply chain management and corporate performance using a mixed method approach: developing a roadmap for future research. IIMB Manag. Rev. 32 (3), 305–324.
Yu, W., Chavez, R., Feng, M., Wiengarten, F., 2014. Integrated green supply chain management and operational performance. Supply Chain Manag. 19 (5–6), 683–696.
Yu, W., Chavez, R., Feng, M., 2017. Green supply management and performance: a resource-based view. Prod. Plann. Control 28 (6–8), 659–670.
Zaremohzzabieh, Z., Ismail, N., Ahrari, S., Samah, A.A., 2021. The effects of consumer attitude on green purchase intention: a meta-analytic path analysis. J. Bus. Res. 132, 732–743.
Zhou, S., Shen, C., 2022. Avoiding definitive conclusions in Meta-analysis of heterogeneous studies with small sample sizes. JAMA Otolaryngol Head Neck Surg 148 (11), 1003–1004.
Zhu, Q., Sarkis, J., Lai, K., 2007. Green supply chain management: pressures, practices and performance within the Chinese automobile industry. J. Clean. Prod. 15 (11–12), 1041–1052.
Zhu, Q., Sarkis, J., Lai, K., 2008. Confirmation of a measurement model for green supply chain management practices implementation. Int. J. Prod. Econ. 111 (2), 261–273.
Zhu, Q., Geng, Y., Lai, K.-H., 2011. Environmental Supply Chain Cooperation and its effect on the circular economy practice-performance relationship among Chinese manufacturers. J. Ind. Ecol. 15 (3), 405–419.
Zhu, Q., Geng, Y., Sarkis, J., 2013. Motivating green public procurement in China: an individual level perspective. J. Environ. Manag. 126, 85–95.
Zhuang, W., Luo, X., Riaz, M., 2021. On the factors influencing green purchase intention: a meta-analysis Approach. Sec. Organ. Psych. 12.
Zimmer, K., Fröhling, M., Schultmann, F., 2016. Sustainable supplier management – a review of models supporting sustainable supplier selection, monitoring and development. Int. J. Prod. Res. 54 (5), 1412–1442.
Zimmermann, F., Foerstl, K., 2014. A meta-analysis of the "purchasing and supply management practice-performance link.". J. Supply Chain Manag. 50 (3), 37–54.
Zsidisin, G.A., Siferd, S.P., 2001. Environmental purchasing: a framework for theory development. Eur. J. Purch. Supply Manag. 7 (1), 61–73.