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Original Article

ASSESSING SUSTAINABILITY IN BRI RAILWAY PROJECTS WITH A NOVEL INTEGRATED FUZZY METHODOLOGY

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Highlights:
- the integrated *p*, *q* ROFS–PIPRECIA–LOPCOW is proposed to obtain criteria weights;
- the *p*, *q* ROFS–EDAS is proposed to rank BRI railway projects;
- the Delphi approach is extended with *p*, *q* ROFSs;
- a novel PIPRECIA–LOPCOW–EDAS model based on *p*, *q* ROFSs is developed for a mathematical tool;
- a real case study for sustainability assessment of BRI railway projects problem is handled.

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Abstract. China's Belt and Road Initiative (BRI) and South–South cooperation have received universal concern over sovereignty and debt issue, despite their goal to promote development. In Africa, the rapid expansion of Chinese-funded railway projects has overtaken the development of systematic methods for evaluating sustainability, producing a serious gap in decision-making. To address this challenge, this study proposes an integrated methodological approach, i.e., Delphi, PIvot Pairwise RElative Criteria Importance Assessment (PIPRECIA), Logarithmic Percentage Change-Driven Objective Weighting (LOPCOW), and Evaluation Based on Distance from Average Solution (EDAS) methods within the *p*, *q* Rung Orthopair Fuzzy Sets (*p*, *q* ROFSs) to assess sustainability performance under high uncertainty. The findings indicate that trade facilitation, job creation, debt sustainability, accessibility and connectivity, and safety and security are the most significant criteria for sustainability. Among the projects assessed, the Nairobi – Mombasa Standard Gauge Railway (SGR) project exhibits greatest sustainability performance, followed by the Addis Ababa – Djibouti railway while others indicated weakened outcomes because of restricted freight integration. These findings recommend that future projects should prioritize powerful trade and freight connections, guarantee employment creation and skills transfer, and implementing financing models that safeguard debt sustainability. In doing so, policymakers, managers, and planners can reinforce regional integration, improve the long-term socio-economic advantages, and obtain the operational and financial viability of extensive railway investments in Africa.

Keywords: sustainability performance analysis; Belt and Road Initiative (BRI); Chinese railway project; developing country; multi-criteria decision-making; *p*, *q* rung orthopair fuzzy sets (*p*, *q* ROFSs); *p*, *q* ROFS–Delphi–PIPRECIA–LOPCOW–EDAS.

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Notations

AHP – analytic hierarchy process;
AI – artificial intelligence;
ANP – analytical network process;
ARAS – additive ratio assessment;
BRI – belt and road initiative;
CIF – circular intuitionistic fuzzy;
CoCoSo – combined compromise solution;
COPRAS – complex proportional assessment;
CRITIC – criteria importance through intercriteria correlation;
DANP – DEMATEL-based ANP;
DEMATEL – decision-making trial and evaluation laboratory;

EDAS – evaluation based on distance from average solution;
ELECTRE – elimination and choice translating reality (in French: *ÉLimination Et Choix Traduisant la RÉalité*);
FS – fuzzy set;
FFS – Fermatean FS;
GDM – group decision-making;
GDP – gross domestic product;
GIS – geographic information system;
GLDS – gained and lost dominance score;
HSR – high speed railway;
IAS – integrated appraisal score;
IFS – intuitionistic FS;
IRF – interval rough fuzzy;
IRN – interval rough number;
IVFNN – interval-valued fuzzy neutrosophic number;
IVIF – interval-valued intuitionistic fuzzy;
IVNF – interval-valued neutrosophic fuzzy;
LCA – life cycle assessment;
LOPCOW – logarithmic percentage change-driven objective weighting;
LT-SF – linguistic T-SF;
MARCOS – measurement of alternatives and ranking according to compromise solution;
MCDM – multi-criteria decision-making;
MCRAT – multiple criteria ranking by alternative trace;
MEREC – method based on the removal effects of criteria;
MOORA – multiple objective optimisation on the basis of ratio analysis;
MULTIMOORA – multiplicative MOORA;
NDA – negative distance from average;
NDAS – negative deviance from average solution;
NWD – negative weighted deviance;
NNWD – normalized NWD;
NPWD – normalized PWD;
p, *q* ROFS – *p*, *q* rung orthopair fuzzy set;
p, *q* ROFN – *p*, *q* rung orthopair fuzzy number;
p, *q* ROFWA – *p*, *q* ROFS weighted averaging operator;
PDA – positive distance from average;
PDAS – positive deviance from average solution;
PFS – Pythagorean FS;
PIPRECIA – pivot pairwise relative criteria importance assessment;
PIPRECIA-F – fuzzy PIPRECIA;
PIPRECIA-S – simplified PIPRECIA;
PROMETHEE – preference ranking organization method for enrichment evaluation;
PSI – preference selection index;
PWD – positive weighted deviance;
q ROFS – *q* rung orthopair fuzzy set;
RQ – research question;
SGR – standard gauge railway;
SPC – symmetry point criterion;
SSA – Sub-Saharan Africa;
SVN – single-valued neutrosophic;
SWARA – stepwise weight assessment ratio analysis;
T-SF – *T*-spherical fuzzy;
TOPSIS – technique for order preference by similarity to ideal solution;
VIKOR – multicriteria optimization and compromise solution (in Serbian: *Višekriterijumska optimizacija I KOmpromisno Rešenje*);
WASPAS – weighted aggregated sum product assessment;
WISP – simple weighted sum product;
ZCRN – *Z*-cloud rough number.

1. Introduction

The African railway network development was mainly operated by colonial empires to take out and convey raw materials. Early investment centered on ports and railways because of their capacity in transporting bulk, low-cost goods over great distances. However, road transport progressively overtook railway in addressing crucial passenger and goods traffic, because of huge adaptability and speed. African railways undergone greater indirect costs, approximately 65% of total expenses and restricted traffic, making them less beneficial than roads (Bouraima *et al.* 2023a). SSA especially indicated less traffic density in contrast to North Africa (Franky *et al.* 2025). From independence through the 1990s, most railways were state-owned but functioned at a loss, weakening public finances. Even with international assistance, investment and maintenance were constantly insufficient, and by the beginning of early 1990s, many railways were near crumbled. In response, countries started allowing concessions, keeping privatizing operations while infrastructure is public ownership. Assisted by donors favouring policy reform over direct investment (Bouraima *et al.* 2020), this change provided mixed outcomes and activated debate over the World Bank's function in the sector's recession (Amadou *et al.* 2015).

Despite these extensive debates on railways in Africa, there remains a considerable gap in methodological approaches that strictly assess their durable sustainability, especially under huge foreign-funded projects. Recently, the Chinese infrastructure-led approach to global development, especially via the BRI and the South–South cooperation has drained considerable international attention (Shaoshi *et al.* 2020). Megaprojects that are highly-cost initiatives and huge, commonly over $1 billion with developmental capacity are fundamental to this initiative. They comprise 19% of BRI projects but approximately 55% of total BRI expenditure (Flyvbjerg 2017). African infrastructure projects represent approximately 47...94% of Chinese yearly loan from 2000 to 2019 (AEI 2025), with railways acting as a basis of its development attempts (CDPC 2025).

While some scholar's alert sovereignty apprehension and debt sustainability endanger (Irandu, Owilla 2020), others regard these projects as mechanisms for infrastructural development and economic growth (Marson *et al.* 2021).

Comprehending the sustainability performance analysis of China-funded infrastructure is crucial for boosting data capacity, ameliorating transparency in host countries, and giving data-driven feedback to both Chinese stakeholders and international community. While studies on African railway projects under BRI contiguously growing, much of them are restricted in scope. Existing research is mainly centered on perspectives such as clientelism, technology transfer, and political dynamics. Furthermore, most of previous research are country-specific, with significant cases from Ethiopia (Weng *et al.* 2021), Tanzania (Wang *et al.* 2021), and Kenya (Chen 2024; Githaiga, Bing 2019; Wissenbach, Wang 2017). A major gap in this research is the absence of methodological and structured methodologies to sustainability performance analysis that can overcome the difficulties of decision-making. As the infrastructure footprint of China quickly expands across the continent, the long-term sustainability concerns of these huge projects have become gradually important.

1.1. Objective and scope of the study

The increase of BRI railway projects in Africa has generated both advantages and challenges for sustainable development. While, connectivity, economic growth, and trade have been promoted in these projects, concerns regarding suitability of durable management structures, unequal socio-economic advantages, and debt sustainability remain some concerns. Previous assessment of such projects has mainly relied on fragmented parameters and qualitative case studies, which doesn't have the methodological precision necessitated to apprehend the undetermined and complex nature of sustainability. This gap shows a comprehensible need for a powerful and structured assessment framework that can direct practitioners, planners, and policymakers in making adequate decisions about the durable viability of these investments. In this context, the objective of this research is to develop an integrated MCDM framework planned to assess the railway projects sustainability performance analysis by combining 4 well defined methods: the Delphi technique, PIPRECIA, LOPCOW, and EDAS, all under the *p*, *q* ROFSs. This thorough framework employs the advantages of each single method along with the resilience and meaningful power of *p*, *q* ROFSs to ameliorate the validity and precision of sustainability performance analysis of completed railway projects funded by Chinese under BRI.

1.2. Rationale for employing *p*, *q* ROFSs in sustainability assessment

Zadeh (1965) introduced a FSs theory that has been later extended to surpass ambiguity in making decisions. In the IFSs, Atanassov (1986) presented both hesitation and non-membership but were restricted by a precise supplement restriction. Yager (2013) and Senapati & Yager (2020) introduced PFSs and FFSs that mitigate this restriction by employing squared and cubes sums, respectively, permitting huge persuasiveness. However, FSs, IFSs, PFSs, and FFSs are restricted to predetermined mathematical constraints, diminishing their flexibility when dealing with greatly complicated, ambiguous sustainability evaluations. Ibrahim & Alshammari (2022) introduced the *p*, *q* ROFSs to overcome these restrictions by permitting adjustable powers (*p*, *q*), which offer a larger and more adaptable modelling capacity. This make them especially appropriate for sustainability evaluations, where the judgments of stakeholders are frequently dependent on the context, conflicting, and uncertain. The novelty is based on the extending sustainability evaluation of BRI-funded railway projects into the *p*, *q* ROFS environment, which has not been examined by the past, thereby providing a more resilient and stronger tool for apprehending ambiguity in expert opinion.

1.3. Justification for applying PIPRECIA, LOPCOW, and EDAS methods in the framework

In our developed framework for sustainability performance analysis, each integrated methodology offers a specific contribution. The PIPRECIA introduced by Stanujkic *et al.* (2017) keeps the advantages of SWARA method while abstaining from its inherent restrictions, yet has never been implemented under the *p*, *q* ROFS environment. The *p*, *q* ROFS–PIPRECIA developed in this study outperforms previous pairwise comparison techniques for acquiring and processing expert opinions. This efficiency arises from the ability to immediately and precisely gather the opinions of experts who are unfamiliar with MCDM approaches and data collection procedures. AHP (Saaty 2004), a well-known pairwise comparison-based method, necessitates – $n \cdot (n-1)/2$ – pairwise comparisons for n criteria, reducing the accuracy and consistency of expert evaluations, particularly in problems with a high number of criteria. Furthermore, with adjustable p and q parameters, *p*, *q* ROFS–PIPRECIA may handle uncertain expert judgments more broadly and with greater flexibility than PIPRECIA extensions defined by sets such as FSs, IFSs, and PFSs.

The LOPCOW technique is a newly proposed objective weighting approach with the goal of prioritizing assessment criteria within an organized grading applied in the procedure of making decision (Ecer, Pamucar 2022). It outshines other objective techniques because of various main benefits. Unlike the conventional approaches, it can successfully address negative values including in the input data and stop wide variations in the defined weights of associated criteria. It also provides stable solutions irrespective of whether a criterion is beneficial or costly type, and it assists in reducing challenges produced by variations in units or data scale. Unluckily, this method has not yet been examined within the *p*, *q* ROFS environment. The *p*, *q* ROFS–LOPCOW extension proposed in this study will enable the method to be used in broader and more flexible modelling of uncertainty.

The EDAS technique is a ranking approach that deals with complicated decision-making approaches that comprise different criteria (Keshavarz Ghorabaee *et al.* 2015). In contrast to other techniques that depend just on accessibility to correct solutions, this technique employs average based normalization, which makes it more appropriate for practical world cases where such proximity may not result in best results. It assesses alternatives via PDA and the NDA that are 2 main parameters. This approach allows for efficient results even when ideal and anti-ideal values are very extreme. Although the TOPSIS (Hwang, Yoon 1981) and VIKOR (Opricovic, Tzeng 2004), 2 widely used methods, focus on ideal and anti-ideal solutions, they may be inappropriate when considering variability in the criteria values. The MOORA plus full multiplicative form (MULTIMOORA) method, on the other hand, focuses on finding the integrated solution of ratio, reference, and multiplicative model approaches while ignoring the data structure (Brauers, Zavadskas 2012). Among the outranking-based methods, the PROMETHEE (Brans *et al.* 1984) and the ELECTRE (Roy 1991) include parameters and tools such as dominance, incomparability, threshold value, and veto value, which allow for more detailed modelling of the problem. However, these 2 methods complicate the application process and sometimes failure to produce the full ranking order of options. The reasons for choosing EDAS for this study are that the studied problem requires solutions based on expert judgment, and that the variation in the data can be standardized to some extent by averaging the solution. Furthermore, the *p*, *q* ROFS–EDAS extension will be introduced for the 1st time in this study, contributing to the broad and flexible modelling of uncertainty.

1.4. Novel contributions and practical significance of the study

This study has following contributions. From methodological aspect, it is the 1st study that combine Delphi technique, PIPRECIA, LOPCOW, and EDAS within the *p*, *q* ROFS context, promoting MCDM tools for large-scale infrastructure assessments. From application perspective, it offers the 1st meticulous sustainability performance analysis of extensive African railway projects funded by Chinese under BRI framework applying a powerful MCDM technique. From criteria identification aspect, the study pinpoint and rank sustainability criteria like trade facilitation, employment, debt sustainability, accessibility and connectivity, and safety and security, giving an authenticated category of main parameters for railway project assessment. From policy pertinence, the study findings provide useful instructions for both project managers and policymakers, emphasizing the significance of conforming to railway planning with the integration of freight, debt sustainability, and employment to guarantee durable socio-economic advantages. From theoretical development, the study extends the relevance of these methodologies and offers a standard for future research in infrastructure sustainability by extending the PIPRECIA, LOPCOW, and EDAS into the *p*, *q* ROFS context.

To explore the study, the next section indicated important literature review on railway performance assessment and applications of methodologies used, emphasizing the gaps this research aims to fill.

2. Literature review

2.1. Existing literature on sustainability performance assessment of railway projects

Transportation infrastructure projects improve economic growth. Therefore, various studies have evaluated their sustainability performance. From the aspect of establishing assessment methodologies and models, Hosny *et al.* (2022) applied an AHP method to identify the most significant sustainability factors, while Liu & Zhang (2022) implemented an integrated MCDM technique for sustainability appraisal of 4 railway projects in China, discovering economic condition and regional resources as important parameters. Complementary methodological contributions comprise Ribeiro *et al.* (2022), who implemented LCA to explore the effect of global warming on railway projects, and Gulcimen *et al.* (2021), who adopted a cradle-to-grave technique to emphasize energy costs as the major driver of life cycle expenses.

Other studies have considered the ecological and social aspects. Using the perceptions of stakeholders, Nyumba *et al.* (2021) discovered Kenya's SGR as producing restricted construction-related destruction but considerable ecosystem degradation. Similarly, Martín *et al.* (2021) revealed that the expansion of Spanish HSR enhanced accessibility but compromise habitat connectivity, while Rao (2021) indicated that the economic dimension was the main factor in Taiwan's passenger railway, followed by the social and environmental dimensions, respectively.

In a series of research, Bouraima and colleagues have considerably explored railway systems in Africa from various viewpoints. Starting with Bouraima & Qiu (2018) assessed the sustainability of existing railway system after exploring its historical background. Extending the focus to West Africa, Bouraima *et al.* (2023b) indicated that information system is the most critical challenge to the railway system, with Nigeria performing best regionally. Further, Bouraima & Qiu (2023) indicated the latest efforts to upgrade and integrated railway infrastructure to overcome the mobility issues encountered by rapid population growth in this region of West Africa. At the SSA region level, Bouraima *et al.* (2021) evaluated the performance of 4 railways systems based on multi-criteria framework, while Bouraima *et al.* (2023c) evaluated the strategies to adopted for railway sector performance and found that improving the governance of transport sector as the most appropriate action.

In general, various methodological approaches have been shown as well as trade-offs highlighted among socio-economic and environmental aspects in the literature. However, most of these studies are context-dependent, fractured by geography, or centered on unusual sustainability aspects, leaving a gap for consolidated, cross-regional assessment frameworks that estimate various perspectives, concurrently. The associated studies on railway project sustainability performance assessment are indicated in Table A1 (Appendix A).

2.2. Application and extensions of PIPRECIA, LOPCOW, and EDAS methods in prior studies

Since the PIPRECIA method was introduced to keep the advantages of SWARA method while abstaining from its restrictions (Stanujkic *et al.* 2017), it has been applied in various studies. Recent research implemented it to prioritize the AI algorithms in various areas (Popović *et al.* 2025), evaluated waste management and agricultural production alternatives (Mishra *et al.* 2025; Radović *et al.* 2024), decision support system in wine bottle and livestock systems choice (Alnoor *et al.* 2025; Popovic *et al.* 2025), and identification of appropriate locations for photovoltaic agriculture (Yücenur, Maden 2025). The examples show its adaptability in addressing both environmental and technological decision issues.

Similarly, the LOPCOW technique introduced by Ecer & Pamucar (2022) to handle instabilities in the entropy weighting method, has obtained wider implementation. It has been adopted for financial markets analysis and foreign investment performance (Aydemir 2025; Biswas, Joshi 2023; Durdu 2025), assess sustainability in energy, transportation, and building fields (Deveci *et al.* 2025; Ecer *et al.* 2023; Ulutaş *et al.* 2023), and suggest waste treatment solutions (Dhruva *et al.* 2025). Such implementations confirm its ability to generate stable and accurate criteria weighting across various fields.

The EDAS method developed by Keshavarz Ghorabaee *et al.* (2016) have been comprehensively adopted. Research have applied it for waste and environmental management (Samastı *et al.* 2024; Shah, Pan 2024), overcoming manufacturing sustainability challenges (Batwara *et al.* 2025), assessing the properties of materials (Sultana *et al.* 2025), and choosing green technologies or approaches in automobile and construction industries (Hatefi *et al.* 2025; Imran, Ullah 2025; Rasool *et al.* 2025). These studies show its potency in assessing complicated multi-criteria issues across environmental, industrial, and risk-assessment environment. In Table A2 (Appendix A), the applications and extensions of these 3 methods are indicated.

2.3. Identified research gaps and need for the present study

According to antecedent studies, this study addresses distinct significant research gaps as follows:

- very few comparative analyses of BRI railways projects in Africa. Most antecedent studies on railway projects in the continent are either specific case studies like the Addis Ababa – Djibouti railway and Tanzania (Wang *et al.* 2021; Weng *et al.* 2021), socio-economic impacts (Deyas, Woldeamanuel 2020), or financing structures (Owusu-Manu *et al.* 2021). However, no study has offered a structured comparative sustainability performance analysis of various BRI railway projects across African countries. Our study fills this gap by presenting the 1st methodological assessment of such projects using a multi-criteria framework;
- absence of coherent criteria system for sustainability analysis. Antecedent studies have regularly centered on disintegrated aspects of sustainability: economic feasibility (Curtis, Mont 2020), social inclusivity (Jedwab, Moradi 2016), and environmental performance (Kouladoum *et al.* 2025), but there is no commonly accepted, extensive framework of criteria for evaluating sustainability in BRI railway projects in Africa. This work contributes by presenting and confirming a powerful set of criteria appropriate for African railway projects;
- methodological restrictions in precedent decision-making techniques. Previously adoptions of decision-making techniques in infrastructure and transportation research have mainly focused on AHP or entropy-based weighting methods (Hosny *et al.* 2022; Zeng *et al.* 2024). While important, these methods are not adequately able of modelling ambiguity and conflicting expert opinions, which are frequent in complex, large-scale infrastructure projects. Our study overcomes this limitation by implementing an integrated p, q ROFS framework that permits for higher adaptability and pragmatism in decision-making under uncertainty;
- absence of methodological integration in fuzzy context. Although the Delphi technique, PIPRECIA, LOPCOW, and EDAS methods have been applied separately in sustainability and infrastructure contexts (Ecer *et al.* 2023; Keshavarz Ghorabaee *et al.* 2015; Stanujkic *et al.* 2017), none have been expanded under the p, q ROFS context or combined into a unique methodological framework for sustainability evaluation of African railway projects. Our study fills this gap by implementing the 1st integrated Delphi–PIPRECIA–LOPCOW–EDAS framework under p, q ROFS, particularly customized for the African context.

Building on these insights, the methodological approach adopted to assess sustainability performance of the different railway projects based on the sustainability criteria is shown in the following section.

3. Methodology

To offer a full understanding before showing the technical details, the methodology in this study can be summarized in 3 major stages:

- at 1st, the main assessment criteria applicable to sustainable railway development are identified after the consultation of experts, using a systematic consensus-building approach: the Delphi technique. This leads to the obtention of 17 criteria categorized under socio-economic, and environmental aspects;

- at 2nd, an integrating weighting method that used expert-based opinions (PIPRECIA) with objective, data-driven examination (LOPCOW) under *p*, *q* ROFS environment determined the relative significance of these criteria. This guaranteed that both quantitative strictness and expert opinion were considered;
- at 3rd, 4 distinct railway projects from various African countries were evaluated and prioritized using the under *p*, *q* ROFS–EDAS method, which compare the performance of the projects against ideal and non-ideal solutions. The integrated methodology offers a methodical, clear, and adaptable framework for assessing large-scale infrastructural decisions.

3.1. Overview of *p*, *q* ROFSs

Yager (2017) proposed *q* ROFS to model uncertainty with greater membership and non-membership degrees across a larger area. The value of q, a regularizing parameter, increases, and uncertainty is modelled over a broader region. A modified variation of the *q* ROFS is a *p*, *q* ROFS. With the help of the extra parameter *p*, *q* ROFS can more fully and flexibly describe missing information (Alballa *et al.* 2025; Seikh, Mandal 2022). Some basic operations of the *p*, *q* ROFSs are indicated in Appendix B.

3.2. Integration of Delphi technique with *p*, *q* ROFs

The 1st phase in solving multi-criteria decision problems is to identify the criteria and options. In this situation, correctly defining the criteria is critical for the right solution of the problem. For this aim, the criteria will be determined using the *p*, *q* ROFS–Delphi technique. Delphi technique derivatives defined under fuzzy sets have many advantages over the classical Delphi technique. The Delphi technique defined under fuzzy sets can handle internal expert evaluation dependencies, insufficient time, inadequate meeting environment, form filling errors, form distribution delays, and evaluation process uncertainties (Hashemkhani Zolfani *et al.* 2022). In this study, the set of criteria will be determined using the *p*, *q* ROFS–Delphi technique (Aytekin 2022; Aytekin *et al.* 2025a; Hashemkhani Zolfani *et al.* 2022). The steps of the *p*, *q* ROFS–Delphi technique are shown in Appendix C. For this study, an evaluation of the *p*, *q* ROFNs are associated with the linguistic terms for evaluating the significance of criteria and experts in Table C (Appendix C).

3.3. Proposed integrated *p*, *q* ROFS–PIPRECIA–LOPCOW–EDAS methodology

The 2nd phase of the study aims to determine the importance levels of the criteria and the ranking of the options. For this aim, the implementation steps of the proposed methodology are provided (Gündoğdu *et al.* 2023). The steps of the *p*, *q* ROFS–PIPRECIA–LOPCOW–EDAS methodology are indicated in Appendix D. The flowchart of the methodology is presented in Figure 1. For this study, an evaluation of the *p*, *q* ROFNs are associated with the linguistic terms for evaluating the criteria and options in Table D (Appendix D). Having implemented the methodology to adopted, the next section shows its application.

4. Application

This section highlights and discusses the major significant findings of the current work. A research procedure centred on assessing the sustainability performance of Chinese-funded railway projects in African countries is designed, an area of increasing significance and complexity. Recently, the Chinese government has assisted financially the construction of various main railway lines across the continent. From these, 4 projects that are in operation for significant period of time were chosen for analysis – Table E1 (Appendix E) – for their comprehensive background information: the Addis Ababa – Djibouti SGR (AAD–SGR), Abuja – Kaduna SGR (AK–SGR), Lagos – Ibadan SGR (LI–SGR), and Nairobi – Mombasa SGR (NM–SGR).

This study aims to find out which selected projects for comparative analysis are the most sustainable, thereby assisting decision-makers and transport policymakers in establishing a successful and feasible decision-making framework for identical future initiatives. A main issue in the procedure is pinpointing which aspects of sustainability should be organized, as the existing literature shows various contradictory criteria with no adequate consensus on their respective significance or effect. To exclusively handle this issue, a 5-stage analytical procedure with the goal to direct decision-making attempt and generating useful results. 1st, preliminary preparation is made, in which the main research problem is presented. Next, there is a collection of pertinent information and fuzzy data through a comprehensive examination procedure to obtain a greater understanding of the making decision conditions. Then, there is a calculation of the associated weights of the related criteria weights applying the suggested decision-making technique. Later, there is an evaluation and ranking of the sustainability performance of each alternative project appropriately. Finally, there is a review and discussion of the main findings along with the managerial implications of this study.

4.1. Preliminary stage: expert selection and data collection

In the 1st phase, a preliminary scheme is established to collect important data and better outline the making decision issue. This stage makes sure the issue is adequately organized before passing on the examination. To start with, the main RQs involved are identified to handle the decision-making issue:

- RQ1: which of the completed railway projects exhibits the highest degree of sustainability?
- RQ2: what criteria should be included under socio-economic and environmental dimensions?

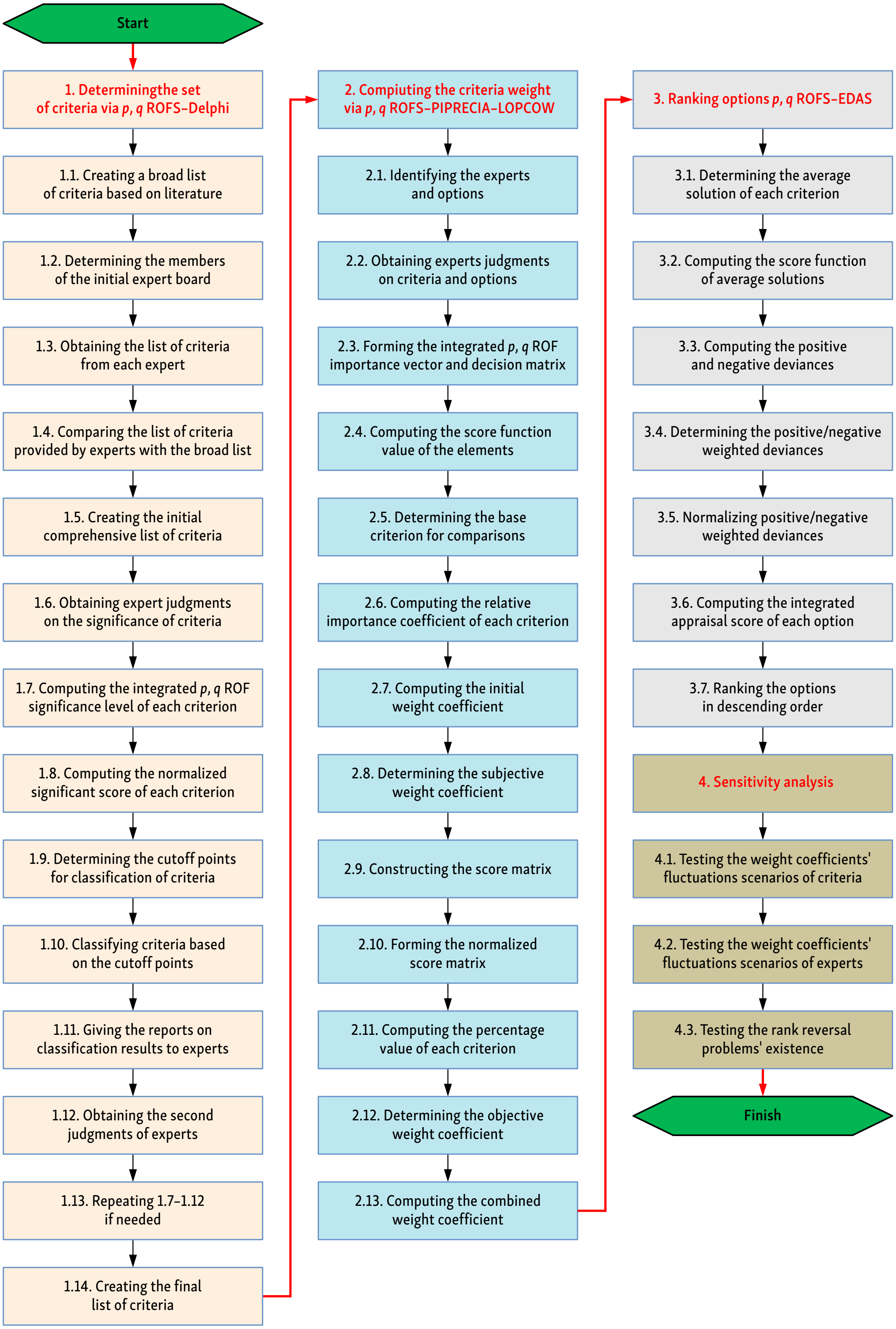


Figure 1. The flowchart of the *p*, *q* ROFS–PIPRECIA–LOPCOW–EDAS methodology

- RQ3: what technique is suitable for precisely choosing these criteria?
- RQ4: how can imprecise, vagueness, and uncertainty information be successfully represented in the evaluation?

In the 2nd phase of the procedure, an investigation is carried out to pinpoint appropriate experts to outline the criteria that are important to the issue of making decisions. To reduce potential bias, the choice of experts is centred on people with active participation in the field and proven experience. To make a powerful foundation for understanding, an organized and targeted selection technique is implemented-engaging candidates via referrals of experts, professional contacts, and personal networks. 7 people agreed to be involved as initial expert council. All chosen members met the required qualifications for insertion. The background information of these experts is shown in Table 1.

The collection of expert insights is a very important step in modelling issues related to decision-making, exploring antecedent challenges, and pinpointing appropriate solutions. There may be variation in the education and experience of experts (Hashemkhani Zolfani *et al.* 2022). While Ecer & Pamucar (2022) indicated that the panels of experts generally can be between 2 to 7 members, more than this range may diminish assessment precision. In this study, railway experts in signalling, rolling stock, civil, and electrification sectors, from African countries with completed projects in the sector were invited. They have greater experience related to the construction, maintenance, and operation of railways at both national and international level, reducing the risk of misinterpretation. An initial meeting was done to present the scope of the research and collect initial perceptions. The main takeaway from this meeting was the shared consensus that assessing the most appropriate criteria is important. Experts highlighted that while there are many criteria, there is an absence of transparency regarding their current credibility, making this the initial crucial step important in figuring out the problem.

4.2. Identification and assessment of significant sustainability criteria

After the initial opening meeting, a 4-stage negotiation procedure is established by the researchers for criteria definition. A couple of weeks later, the 2nd meeting, which represents the Round 1, is carried out. Experts were required to compose catalogue of criteria they judge significant for evaluating the sustainability of Chinese-funded railway projects, with no reduction on the type or number. 2 weeks were provided for them to perform this task. At the same time, a comprehensive literature review is performed by researchers to collect existent criteria from antecedent studies. A comparative analysis is done between the recommendations made by the experts and the findings from the literature, and all inputs were recorded. This represented the 1st comprehensive list of criteria, as indicated in Table E2 (Appendix E).

Round 2: over one week, the experts were requested to express their evaluations regarding the significance degree of the relevant criterion that was considered in solving the problem, using the linguistic expressions in Table C (Appendix C). The evaluations received from the experts because of this round are given in Table E3 (Appendix E).

The linguistic variables from Table E3 (Appendix E) were changed to corresponding p, q ROFN alternatives. For this study, an evaluation of the p, q ROFNs associated with the scales in Table C (Appendix C) and Table D (Appendix D) showed that the less logical factor pair is p = 2 and q = 3. Therefore, the completed analysis will apply the 2, 3 ROFS scheme. The outcomes from the Round 2 of the p, q ROFS–Delphi technique are shown in Table 2.

Round 3: After carried out the computations of the p, q ROFS–Delphi technique, the threshold coefficients for the ranking of criteria are found out as $\psi_{cut\,1} = 0.9181$ and $\psi_{cut\,2} = 0.9874$. The results of the classification, together with evaluations in Table E3 (Appendix E), were distributed to experts for their implication in the next p, q ROFS–Delphi technique round. Therefore, various experts improved their 1st linguistic opinions. The updated linguistic inputs and associated outcomes are indicated in Table 3.

Round 4: In this round, the threshold coefficients for grading criteria were discovered to be $\psi_{cut\,1} = 0.9770$ and $\psi_{cut\,2} = 0.9886$. The outcomes from Round 3 for the p, q ROF–Delphi technique, together with the antecedent evaluation of the experts, were given to the experts in the Round 4. In the last round, the initial assessments from experts are kept, showing that agreement has been attained. An examination of the Table 3 outcomes indicated that ENSUG1, ENSUG2, SO6, and SOSUG1 criteria are not considered. Therefore, new codes have been attributed, indicated in the leftmost column of Table 3, to the criteria that will be used in the next stage of this study. Among the new criteria considered, land use and biodiversity impact, air and noise pollution levels, debt sustainability, operating costs vs revenue, affordability of railway services, and resettlement and compensation are categorized as costly criteria, while the rest are beneficial criteria.

Considering that the goal of this study is to assess the sustainability performance of 4 different Chinese-funded railway projects in Africa, 12 dedicated railway experts, 4 in each country were involved. In most of African countries, modern railway networks are moderately new and mainly developed via considerable Chinese-funding. These projects are regularly the 1st of their kind in each country, signifying that deep knowledge is commonly detained by

Table 1. Brief information regarding the initial expert council

Expert	Gender	Profession	Education	Experience [years]
EXP-1	male	railway civil engineer	MSc	5…10
EXP-2	female	railway stock engineer	MSc	5…10
EXP-3	male	rolling stock engineer	PhD	0…5
EXP-4	male	railway civil engineer	MSc	5…10
EXP-5	male	railway civil engineer	MSc	5…10
EXP-6	female	electrification engineer	BSc	10+
EXP-7	male	signal and communication engineer	MSc	5…10

Table 2. The results of *p*, *q* ROFS–Delphi technique Round 2

Criteria*	The *p*, *q* ROFS significance level of *h*th criterion determined by *g*th expert $\xi_h^{(g)} = \left(a_h^{(g)}, b_h^{(g)}\right)$		The significant score value $\mathcal{S}\left(\xi_h\right)$	The normalized significant score value ψ_h	Class
	The membership degree of the element $a_h^{(g)}$	The non-membership of the element $b_h^{(g)}$			
EN-1	0.9742	0.1620	0.9724	0.9886	influential
EN-2	0.9378	0.2217	0.9343	0.9498	moderate
EN-3	0.8942	0.2790	0.8889	0.9037	uninfluential
EN-4	0.9761	0.1506	0.9747	0.9910	influential
ENSUG-1	0.7819	0.4063	0.7722	0.7850	uninfluential
ENSUG-2	0.8001	0.3777	0.7932	0.8064	uninfluential
ENSUG-3	0.9378	0.2217	0.9343	0.9498	moderate
EC-1	0.9733	0.1699	0.9712	0.9874	influential
EC-2	0.9600	0.1895	0.9574	0.9734	moderate
EC-3	0.9024	0.2594	0.8985	0.9134	uninfluential
EC-4	0.9846	0.1287	0.9836	1.0000	influential
EC-5	0.9630	0.1761	0.9610	0.9770	moderate
ECSUG-1	0.8452	0.3034	0.8432	0.8572	uninfluential
ECSUG-2	0.9846	0.1287	0.9836	1.0000	influential
SO-1	0.9600	0.1895	0.9574	0.9734	moderate
SO-2	0.9742	0.1620	0.9724	0.9886	influential
SO-3	0.8452	0.3034	0.8432	0.8572	uninfluential
SO-4	0.9425	0.2061	0.9398	0.9554	moderate
SO-5	0.9326	0.2385	0.9281	0.9436	moderate
SO-6	0.7416	0.4811	0.7193	0.7313	uninfluential
SOSUG-1	0.7616	0.4745	0.7366	0.7489	uninfluential

Notes: EN – environmental; ENSUG – environmental suggested; EC – economic; ECSUG – economic suggested; SO – social, SOSUG – social suggested.

Table 3. The results of the *p*, *q* ROF–Delphi Round 3

Criteria*	IE1	IE2	IE3	IE4	IE5	IE6	IE7	The significant score value $\mathcal{S}\left(\xi_h\right)$	The normalized significant score value ψ_h	Class	Code
	Codes of the linguistic terms**										
EN-1	M	VH	VH	VH	H	VH	VH	0.9724	0.9886	influential	C1
EN-2	VH	H	H	VH	M	VH	H	0.9343	0.9498	moderate	C2
EN-3	H	VH	VH	VH	VH	H	H	0.9610	0.9770	moderate	C3
EN-4	H	VH	VH	VH	H	VH	VH	0.9747	0.9910	influential	C4
ENSUG-1	H	VH	H	M	H	H	M	0.8284	0.8422	uninfluential	–
ENSUG-2	H	VH	VH	H	M	H	M	0.8889	0.9037	uninfluential	–
ENSUG-3	H	H	H	VH	VH	VH	M	0.9343	0.9498	moderate	C5
EC-1	VH	VH	VH	VH	VH	H	H	0.9747	0.9910	influential	C6
EC-2	VH	VH	VH	M	H	VH	VH	0.9724	0.9886	influential	C7
EC-3	VH	VH	H	M	H	VH	H	0.9343	0.9498	moderate	C8
EC-4	VH	VH	VH	H	VH	VH	VH	0.9836	1.0000	influential	C9
EC-5	VH	H	H	VH	H	VH	VH	0.9610	0.9770	moderate	C10
ECSUG-1	VH	VH	VH	H	H	H	H	0.9398	0.9554	moderate	C11
ECSUG-2	VH	VH	VH	VH	VH	VH	H	0.9836	1.0000	influential	C12
SO-1	VH	VH	H	H	H	VH	VH	0.9610	0.9770	moderate	C13
SO-2	VH	VH	VH	H	H	VH	VH	0.9747	0.9910	influential	C14
SO-3	VH	VH	VH	H	H	H	H	0.9398	0.9554	moderate	C15
SO-4	VH	VH	H	H	VH	H	H	0.9398	0.9554	moderate	C16
SO-5	VH	VH	H	VH	VH	H	H	0.9610	0.9770	moderate	C17
SO-6	M	M	M	M	M	L	L	0.5150	0.5235	uninfluential	–
SOSUG-1	H	L	H	M	L	VL	L	0.5445	0.5536	uninfluential	–

Notes: * – Table E2 (Appendix E) provides the clarifications of the criteria;
** – Table D (Appendix D) provides the clarifications of the linguistic terms and codes;
IE – internal expert council.

native engineers, officials, and project managers personally implicated in that project. Because there is a highly localized and variation of expertise with each project context, it is very challenging to obtain one category of expert with direct, effective knowledge of all 4 railway projects across distinct countries. In addition, the operation of each railway is done under the influence of the community and specific local circumstances, which necessitate context-specific apprehension. Therefore, engaging committed local experts for each project guarantees that the evaluations are precise, pertinent, and based on clear environmental and operational circumstances. While our methodology may result in little variation in viewpoints, it provides more accurate and practical insights given the region's emerging railway sector and the project-unique nature of available expertise. A trip was made by the 1st author to each country 22 May – 7 June 2025, to meet with 4 prominent experts per country. Table E4 (Appendix E) indicated the background information of these experts.

4.3. Computation of criteria weights using *p*, *q* ROFS–PIPRECIA and *p*, *q* ROFS–LOPCOW

In this stage, 5 environmental, 7 economic, and 5 social criteria are used in the calculation process. Experts were demanded to evaluate the criteria's importance using Table C (Appendix C). Therefore, their evaluations are shown in Table E5 (Appendix E). In addition, they offered their linguistic evaluations of the sustainability performance of railway projects indicated in Table E6 (Appendix E). The integrated evaluations from the experts are applied to obtain the integrated *p*, *q* ROFS significance values for the criteria. Later, the *p*, *q* ROFS–PIPRECIA method is adopted, leading to the results shown in Table 4.

Using Equation (B8), there is an establishment of an integrated decision matrix. Therefore, this integrated decision matrix is incorporated in Table 5.

In Table 6, the score matrix related to *p*, *q* ROFS–LOPCOW is established and shown.

The score matrix is constructed via Equation (B6). Then the normalized score matrix is formed using Equation (D5). Next, the values of PV_j, w_{obj}, and w_j values are calculated using the *p*, *q* ROFS–LOPCOW and *p*, *q* ROFS-combined weight method. Table 7 indicated the results, which show the final weight coefficients of the criteria. Furthermore, the results regarding the weight coefficients of the criteria are visualized in Figure 2.

From Figure 2 and Table 7, the "Trade facilitation – C11" is the most significant criterion for analysing the sustainable performance of these railways' projects, followed by "Job creation – C6", "Debt sustainability – C7", "Accessibility and connectivity – C16", and "Safety and security – C13", respectively. While the "Land use and biodiversity impact – C1" is the most significant environmental criterion, the "Job creation – C6" and "Accessibility and connectivity – C16" are the most significant economic and social criteria, respectively.

4.4. Ranking of railway project alternatives using the *p*, *q* ROFS–EDAS method

In this stage, the sustainable performance of Chinese-funded railway projects in Africa are evaluated with the experts. Experts and researchers have identified 4 alternative projects that have been completed and are currently in operation. After the weight of criteria determination, these 4 alternatives have been ranked using the p, q ROFS–EDAS method. The findings of this method are indicated in Figure 3.

Table 4. The results of *p*, *q* ROFS–PIPRECIA

Criterion	The integrated *p*, *q* ROFS importance of the *j*th criterion $\iota_j = (a_j, b_j)$		The score function value of the integrated *p*, *q* ROFS importance of the *j*th criterion $\mathcal{S}(\iota_j)$	The comparison score value $comp_j$	The relative importance coefficient ζ_j	The initial weight coefficient ϑ_j	The subjective weight coefficient w_{subj}
	The membership degree of the element a_j	The membership degree of the element b_j					
C1	0.9305	0.2359	0.9263	1.00000	1.0000	1.0000	0.0593
C2	0.9400	0.2414	0.9348	1.00846	0.9915	1.0085	0.0598
C3	0.9014	0.2703	0.8964	0.96159	1.0384	0.9712	0.0576
C4	0.8745	0.2833	0.8710	0.97463	1.0254	0.9472	0.0561
C5	0.9248	0.2495	0.9199	1.04883	0.9512	0.9958	0.0590
C6	0.8657	0.3033	0.8608	0.94094	1.0591	0.9403	0.0557
C7	0.8671	0.2963	0.8629	1.00210	0.9979	0.9423	0.0558
C8	0.9023	0.2361	0.9005	1.03762	0.9624	0.9791	0.0580
C9	0.9575	0.2106	0.9537	1.05317	0.9468	1.0341	0.0613
C10	0.9083	0.2567	0.9040	0.95033	1.0497	0.9852	0.0584
C11	0.9467	0.2198	0.9428	1.03881	0.9612	1.0249	0.0607
C12	0.9160	0.2393	0.9127	0.96986	1.0301	0.9949	0.0590
C13	0.9445	0.2282	0.9401	1.02745	0.9725	1.0230	0.0606
C14	0.8382	0.2977	0.8381	0.89799	1.1020	0.9283	0.0550
C15	0.9512	0.2379	0.9457	1.10753	0.8925	1.0402	0.0616
C16	0.9526	0.2021	0.9496	1.00394	0.9961	1.0443	0.0619
C17	0.9241	0.2530	0.9189	0.96933	1.0307	1.0132	0.0601

Table 5. The integrated *p*, *q* ROFS decision matrix

	C1		C2		C3		C4		C5	
	$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$	
	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}
A1	0.7807	0.3218	0.8891	0.3039	0.7807	0.3218	0.6500	0.4500	0.6679	0.4516
A2	0.9054	0.2603	0.7287	0.3727	0.9575	0.2106	0.8500	0.2500	0.5586	0.5454
A3	0.6158	0.4912	0.7042	0.4085	0.6878	0.4173	0.5500	0.5500	0.6044	0.4975
A4	0.9621	0.1936	0.9521	0.2358	0.7800	0.3312	0.8072	0.2958	0.7500	0.3500
	C6		C7		C8		C9		C10	
	$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$	
	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}
A1	0.6673	0.4821	0.9521	0.2358	0.7042	0.4085	0.8792	0.6673	0.4821	0.9521
A2	0.3591	0.7466	0.4438	0.6667	0.6044	0.4975	0.9254	0.3591	0.7466	0.4438
A3	0.6783	0.4545	0.7524	0.3677	0.7500	0.3500	09	0.6783	0.4545	0.7524
A4	0.8066	0.3045	0.7492	0.3603	0.9254	0.2200	0.9160	0.8066	0.3045	0.7492
	C11		C12		C13		C14		C15	
	$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$	
	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}	a_{ij}	b_{ij}
A1	0.9054	0.2603	0.7167	0.4000	0.7626	0.9054	0.2603	0.7167	0.4000	0.7626
A2	0.3867	0.7204	0.8500	0.2500	0.5500	0.3867	0204	0.8500	0.2500	0.5500
A3	0.7915	0.3150	0.7121	0.4034	0.6272	15	0150	0.7121	0.4034	0.6272
A4	0.8072	0.2958	0.8301	0.2719	0.9254	0.8072	0.2958	0.8301	0.2719	0.9254
	C16		C17							
	$x_{ij} = (a_{ij}, b_{ij})$		$x_{ij} = (a_{ij}, b_{ij})$							
	a_{ij}	b_{ij}	a_{ij}	b_{ij}						
A1	0.9054	0.2603	0.9054	0.2603						
A2	0.5280	0.5735	0.5280	0.5735						
A3	0.7383	0.3866	0.7383	0.3866						
A4	0.9621	0.1936	0.9621	0.1936						

Note: $x_{ij} = (a_{ij}, b_{ij})$ denoted the *p*, *q* ROFS performance value of the *i*th option in the *j*th criterion.

Table 6. The score matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	0.7881	0.8812	0.7881	0.6657	0.6770	0.6666	0.9467	0.7139	0.8705
A2	0.9010	0.7396	0.9537	0.8534	0.5749	0.3564	0.4503	0.6211	0.9229
A3	0.6304	0.7139	0.7002	0.5681	0.6211	0.6831	0.7582	0.7598	0.6770
A4	0.9592	0.9467	0.7861	0.8128	0.7598	0.8112	0.7573	0.9229	0.9127
	C10	C11	C12	C13	C14	C15	C16	C17	
A1	0.8000	0.9010	0.7249	0.7706	0.8524	0.8128	0.9010	0.8501	
A2	0.6443	0.3878	0.8534	0.5681	0.7598	0.5681	0.5451	0.5749	
A3	0.6119	0.7976	0.7207	0.6308	0.5749	0.6261	0.7436	0.7573	
A4	0.9055	0.8128	0.8345	0.9229	0.7976	0.7008	0.9592	0.7706	

Table 7. The results of the *p*, *q* ROFS–LOPCOW and the *p*, *q* ROFS-combined weight method

	C1	C2	C3	C4	C5	C6	C7	C8	C9
The percentage value PV_j	0.2597	0.2015	0.1911	0.2542	0.1837	0.4163	0.3818	0.2298	0.2258
The objective weight coefficient w_{obj}	0.0576	0.0447	0.0424	0.0563	0.0407	0.0923	0.0846	0.0510	0.0501
Weight w_j	0.0584	0.0522	0.0500	0.0562	0.0499	0.0740	0.0702	0.0545	0.0557
Rank	6	14	15	9	16	2	3	13	11
	C10	C11	C12	C13	C14	C15	C16	C17	
The percentage value PV_j	0.2542	0.4344	0.1392	0.2846	0.2573	0.2232	0.3231	0.2512	
The objective weight coefficient w_{obj}	0.0563	0.0963	0.0308	0.0631	0.0570	0.0495	0.0716	0.0557	
Weight w_j	0.0574	0.0785	0.0449	0.0619	0.0560	0.0556	0.0668	0.0579	
Rank	8	1	17	5	10	12	4	7	

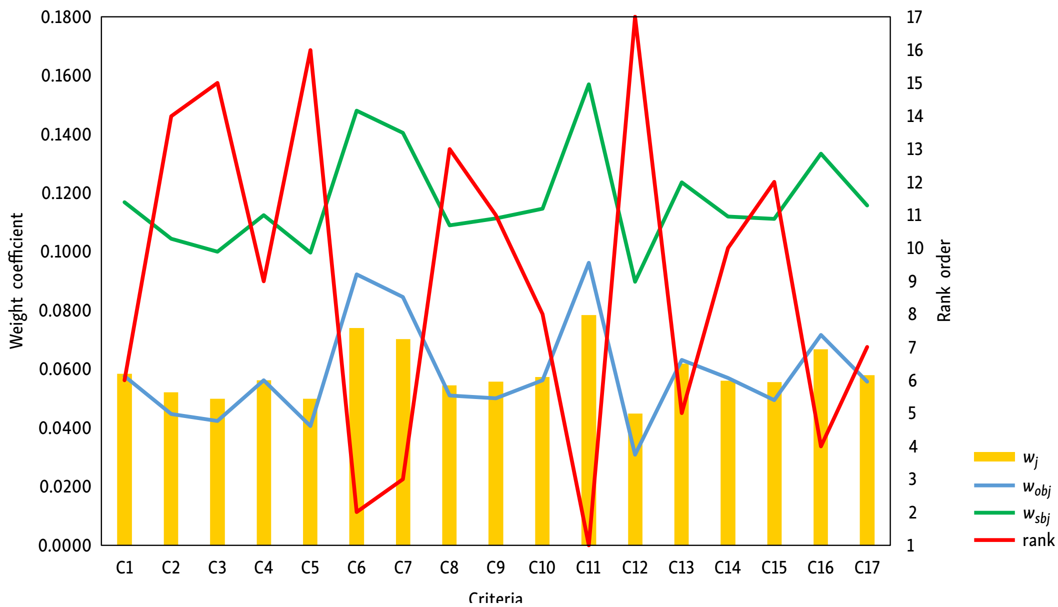
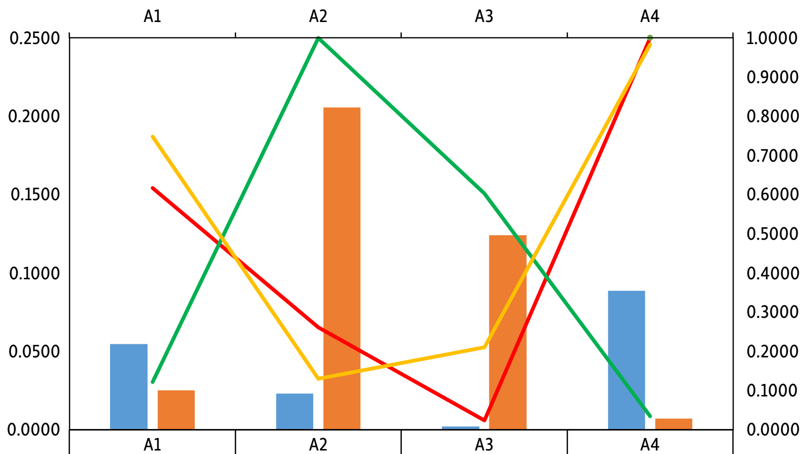


Figure 2. The results of *p*, *q* ROFS–PIPRECIA–LOPCOW method



	A1	A2	A3	A4
PWD	0.0547	0.0231	0.0021	0.0886
NWD	0.0250	0.2058	0.1241	0.0070
NPWD	0.6172	0.2608	0.0239	1.0000
NNWD	0.1215	1.0000	0.6032	0.0342
IAS	0.7479	0.1304	0.2104	0.9829
Rank	2	4	3	1

Figure 3. The results of the *p*, *q* ROFS–EDAS method

From Figure 3, the ranking order of railway projects are obtained as $A4 \succ A1 \succ A3 \succ A2$. The 4th alternative NM–SGR indicated the greatest overall sustainability performance followed by the AAD–SGR and AK–SGR, which occupy the 2nd and 3rd places, respectively. The LI–SGR has the least sustainability performance among the 4 alternatives, showing relatively weaker performance across the assessed sustainability criteria. The results from this application are now discussed in detail to interpret their theoretical significance.

4.5. Sensitivity analysis

This section will test the validity and reliability of the results obtained. 1st, the scenarios in Table F1 (Appendix F) were created to examine the effects of changes in criterion weight coefficients. There were ten scenarios generated for each criterion, for a total of 170 (e.g., W0, W1, …. W170). The approach adopted in scenario development was to reduce the weight coefficient of a criterion by 10%, 20%, 30%, and so on, and then add it equally to the other criteria (Aytekin *et al.* 2025b). This will allow for a wide range of criterion weight coefficient changes and test the methodology's responses. The ranking results obtained from the solutions are presented in Figure 4.

Figure 4 shows that the proposed methodology accurately reflects the variation in the criterion weight coefficients in the problem solution. Furthermore, the lack of constant variations in the results proves the reliability and validity. To determine the impact of changes in experts' weight coefficients on the problem solution, we adopted an approach of examining the effects of changes in weight coefficients within 3 expert groups. For this purpose, forty scenarios were created for each group, for a total of 120 scenarios as detailed in the criteria weight coefficient variation process. Moreover, it was created by changing the weight coefficients of 2 expert groups each time in 40 scenarios. Thus, a total of 160 scenarios were created (e.g., T0, T1, ... T160). However, it is possible to conduct tests by creating more scenarios. But the primary goal here is to monitor the effects of changes in expert weights. The scenarios regarding weight coefficients of experts are presented in Table F2 (Appendix F). The ranking results obtained for the options are presented in Figure 5.

The results in Figure 5 show that changes in expert weight coefficients do not alter the ranking of the options in the context of the scenarios presented in Table F2 (Appendix F). Finally, we will examine the existence of a ranking change problem. The results of rank reversal examinations are presented in Table 8.

Table 8 demonstrates that the proposed methodology does not cause any rank reversal issue for the studied problem. The proposed methodology successfully solved the problem. The tests performed in this subsection demonstrate that the solution is valid and reliable.

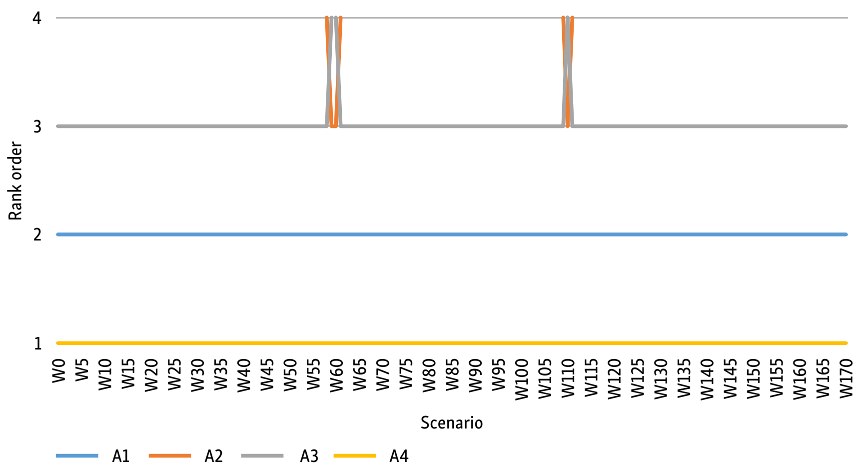


Figure 4. The results of the weight coefficient changes of criteria

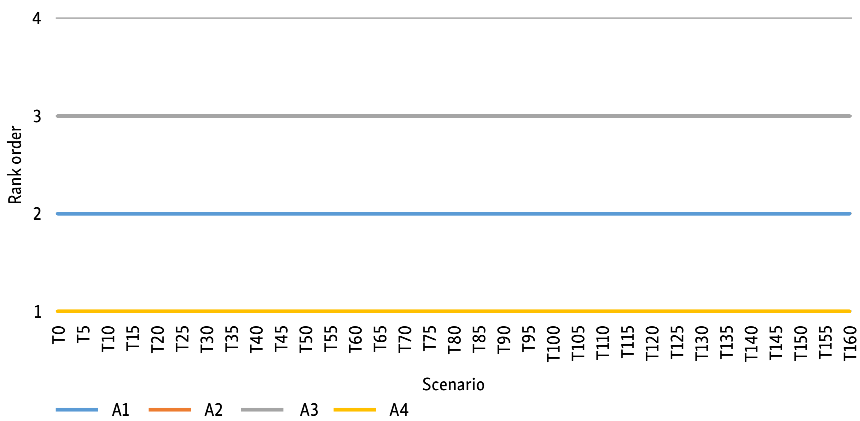


Figure 5. The results of the weight coefficient changes of experts

Table 8. The results of rank reversal examinations

	Excluded option									
	–	A1	A1, A2	A1, A3	A1, A4	A2	A2, A3	A2, A4	A3	A3, A4
A1	2	–	–	–	–	2	2	1	2	1
A2	4	3	–	2	2	–	–	–	3	2
A3	3	2	2	–	1	3	–	2	–	–
A4	1	1	1	1	–	1	1	–	1	–

5. Discussion

This study introduced a new integrated *p*, *q* ROFS–Delphi–PIPRECIA–LOPCOW–EDAS framework for the sustainability performance analysis of Chinese-funded railway projects in African countries, emphasizing how significant are both the application of multi-criteria techniques for alternative rankings and the judgments of experts in the findings of criteria weighting. Via the analysis, criteria under 3 sustainability dimensions are defined through a 4 round of *p*, *q* ROFS–Delphi technique. Then, these criteria are evaluated using the *p*, *q* ROFS–PIPRECIA–LOPCOW technique.

Trade facilitation is the most important criterion in the analysis, as it considerably impacts the strategic relevancy, developmental influence, and durable economic advantages of a railway project. This corroborates the study of Atta-Mensah (2014), who indicated the criterion as major factor in evaluating such a project. In Africa, high costs of transportation and inadequate logistics have long restricted integration and regional trade. Railways connecting inland to industrial zones and seaports enhance access, diminish costs, and refine goods transport. The NM–SGR certainly displays the positive influence of powerful trade facilitation. Since its completion, millions of tons of cargo have been yearly transported from Mombasa Port to inland hubs. With the implementation of Nairobi Inland Container Depots, there was an improvement in the access of the main industrial area and the port has been decongested. This ameliorated the Kenya's position as a regional logistic hub. Likewise, the trade logistics in Ethiopia has been considerably enhanced with the AAD–SGR, with the transport time decreasing from 50 to 12 hours. The newly constructed railway currently handles most of the country's imports and exports and helps main industrial parks. Although poor last-mile connections and restricted rolling stock are some of the issues encountered, the AAD–SGR is crucial for the national industrial growth, emphasizing the significance of trade facilitation in sustainability. In contrast, the AK–SGR, constructed mostly for passengers, is short of industrial links and freight infrastructure, which leads to raising financial issues and less economic impact. Similarly, the LI–SGR struggle with trade facilitation because of delays at Apapa Port (Nigeria) and restricted freight services, failing to enhance the distribution of goods or reducing the port congestion. These examples reveal that trade facilitation in railway planning is important for durable economic advantages and sustainability.

Job creation is the 2nd most significant criterion in the analysis of sustainability of these projects. This aligned with the study of Chen (2018) that indicated the importance of this criterion, as it literally aids the community livelihoods, diminishes poverty, and strengthens skills development important for durable community stability. The employment produced during both the construction and operational stages improves local economies by rising income and building technical ability, which helps satisfy infrastructure advantages with time. When comparing the 4 projects, the NM–SGR ranks 1st in terms of sustainability performance, mainly because of its considerable employment influence. The project made easier the involvement of approximately 300 local firms and 1200 local suppliers during its construction, generally producing nearly 46, 000 direct and indirect jobs, over 90% of which were filled by domestic workers. In addition, nearly 5000 Kenyans have been trained in railway operations and maintenance, establishing technical expertise and skills transfer. The AAD–SGR succeeds, having trained nearly 300 Ethiopian staff in China and hiring nearly 2000 local workers in operations and maintenance, helping local economic resilience and capacity development. The AK–SGR comes 3rd, producing an approximated 4000 construction jobs and hiring approximately 500 Nigerians in its daily operations, which, while worthy, stayed restricted because of its focus on passenger over freight transport. At last, the LI–SGR exhibits the least sustainability score concerning the employment influence: although nearly 5000 people are yearly employed during the construction and concomitantly profiting some 20000 community people, its partial freight logistics system and centers on passenger services have limited larger job creation and industrial connections. In general, through the rank of these projects, it is shown how powerful and continuous job creation is not just fundamental to allowing communities and developing social welfare, but it is also a crucial pier helping the regional development contributions and continuing economic viability of these large-scale railway projects.

Debt sustainability is the 3rd most important criterion affecting the long-term feasibility of these railways because it found out whether the loans produced sufficient economic returns to repair the debt without adding extreme pressure on national budgets. If there is not enough revenue generation in case of failure of railway operations, governments must redirect funds from other important sectors, jeopardizing inherent defaults and fiscal strain. Studies and reports frequently emphasize this issue across the 4 projects (Ampaw *et al.* 2025; Bo *et al.* 2024). The NM–SGR, constructed at an approximate cost of $3.6 billion, has encountered uninterrupted revenue deficiencies although great numbers of passengers and increased freight traffic. The International Monetary Fund and Kenya's Auditor General evaluations highlight that earnings frequently diminish under the level required to fulfil repayment obligations, constraining the government to balance deficits through budgets redistributions. The AAD–SGR, financed partly through $2.5 billion Chinese loans, is Ethiopia's major trade, controlling approximately 90% of the imports and exports. However, power supply, technical, and operational related challenges have restricted its revenue leading Ethiopia's to settle debt restructuring with China to facilitate repayment pressure. In Nigeria, the AK–SGR, value approximately $876 million, was established mainly for passenger travel, with approximately no freight operations to increase revenue. Nigerian budget office reports indicated that the income of the line fare is not enough to counterbalance operational expenses, making the debt servicing relying on state subsidies. Correspondingly, LI–SGR, which values over $1.5 billion, remains hugely dependent on passenger services because of port integration issues and delayed in the completion of freight terminal. The studies from the Nigerian Ministry of Transport and observers at international level identify this fragile freight capacity menaces revenue generation and increase Nigeria's larger debt burden. To summarize, these findings show that except if the planning of railway projects is made with powerful freight and commercial connections, high degree of debt can threaten financial sustainability and restrict the developmental benefits proposed by such huge investments under the BRI.

Accessibility and connectivity are essential for durable prosperity of critical railway projects, as they reveal how adequately a railway connects with communities, markets, and major infrastructure. Among the 4 projects, the NM–SGR showcases powerful performance by linking Nairobi's industrial zones, Mombasa port, and major corridors, improving both cargo and passenger transport. The AAD–SGR also played a main role in easing the country's trade, although restricted last-mile infrastructure, power outages, and operational barriers. Contrary to say, the AK–SGR, constructed mainly for passenger transport, did not integrate with industrial networks and freight, restricting its economic viability. The LI–SGR has significant potential but is still underused because of logistical deficiencies and deficient port links.

Safety and security are crucial for the sustainability of these projects, as they have a considerable impact on operational stability, ridership, and general approval. The NM–SGR is magnified for its powerful safety record, providing a safer alternative to the past threat highway. The AAD–SGR also enhances safety over older highway routes, although there are power outages issues. The AK–SGR takes advantage of being safer than the exposed to crime highway, though it encounters menaces from vandalism and attacks. The LI–SGR has seen little disturbance yet exposed to vandalism and theft. These cases show the necessity of powerful safety actions to ensure durable and stable success. According to these findings, the next section specifies on the managerial implications, providing practical recommendations for different stakeholders in the railway sector.

6. Managerial implications

In this study, judicious instructions are presented to decision-makers that supervised the Chinese-funded railway projects in Africa. 1st, managers should in their priority integrated railway with trade corridors, industrial hubs, and main ports to diminish the costs of transport and open regional economics. The logistical connectivity and freight infrastructure should be highlighted in the planning stage to increase the developmental returns. 2nd, project developers should make sure that policies that hire domestic firms from construction to operations stages encourage skill development and local employment are implemented. This technique not just builds technical expertise for durable sustainability but also improves local economies. 3rd, financial institutions and infrastructure planners should check the economic viability of projects, with rational predictions for cost recovery and revenue generation. Strategies to escape fiscal strain on national budgets, varied income sources, and emergency plans should be included in the loan agreements. 4th, while the last-mile links should be enhanced by the railway authorities, the urban infrastructure should be integrated with precedent transport networks to make wider use and regional inclusivity easier. Finally, driven strategies like stable infrastructure design, community commitment to construct operational stability and general approval should be entrenched by the managers. These implications highlight the significance of various dimensional sustainability attention into each stage of railway project planning and execution. While the proposed recommendations offer practical directions, their execution may face real challenges. Combining railway networks with industrial hubs and trade corridors necessitated durable coordination among various stakeholders and considerable fundings, which may not consistently be practical due to the fiscal constraints. Likewise, the development of skills and the guarantee of larger employment at local level necessitated durable training programs, the cost of which may go beyond the short-term budgets of project developers. Another issue remains the scalability, as the accomplishment or achievement in one project, for instance NM–SGR may not spontaneously translate to other situations with restricted freight demand and poor institutional capacity. Therefore, policymakers and managers should adjust recommendations to local institutional cases, implement phased implementation strategies, and purchase blended financial models to maximize sustainability and practicability. Beyond practice, the insights further advance theoretical contributions, as described in following section.

7. Theoretical contributions

This study proposes a new *p*, *q* ROFS–Delphi–PIPRECIA–LOPCOW–EDAS methodology that facilitate the conceptual apprehension of sustainability performance for huge infrastructure projects. Through the integration of both subjective expert opinions and objective weighting techniques under this environment, the model successfully handles complexity and uncertainty in the opinion of experts. The extension of Delphi technique under this environment enhances the pinpointing of important criteria, while both PIPRECIA and LOPCOW methods integration offers a stable method to the weight of criteria. In addition, the EDAS technique application within identical environment guarantees a powerful and selective alternative ranking. This framework provides a workable, coherent, and reproducible instrument for infrastructure projects assessment in unknown environments, without the existence of higher mathematical expertise. In theory, it provides a systematic methodology for addressing complicated decision issues and improve the literature by implementing a fitted range of sustainability criteria, particularly important to African railway projects funded by the Chinese. The flexibility of the model makes it relevant to a large range of sustainability assessments across different sectors and regions.

Finally, the policy insights of the study are provided, connecting theoretical and managerial implications to practical measures for sustainable railway development.

8. Policy insights

As policy formulation, trade-oriented investments must be prioritized to enhance economic corridors and regional integration. Governments at national level are invited to insert skill development objectives and employment within infrastructure policies to ameliorate social advantages. Given the intermittent debt sustainability issues, practical evaluations that comprise durable revenues projection should be mandated in the fiscal policies. Enforcement integration with larger transport networks together with connectivity with industrial zones should also be needed in policies to increase the value of public. Finally, community-based protection mechanisms and powerful safety regulations should be regulated to guarantee the durability and security of public assets. Furthermore, to implement these results into real-life, policies should consider the diversified institutional capacities across African countries and the high upfront resources demands. Feasible measures like private investors, phased project rollouts, collaboration with regional organizations, and prioritization of high-demand corridors can improve scalability and reduce cost burdens. By admitting resource restrictions and adjusting implementation strategies, governments can move from theoretical recommendations to practical and sustainable railway development.

9. Conclusions

This study introduced a new methodology to analyse the sustainability performance of Chinese-funded railway projects in Africa. It symbolized a considerable turn point by handling and determining the criteria to considered for the sustainability performance analysis of these projects. Through 4 rounds of *p*, *q* ROFS–Delphi technique, 17 criteria were selected to evaluate 4 distinct railway projects in Ethiopia, Kenya, and Nigeria, respectively. The analysis of the sustainability performance of these 4 projects under the 3 sustainability dimensions provided an adequate framework for planners, policymakers, and managers to make smart decisions that improve durable socio-economic impact, regional integration, and sustainability. In contrast to previous studies that are restricted in scope, country-specific, and mainly centred on perspectives such as clientelism, technology transfer, and political dynamics, this study presents a *p*, *q* ROFS–Delphi–PIPRECIA–LOPCOW–EDAS technique for sustainability performance analysis of railway projects. While the most important criteria for this analysis are trade facilitation, job creation, debt sustainability, accessibility and connectivity, and safety and security, the most sustainable railway projects are the NM–SGR project followed by the AAD–SGR project.

This study, while providing important contributions to the sustainability performance of these railway projects in Africa, is susceptible to some limitations. 1st, the analysis centers on restricted number of flagship projects across specific African countries, which may not comprehensively apprehend the various realities and findings of identical infrastructure developments in the continent. Next, the chosen railway projects are quite recent, which signify that durable sustainability outcomes, such as entire economic returns, and environmental resilience, are still unfolding and cannot yet be extensively quantified. Later, while the opinions of experts were important to the assessment procedure, the consulted experts differed across projects and countries regarding experience, institutional affiliation, and specialization. This presents potential discrepancy in evaluation perspectives and may influence the comparability of results across projects. After that, the study relies mainly on expert judgment, which may not adequately include the experience of impacted local communities and common people's voices. Furthermore, there is no comparative analysis between Chinese-funded projects with identical projects funded by other international actors, which could offer a wider benchmark for evaluating sustainability. Environmental criteria such as land use and biodiversity impacts, and emissions are also underexamined because of restricted data. Additionally, publicly available operational, economic, and environmental datasets that could have been employed to complement or validate the expert-derived evaluations remain unavailable, as such information is often sensitive and embedded in contractual agreements between recipient countries and China. Subsequently, the study focused on the solution of the problem based on evaluations from expert opinions. The difficulty of accessing experts and convincing them to participate in the study limits the number of experts. In addition, the problem solved in the study is limited to the projects and criteria examined. Undoubtedly, studies that address projects from different perspectives can be carried out with the participation of more experts in future. Moreover, the proposed methodology can be employed as a useful tool especially in problems that involve uncertainty and are solved intuitively. In addition to providing solutions to problems with similar characteristics, problems in different fields can also be solved using the proposed method. Finally, elaborating financial and geopolitical dynamics such as changes in global lending practices and shift in China–Africa cooperation, may impact the project sustainability over time in manners do not apprehend in this study. These limitations recommend the necessity for future research that incorporates comparative assessment across various funding models, longitudinal impact assessment, wider geographic scope, and more comprehensive stakeholder representation. Beyond the limitations, this study is prone to wider methodological restrictions. The dependency on a predetermined choice of projects and experts increases the concerns regarding sample representation, as the opinions included may not completely apprehend the divergence of perspectives across all groups of stakeholders and African regions. Likewise, possible biases in the collection of data may have emerged from experts' professional and institutional backgrounds, which could model their opinions and impact weighting results. These factors may successively restrict the external validity of the findings, as the obtained conclusions here may not be completely widespread to all BRI railway projects or similar infrastructure ambitions in various environs. Considering these issues is significant to offer a steady explanation of the results and to emphasize fields where future research must ameliorate methodological precision via an immense, more illustrative samples and surveying with supplementary data sources.

Appendix A: related studies

Table A1. Studies related to sustainability performance assessment of railway projects

Author(s)	Location	Objective	Technique	Environment	GDM
Hosny *et al.* (2022)	–	sustainability assessment of railway project	AHP, questionnaire	precise and exact information	no
Ribeiro *et al.* (2022)	–	environmental performance analysis of railway infrastructure	LCA	–	no
Liu & Zhang (2022)	China	comprehensive sustainable evaluation and ranking	DEMATEL, DANP, VIKOR	precise and exact information	yes
Nyumba *et al.* (2021)	Kenya	ecological impacts assessment of railway transportation infrastructure	Qualitative content analysis	–	–
Gulcimen *et al.* (2021)	Kayseri, Turkey	life cycle sustainability assessment	Cradle-to-grave approach	–	–
Bouraima *et al.* (2023b)	West Africa	railway system evaluation for sustainable transportation	SWARA, CoCoSo	IRN	yes
Rao (2021)	Taiwan	transportation synthetic sustainability parameter analysis	DEMATEL, ANP	precise and exact information	yes
Martín *et al.* (2021)	Spain	improvement of HSR network environmental evaluation	GIS-based indicators	–	–
Current study	Ethiopia, Kenya, Nigeria	sustainability performance analysis for Chinese-funded railway projects	Delphi, PIPRECIA, LOPCOW, EDAS	p, q ROFSs	yes

Table A2. Applications and extensions of the PIPRECIA, LOPCOW, and EDAS techniques

Author(s)	Method	Environment	Application	Location
Popović *et al.* (2025)	PIPRECIA-S	precise and exact information	development of AI algorithm choice	–
Radović *et al.* (2024)	PIPRECIA-IRF	IRF	assessment of criteria in production of fruit	–
Alnoor *et al.* (2025)	PIPRECIA, CoCoSo	ZCRN	evaluation of agriculture decision support system	–
Popovic *et al.* (2025)	PIPRECIA	SVN	suitable choice of bottle for red Tamjanika wine	–
Mishra *et al.* (2025)	GLDS, PIPRECIA	IVIF-GLDS	choice of household solid waste processing plant location	India
Yücenur & Maden (2025)	PIPRECIA-F, WASPAS	precise and exact information	location choice for PV agricultural	Turkey
Biswas & Joshi (2023)	LOPCOW	precise and exact information	market performance of initial public offerings	India
Ecer *et al.* (2023)	Delphi, LOPCOW, CoCoSo	IVFNN	sustainability appraisal examination of micro-mobility solutions	Turkey
Ulutaş *et al.* (2023)	PSI, MEREC, LOPCOW, MCRAT	precise and exact information	commercial building material choice	Turkey
Dhruva *et al.* (2025)	LOPCOW, COPRAS	q ROFS	waste treatment approaches choice	India
Durdu (2025)	SPC, LOPCOW, MARCOS	precise and exact information	financial performance assessment for firms	Turkey
Aydemir (2025)	CRITIC, LOPCOW, ARAS	precise and exact information	FDI attractiveness assessment	BRICS countries
Deveci *et al.* (2025)	LOPCOW, WISP	T-SF	green energy analysis for sustainable transportation	developing countries
Samastı *et al.* (2024)	EDAS	IVNF	medical waste disposal facility site choice	Turkey
Shah & Pan (2024)	TOPSIS, VIKOR, EDAS	precise and exact information	food susceptibility evaluation	India
Batwara *et al.* (2025)	EDAS	stochastic fuzzy	smart sustainable manufacturing barrier evaluation	–
Sultana *et al.* (2025)	CRITIC, EDAS	precise and exact information	surface quality and tensile test behaviour	–
Rasool *et al.* (2025)	CRITIC-EDAS	LT-SF	sustainable green technology assessment	–
Imran & Ullah (2025)	EDAS	CIF	automotive industry sector assessment	–
Hatefi *et al.* (2025)	Shannon entropy, EDAS	fuzzy	mass housing project risk evaluation	–
This study	Delphi, PIPRECIA, LOPCOW, EDAS	p, q ROFSs	sustainability appraisal of Chinese infrastructure-led growth model	Ethiopia, Kenya, Nigeria

Appendix B: basic operations of the *p*, *q* ROFSs

Let X be a discourse universe. Then, a p, q ROFS H in X can be expressed as $H = \left\{x, \left(a_H(x), b_H(x)\right) \middle| x \in X\right\}$, where $0 \le a_H(x), b_H(x) \le 1$. $a_H(x)$ is the membership degree of the element $x \in X$ to set H. Also, $b_H(x)$ represents the non-membership degree of the element $x \in X$ to set H. Here, $0 \le \left(a_H(x)^p + b_H(x)^q\right) \le 1$, $p \ge 1$, $q \ge 1$, p and q are integers. It is recommended that the p and q values be determined as the smallest pair that satisfies these conditions. The hesitancy degree is defined as $\pi_H(x) = \left(1 - \left(a_H(x)\right)^p - \left(b_H(x)\right)^q\right)^{\frac{1}{\kappa}}$, where κ is the least common multiple of p and q (Alballa *et al.* 2025). On the other hand, the pair $h = \left(a_h(x), b_h(x)\right)$ is called p, q ROFN. For convenience, let $h_j = \left(a_j, b_j\right)$ be a collection of p, q ROFNs, where $j = 1, 2, \ldots, n$. Then, some basic operations, the score function, the accuracy function, and the p, q ROFS weighted averaging operator – p, q ROFWA, are presented below, where $\lambda \ge 0$, $\sum_{j=1}^{n} w_j = 1$, $0 \le w_j \le 1$ (Alballa *et al.* 2025; Seikh, Mandal 2022).

$$h_1 \oplus h_2 = \left(\sqrt[p]{(a_1)^p + (a_2)^p - (a_1)^p \cdot (a_2)^p}, b_1 \cdot b_2\right); \quad \text{(B1)}$$

$$h_1 \otimes h_2 = \left(a_1 \cdot a_2, \sqrt[q]{(b_1)^q + (b_2)^q - (b_1)^q \cdot (b_2)^q}\right); \quad \text{(B2)}$$

$$\lambda \cdot h_1 = \left(\sqrt[p]{1 - \left(1 - (a_1)^p\right)^\lambda}, (b_1)^\lambda\right); \quad \text{(B3)}$$

$$h_1^\lambda = \left((a_1)^\lambda, \sqrt[q]{1 - \left(1 - (b_1)^q\right)^\lambda}\right); \quad \text{(B4)}$$

$$(h_1)^c = (b_1, a_1); \quad \text{(B5)}$$

$$S(h_1) = \frac{1}{2} \cdot \left((a_1)^p - (b_1)^q + 1\right); \quad \text{(B6)}$$

$$\mathcal{A}(h_1) = (a_1)^p + (b_1)^q, \mathcal{A}(a_1); \quad \text{(B7)}$$

$$p,q - ROFWA(a_1, a_2, \ldots, a_n) = \left(\left(1 - \prod_{j=1}^{n}\left(1 - (a_j)^p\right)^{w_j}\right)^{1/p}, \prod_{j=1}^{n}(b_j)^{w_j}\right). \quad \text{(B8)}$$

The Hamming d_H and Euclidean d_E distance measures between 2 p, q ROFNs are given in Equations (B9) and (B10), respectively. Here, h_1 and h_2 are 2 p, q ROFNs (Alballa *et al.* 2025; Seikh, Mandal 2022):

$$d_H(h_1, h_2) = \frac{1}{2} \cdot \left(\left|a_1 - a_2\right|^p + \left|b_1 - b_2\right|^q + \left|\pi_1 - \pi_2\right|^\kappa\right); \quad \text{(B9)}$$

$$d_E(h_1, h_2) = \sqrt{\frac{1}{2} \cdot \left(\left|a_1 - a_2\right|^p + \left|b_1 - b_2\right|^q + \left|\pi_1 - \pi_2\right|^\kappa\right)}. \quad \text{(B10)}$$

Appendix C: the steps of *p*, *q* ROFS–Delphi approach

Step 1 of Round 1. A comprehensive literature review is used to generate an extensive set of criteria. For this aim, variables, factors, qualities, criteria, and standards pertinent to the subject of these investigations are taken into consideration.

Step 2 of Round 1. Experts whose opinions will be sought in solving the problem are determined. At this stage, the experts whose opinions will be sought are $G = \left\{G_1, \ldots, G_z\right\}$.

Step 3 of Round 1. The experts are given extensive information regarding the problem. The outcomes and contributions that will be provided by resolving the problem are shared. Each expert is requested to list the criteria that should be considered while solving the problem.

Step 4 of Round 1. The criteria lists received from experts are compared with the list created as a result of the comprehensive literature review in the 1st step. The criteria specified by the experts and not included in the 1st list are added to the 1st list. Thus, a comprehensive criteria list is created.

Step 5 of Round 2. Each expert indicates the significance of the criteria in terms of the relevant problem, in other words, the level of consideration, using the linguistic expressions in Table C.

Table C. Linguistic terms for evaluating the significance of criteria and experts

Linguistic terms for evaluating criteria	Code	*p*, *q* ROFN	
		a	*b*
Very high	VH	0.99	0.11
High	H	0.77	0.33
Medium	M	0.55	0.55
Low	L	0.33	0.77
Very low	VL	0.11	0.99

Accordingly, the p, q ROFS significance level of hth criterion determined by gth expert is represented as $\xi_h^{(g)} = \left(a_h^{(g)}, b_h^{(g)}\right)$, where $g = 1, \ldots, z$; $h = 1, \ldots, t$.

Step 6 of Round 2. Equation (B8) is used to integrate evaluations of experts. Then, the integrated p, q ROFS significance level of hth criterion $\xi_h = \left(a_h, b_h\right)$ is obtained.

Step 7 of Round 2. The significant score value of each criterion $\mathcal{S}\left(\xi_h\right)$ is computed using Equation (B6). After that, the normalized significant score of each criterion ψ_h is computed calculated via Equation (C1):

$$\psi_h = \frac{\mathcal{S}\left(\xi_h\right)}{\left(\mathcal{S}\left(\xi_h\right)\right)_{\max}}. \quad \text{(C1)}$$

This procedure makes the significance value of the criterion that is anticipated to be the most influential equal to 1.

Step 8 of Round 2. 2 cutoff points are established for the process of criterion classification. The mean value of the ψ_h is the 1st of these: ψ_{cut1}. The 3rd quartile of ψ_h is found to be the 2nd cutoff points: ψ_{cut2}. Criteria that fall below ψ_{cut1} are categorized as insignificant, while those that fall beyond ψ_{cut2} are categorized as significant. The moderate class, on the other hand, is made up of those falling between the 2 cutoff points. Thus, insignificant criteria are marked for elimination.

Step 9 of Round 3. The experts get a report containing the linguistic evaluations and analysis results from the previous round about the criteria. A form is used to ask the experts if they intend to alter their previous round ratings. If no expert alters their ratings from the previous round, the criteria list is complete.

Step 10+ of Round 4+. If any expert changes their mind, Steps 6–8 are repeated. This process continues until all experts' opinions have not changed since the previous round. Thus, the process is continued until the complete agreement is reached. When a consensus is obtained, the criteria determination process is completed. Finally, the criteria set $C = \left\{C_1, \ldots, C_n\right\}$ is determined.

Appendix D: the steps of the *p*, *q* ROFS–PIPRECIA–LOPCOW–EDAS approach

Step 1. The components related to the problem are identified. In addition to the criteria determined in the 1st phase, options and experts are also identified in this phase. Accordingly, $C = \left\{C_1, \ldots, C_n\right\}$ denotes criteria, $A = \left\{A_1, \ldots, A_m\right\}$ depicts options, and $E = \left\{E_1, \ldots, E_r\right\}$ represents experts, where $j = 1, \ldots, n$; $i = 1, \ldots, m$; $k = 1, \ldots, l$.

Step 2. Experts evaluate the importance of criteria, and the performance of options using the linguistic terms provided in Table D.

Table D. Linguistic terms for evaluating the criteria and options

Linguistic term	Code	*p*, *q* ROFN	
		a	*b*
Extremely high	EH	0.99	0.15
Very high	VH	0.85	0.25
High	H	0.75	0.35
Moderate high	MH	0.65	0.45
Moderate	M	0.55	0.55
Moderate low	ML	0.45	0.65
Low	L	0.35	0.75
Very low	VL	0.25	0.85
Extremely low	EL	0.15	0.95

Step 3. Experts' linguistic evaluations are transformed into the *p*, *q* ROFNs. Accordingly, $\iota_j^{(k)} = \left(a_j^{(k)}, b_j^{(k)}\right)$ reflects the *p*, *q* ROFS importance value of the *j*th criterion, as determined by *k*th expert, where $j = 1, \ldots, n$; $k = 1, \ldots, l$. Moreover, $x_{ij}^{(k)} = \left(a_{ij}^{(k)}, b_{ij}^{(k)}\right)$ denotes the *p*, *q* ROFS performance value of the *i*th option in the *j*th criterion, as determined by k th expert, where $i = 1, \ldots, m$. These evaluations are integrated via Equation (B8). After that, the integrated *p*, *q* ROFS importance of the *j*th criterion $\iota_j = \left(a_j, b_j\right)$ and the integrated *p*, *q* ROFS decision matrix $X = \left[x_{ij}\right]_{m\times n}$ are obtained, where $x_{ij} = \left(a_{ij}, b_{ij}\right)$.

Step 4. The score function value $\mathcal{S}\left(\iota_j\right)$ is computed using Equation (B6) for all criteria.

Step 5. A base criterion is chosen to initiate pairwise comparisons of criteria. This can be the 1st criterion in the criteria list. Then, each criterion in the list is compared with the previous one to produce comparison score values *comp*$_j$. Equation (D1) gives *comp*$_j$ value of each criterion, where $\mathcal{S}\left(\iota_j\right)$ and $\mathcal{S}\left(\iota_{j-1}\right)$ symbolize the score function values of the *j*th criterion and $\left(j-1\right)$ th criterion, respectively:

$$comp_j = \begin{cases} 1 + \mathcal{S}\left(\iota_j\right) - \mathcal{S}\left(\iota_{j-1}\right), & \text{if } \mathcal{S}\left(\iota_j\right) > \mathcal{S}\left(\iota_{j-1}\right); \\ 1, & \text{if } \mathcal{S}\left(\iota_j\right) = S\left(\iota_{j-1}\right); \\ 1 + \mathcal{S}\left(\iota_{j-1}\right) - \mathcal{S}\left(\iota_j\right), & \text{if } \mathcal{S}\left(\iota_j\right) < \mathcal{S}\left(\iota_{j-1}\right). \end{cases} \quad \text{(D1)}$$

Step 6. The relative importance coefficient of each criterion ζ_j s computed using Equation (D2):

$$\zeta_j = \begin{cases} 1, & \text{if } j = 1; \\ 2 - comp_j, & \text{if } j > 1. \end{cases} \quad \text{(D2)}$$

Step 7. The initial weight coefficient of each criterion ϑ_j is calculated by applying Equation (D3). Here, ϑ_j of the base criterion equals 1.

$$\vartheta_j = \frac{\zeta_j}{\zeta_{j-1}}. \quad \text{(D3)}$$

Step 8. The subjective weight coefficient of each criterion w_j is computed via Equation (D4):

$$w_{subj} = \frac{\vartheta_j}{\sum_{j=1}^{n} \vartheta_j}. \quad \text{(D4)}$$

Step 9. The score matrix $Y = \left[y_{ij}\right]_{m\times n}$ is constructed using Equation (B6).

Step 10. The normalized score matrix $R = \left[r_{ij}\right]_{m\times n}$ is constructed by applying Equation (D5):

$$r_{ij} = \begin{cases} \dfrac{x_{ij} - \min_j\left(x_{ij}\right)}{\max_j\left(x_{ij}\right) - \min_j\left(x_{ij}\right)}, & \text{benefit criteria;} \\ \dfrac{\max_j\left(x_{ij}\right) - x_{ij}}{\max_j\left(x_{ij}\right) - \min_j\left(x_{ij}\right)}, & \text{cost criteria.} \end{cases} \quad \text{(D5)}$$

Step 11. The percentage value of criteria *PV*$_j$ is calculated using Equation (D6), where σ_j is the standard deviation of *j*th criterion is, and m denotes the number of options:

$$PV_j = \left| \ln\left(\frac{\sqrt{\frac{\sum_{i=1}^{m} r_{ij}^2}{m}}}{\sigma_j} \right) \cdot 100 \right|. \tag{D6}$$

Step 12. The objective weight coefficient of each criterion w_{obj} is determined by applying Equation (D7):

$$w_{obj} = \frac{PV_j}{\sum_{j=1}^{n} PV_j}. \tag{D7}$$

Step 13. The combined weight coefficient of each criterion w_j is computed using Equation (D8):

$$w_j = \frac{w_{suj} + w_{obj}}{2}, \tag{D8}$$

where: $\sum_{j=1}^{n} w_j = 1,\ 0 \le w_j \le 1.$

Step 14. The average solution of each criterion AS_j is computed via Equation (D9), where m is the number of options:

$$AS_j = \left(\sqrt[q]{1 - \prod_{i=1}^{m} \left(1 - (\mu_{ij})^q\right)^{\frac{1}{m}}},\ \prod_{i=1}^{m} (v_{ij})^{\frac{1}{m}} \right). \tag{D9}$$

Step 15. The score function value of AS_j is computed using Equation (B6). Then, $\mathcal{S}(AS_j)$ is obtained.

Step 16. The PDAS is computed using Equation (D10), while the NDAS is calculated using (D11):

$$PDAS_{ij} = \begin{cases} \dfrac{\max\left(0, \left(\mathcal{S}(x_{ij}) - \mathcal{S}(AS_j)\right)\right)}{\mathcal{S}(AS_j)}, & \text{benefit criteria;} \\ \dfrac{\max\left(0, \left(\mathcal{S}(AS_j) - \mathcal{S}(x_{ij})\right)\right)}{\mathcal{S}(AS_j)}, & \text{cost criteria;} \end{cases} \tag{D10}$$

$$NDAS_{ij} = \begin{cases} \dfrac{\max\left(0, \left(\mathcal{S}(AS_j) - \mathcal{S}(x_{ij})\right)\right)}{\mathcal{S}(AS_j)}, & \text{benefit criteria;} \\ \dfrac{\max\left(0, \left(\mathcal{S}(x_{ij}) - \mathcal{S}(AS_j)\right)\right)}{\mathcal{S}(AS_j)}, & \text{cost criteria.} \end{cases} \tag{D11}$$

Step 17. The PWD and the NWD are calculated via Equations (D12) and (D13), respectively:

$$PWD_i = \sum_{j=1}^{n} w_j \cdot PDAS_{ij}; \tag{D12}$$

$$NWD_i = \sum_{j=1}^{n} w_j \cdot NDAS_{ij}. \tag{D13}$$

Step 18. The NPWD and the NNWD are calculated via Equations (D14) and (D15), respectively:

$$NPWD_i = \frac{PWD_i}{\max(PWD_i)}; \tag{D14}$$

$$NNWD_i = \frac{NWD_i}{\max(NWD_i)}. \tag{D15}$$

Step 19. The IAS is computed using Equation (D16):

$$IAS_i = \frac{NPWD_i + 1 - NNWD_i}{2}. \tag{D16}$$

Options are ranked according to the descending IAS_i values.

Appendix E: Information related to projects, criteria, and experts' evaluations

Table E1. Background information for each railway project

Characteristic \ Railway project	AAD–SGR	NM–SGR	LI–SGR	AK–SGR
Strategic significance	▪ main trade itinerary for Ethiopia (over 90% of trade via Djibouti); ▪ improve regional economic integration	▪ main transport corridor between Kenya's capital (Nairobi) and its main port (Mombasa); ▪ key to the Vision 2030 for economic growth	▪ links from Lagos (Nigeria largest city and port) to Ibadan (a main inland city); ▪ important for improving logistics and unblock roads	▪ links from Abuja (the capital city) to Kaduna (a main northern commercial center); ▪ offers a convenient alternative to Abuja – Kaduna highway
Length and route	▪ total: 759 km: ▪ 666 km (Ethiopia); ▪ 93 km (Djibouti)	▪ total: 472 km	▪ total: 157 km; ▪ portion of a main Lagos – Kano railway project targeted to connect the northern areas with the southern ports	▪ total: 186 km; ▪ links from Idu station (Abuja) to Rigasa station (Kaduna)
Gauge electrification	▪ standard gauge (1435 mm); ▪ fully electrified (1st cross-border electrified railway in Africa)	▪ standard gauge (1435 mm); ▪ diesel-powered, not electrified	▪ standard gauge (1435 mm); ▪ diesel-powered, not electrified	▪ standard gauge (1435 mm); ▪ diesel-powered, not electrified
Speed	▪ 120 km/h (passenger); ▪ 80 km/h (freight)	▪ 120 km/h (passenger); ▪ 80 km/h (freight)	▪ 150 km/h (passenger); ▪ freight: slower varies by cargo type	▪ 150 km/h (passenger); ▪ freight: slower varies by cargo type
Construction companies	▪ China Railway Group (CREC); ▪ China Civil Engineering Construction Corporation (CCECC)	China Road and Bridge Corporation (CRBC)	China Civil Engineering Construction Corporation (CCECC)	China Civil Engineering Construction Corporation (CCECC)
Financing	▪ mainly financed through loans by the Export–Import (EXIM) Bank of China	mainly financed through loans by the Export–Import (EXIM) Bank of China	joint funding by the Nigerian government budget and Export–Import (EXIM) Bank of China	joint funding by the Nigerian government budget and Export–Import (EXIM) Bank of China
Operation starts	▪ inaugurated: 5 October 2016 (Ethiopia), 10 January 2017 (Djibouti); ▪ commercial operation: 1 January 2018	officially launched 31 May 2017	commercial operations began in June 2021	commercial operations began in July 2016
Geopolitical significance	▪ part of China's BRI; ▪ improves Ethiopia and Djibouti positions as regional transport and logistics hubs	▪ part of China's BRI; ▪ strategic to the recommended East African railway network	▪ a flagship BRI project in West Africa; ▪ strategic for linking Nigeria's economy and enhancing regional trade	▪ 1st completed standard gauge line in Nigeria; ▪ main portion of the planned Lagos – Kano national railway corridor

Table E2. The initial list of criteria

Criteria	Literature	IE1	IE2	IE3	IE4	IE5	IE6	IE7	Final criteria based on experts and literature review
Environmental (EN)									
EN-1	land use and biodiversity impact	√	√	√	√	√	√	√	land use and biodiversity impact
EN-2	energy efficiency			√		√		√	energy efficiency
EN-3	air and noise pollution levels				√			√	air and noise pollution levels
EN-4	carbon emissions reduction		√		√		√		carbon emissions reduction
ENSUG-1	water resource management			√	√		√		water resource management
ENSUG-2	waste management				√	√	√	√	waste management
ENSUG-3	climate resilience	√		√		√		√	climate resilience

End of Table E2

Criteria	Literature	IE1	IE2	IE3	IE4	IE5	IE6	IE7	Final criteria based on experts and literature review
Economic (EC)									
EC-1	job creation								job creation
EC-2	debt sustainability	√	√	√	√	√	√		debt sustainability
EC-3	operating costs vs. revenue								operating costs vs. revenue
EC-4	return on investment	√	√	√	√	√	√	√	return on investment
EC-5	impact on GDP growth		√	√	√	√			impact on GDP growth
ECSUG-1	trade facilitation		√		√			√	trade facilitation
ECSUG-2	local content and technology transfer		√		√		√	√	local content and technology transfer
Social (SO)									
SO-1	safety and security	√	√	√	√	√	√	√	safety and security
SO-2	public perception and acceptance	√	√	√	√	√	√	√	public perception and acceptance
SO-3	affordability of railway services			√		√			affordability of railway services
SO-4	accessibility and connectivity		√	√	√	√	√		accessibility and connectivity
SO-5	resettlement and compensation	√			√				resettlement and compensation
SO-6	social inclusion	√		√		√		√	social inclusion
SOSUG-1	cultural and heritage impacts				√			√	cultural and heritage impacts

Table E3. The linguistic significance of criteria determined by experts in the p, q ROF–Delphi technique

Notation	Criterion	IE1	IE2	IE3	IE4	IE5	IE6	IE7
EN-1	land use and biodiversity impact	M	VH	VH	VH	H	VH	VH
EN-2	energy efficiency	VH	H	H	VH	M	VH	H
EN-3	air and noise pollution levels	M	M	VH	H	VH	H	H
EN-4	carbon emission reduction	H	VH	VH	VH	H	VH	VH
ENSUG-1	water resource management	H	VH	M	M	M	M	M
ENSUG-2	waste management	H	VH	H	M	M	M	M
ENSUG-3	climate resilience	H	H	H	VH	VH	VH	M
EC-1	job creation	VH	VH	VH	VH	VH	L	H
EC-2	debt sustainability	VH	H	VH	M	H	VH	VH
EC-3	operating costs vs revenue	VH	H	H	M	H	VH	H
EC-4	return on investment	VH	VH	VH	H	VH	VH	VH
EC-5	impact on GDP	VH	H	H	VH	H	VH	VH
ECSUG-1	trade facilitation	H	H	VH	H	M	H	H
ECSUG-2	local content and transfer of technology	VH	VH	VH	VH	VH	VH	H
SO-1	safety and security	VH	VH	H	M	H	VH	VH
SO-2	public perception and acceptance	VH	VH	VH	M	H	VH	VH
SO-3	affordability of railway services	H	M	VH	H	H	H	H
SO-4	accessibility and connectivity	VH	VH	H	H	VH	H	H
SO-5	resettlement and compensation	VH	M	H	VH	VH	M	H
SO-6	social inclusion	M	M	M	VH	M	L	L
SOSUG-1	cultural and heritage impacts	H	L	H	VH	L	VL	L

Table E4. Brief information regarding the experts

Expert	Railway project and code	Organization*	Graduate	Experience [year]	Age [year]
E1	AAD–SGR (A1)	EDR	electrical engineering	8	36
E2			mechanical engineering	9	39
E3			civil engineering	10	42
E4			transportation engineering	11	45
E5	LI–SGR (A2); AK–SGR (A3)	NITT	railway engineering	15	45
E6			railway engineering	10	43
E7			civil engineering	8	33
E8			transportation engineering	7	35
E9	NM–SGR (A4)	KR	civil engineering	15	50
E10		KR	transportation engineering	8	38
E11		KR	civil engineering	10	45
E12		university	civil engineering	6	35

Note: * EDR – Ethio-Djibouti Railways; KR – Kenyan Railways; NITT – Nigerian Institute of Transport Technology.

Table E5. The linguistic importance of criteria determined by experts

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
E1	EH	EH	EH	EH	EH	VH	VH	VH	EH	EH	VH	H	EH	VH	EH	EH	EH
E2	VH	EH	EH	MH	H	EH	MH	H	H	MH	H	VH	M	H	VH	EH	MH
E3	H	H	VH	VH	EH	VH	EH	VH	EH	H	VH	VH	H	H	EH	VH	VH
E4	EH	EH	EH	EH	VH	EH	EH	EH	EH	EH	EH	EH	EH	EH	EH	EH	EH
E5	VH	H	H	H	VH	MH	H	VH	EH	VH	EH	EH	EH	H	EH	VH	EH
E6	H	H	H	VH	EH	MH	H	VH	EH	VH	EH	EH	EH	H	EH	VH	EH
E7	H	VH	H	H	EH	MH	VH	VH	VH	H	EH	VH	H	VH	EH	VH	VH
E8	H	H	H	MH	H	M	H	VH	H	VH	EH	H	VH	H	H	VH	H
E9	VH	VH	H	VH	H	VH	H	VH	VH	VH	VH	VH	VH	H	MH	VH	VH
E10	VH	M	M	H	H	M	M	VH	VH	VH	H	VH	VH	VH	ML	VH	H
E11	EH	EH	VH	H	H	VH	H	EH	H	MH	H	H	VH	MH	MH	EH	MH
E12	EH	EH	VH	VH	H	VH	VH	VH	EH	EH	VH	VH	EH	VH	VH	EH	H

Table E6. The linguistic assessment of performance of railway projects by experts

Railway project	Code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
NM–SGR	A1	E1	VH	EH	H	MH	VH	VH	EH	VH	EH	EH	VH	VH	VH	EH	H	VH
		E2	H	ML	VH	MH	M	EL	EH	MH	M	ML	EH	ML	MH	ML	VH	H
		E3	H	H	H	MH	M	H	M	M	H	MH	H	H	H	MH	H	H
		E4	H	VH	H	MH	M	ML	VH	MH	H	EL	H	MH	H	H	VH	EH
AAD–SGR	A2	E5	VH	H	EH	VH	M	L	ML	MH	VH	MH	L	VH	M	H	M	M
		E6	H	MH	EH	VH	M	L	ML	MH	VH	MH	ML	VH	M	H	M	M
		E7	EH	H	H	VH	MH	ML	M	M	EH	MH	ML	VH	M	H	M	M
		E8	H	H	VH	VH	ML	VL	VL	M	VH	M	VL	VH	M	H	M	ML
AK–SGR	A3	E9	M	MH	M	M	MH	H	MH	H	M	ML	MH	M	ML	MH	ML	VH
		E10	M	M	H	M	M	ML	ML	H	M	M	VH	H	L	M	VL	ML
		E11	H	VH	MH	M	M	VH	VH	H	VH	H	VH	VH	VH	M	H	VH
		E12	M	MH	H	M	MH	L	VH	H	M	M	H	M	M	ML	H	M
LI–SGR	A4	E9	VH	VH	H	VH	H	VH	H	VH	VH	VH	VH	VH	VH	H	MH	VH
		E10	VH	M	M	H	H	M	M	VH	VH	VH	H	VH	VH	VH	ML	VH
		E11	EH	EH	VH	H	H	VH	H	EH	H	MH	H	H	VH	MH	MH	EH
		E12	EH	EH	VH	VH	H	VH	VH	VH	EH	EH	VH	VH	EH	VH	VH	EH

Appendix F: the weight coefficient changes scenarios and the scenarios for changing expert weight coefficients

Table F1. The weight coefficient changes scenarios

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17
W0	0.0584	0.0522	0.0500	0.0562	0.0499	0.0740	0.0702	0.0545	0.0557	0.0574	0.0785	0.0449	0.0619	0.0560	0.0556	0.0668	0.0579
W1	0.0526	0.0526	0.0503	0.0566	0.0502	0.0744	0.0706	0.0549	0.0560	0.0577	0.0789	0.0453	0.0622	0.0564	0.0559	0.0671	0.0582
W2	0.0467	0.0529	0.0507	0.0570	0.0506	0.0747	0.0710	0.0552	0.0564	0.0581	0.0792	0.0456	0.0626	0.0568	0.0563	0.0675	0.0586
W3	0.0409	0.0533	0.0511	0.0573	0.0510	0.0751	0.0713	0.0556	0.0568	0.0585	0.0796	0.0460	0.0630	0.0571	0.0567	0.0679	0.0590
W4	0.0351	0.0537	0.0514	0.0577	0.0513	0.0755	0.0717	0.0560	0.0571	0.0588	0.0800	0.0464	0.0633	0.0575	0.0570	0.0682	0.0593
W5	0.0292	0.0540	0.0518	0.0581	0.0517	0.0758	0.0721	0.0563	0.0575	0.0592	0.0803	0.0467	0.0637	0.0579	0.0574	0.0686	0.0597
W6	0.0234	0.0544	0.0522	0.0584	0.0521	0.0762	0.0724	0.0567	0.0579	0.0596	0.0807	0.0471	0.0640	0.0582	0.0577	0.0689	0.0601
W7	0.0175	0.0548	0.0525	0.0588	0.0524	0.0766	0.0728	0.0570	0.0582	0.0599	0.0811	0.0475	0.0644	0.0586	0.0581	0.0693	0.0604
W8	0.0117	0.0551	0.0529	0.0592	0.0528	0.0769	0.0732	0.0574	0.0586	0.0603	0.0814	0.0478	0.0648	0.0590	0.0585	0.0697	0.0608
W9	0.0058	0.0555	0.0533	0.0595	0.0532	0.0773	0.0735	0.0578	0.0590	0.0607	0.0818	0.0482	0.0651	0.0593	0.0588	0.0700	0.0612
W10	0.0000	0.0559	0.0536	0.0599	0.0535	0.0777	0.0739	0.0581	0.0593	0.0610	0.0822	0.0486	0.0655	0.0597	0.0592	0.0704	0.0615
W11	0.0587	0.0470	0.0503	0.0566	0.0502	0.0743	0.0706	0.0548	0.0560	0.0577	0.0788	0.0452	0.0622	0.0564	0.0559	0.0671	0.0582

Continue of Table F1

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17
W12	0.0591	0.0418	0.0506	0.0569	0.0505	0.0747	0.0709	0.0551	0.0563	0.0580	0.0792	0.0456	0.0625	0.0567	0.0562	0.0674	0.0585
W13	0.0594	0.0366	0.0509	0.0572	0.0508	0.0750	0.0712	0.0555	0.0567	0.0583	0.0795	0.0459	0.0628	0.0570	0.0565	0.0677	0.0588
W14	0.0597	0.0313	0.0513	0.0575	0.0512	0.0753	0.0716	0.0558	0.0570	0.0587	0.0798	0.0462	0.0632	0.0573	0.0569	0.0681	0.0592
W15	0.0601	0.0261	0.0516	0.0579	0.0515	0.0756	0.0719	0.0561	0.0573	0.0590	0.0801	0.0465	0.0635	0.0577	0.0572	0.0684	0.0595
W16	0.0604	0.0209	0.0519	0.0582	0.0518	0.0760	0.0722	0.0564	0.0576	0.0593	0.0805	0.0469	0.0638	0.0580	0.0575	0.0687	0.0598
W17	0.0607	0.0157	0.0522	0.0585	0.0522	0.0763	0.0725	0.0568	0.0580	0.0597	0.0808	0.0472	0.0641	0.0583	0.0578	0.0690	0.0602
W18	0.0610	0.0104	0.0526	0.0589	0.0525	0.0766	0.0729	0.0571	0.0583	0.0600	0.0811	0.0475	0.0645	0.0586	0.0582	0.0694	0.0605
W19	0.0614	0.0052	0.0529	0.0592	0.0528	0.0769	0.0732	0.0574	0.0586	0.0603	0.0815	0.0478	0.0648	0.0590	0.0585	0.0697	0.0608
W20	0.0617	0.0000	0.0532	0.0595	0.0531	0.0773	0.0735	0.0578	0.0589	0.0606	0.0818	0.0482	0.0651	0.0593	0.0588	0.0700	0.0611
W21	0.0587	0.0525	0.0450	0.0566	0.0502	0.0743	0.0706	0.0548	0.0560	0.0577	0.0788	0.0452	0.0622	0.0563	0.0559	0.0671	0.0582
W22	0.0590	0.0528	0.0400	0.0569	0.0505	0.0746	0.0709	0.0551	0.0563	0.0580	0.0791	0.0455	0.0625	0.0567	0.0562	0.0674	0.0585
W23	0.0594	0.0532	0.0350	0.0572	0.0508	0.0749	0.0712	0.0554	0.0566	0.0583	0.0795	0.0458	0.0628	0.0570	0.0565	0.0677	0.0588
W24	0.0597	0.0535	0.0300	0.0575	0.0511	0.0753	0.0715	0.0557	0.0569	0.0586	0.0798	0.0462	0.0631	0.0573	0.0568	0.0680	0.0591
W25	0.0600	0.0538	0.0250	0.0578	0.0514	0.0756	0.0718	0.0561	0.0572	0.0589	0.0801	0.0465	0.0634	0.0576	0.0571	0.0683	0.0594
W26	0.0603	0.0541	0.0200	0.0581	0.0517	0.0759	0.0721	0.0564	0.0576	0.0592	0.0804	0.0468	0.0637	0.0579	0.0574	0.0686	0.0597
W27	0.0606	0.0544	0.0150	0.0584	0.0521	0.0762	0.0724	0.0567	0.0579	0.0596	0.0807	0.0471	0.0640	0.0582	0.0577	0.0689	0.0601
W28	0.0609	0.0547	0.0100	0.0587	0.0524	0.0765	0.0727	0.0570	0.0582	0.0599	0.0810	0.0474	0.0644	0.0585	0.0581	0.0693	0.0604
W29	0.0612	0.0550	0.0050	0.0591	0.0527	0.0768	0.0731	0.0573	0.0585	0.0602	0.0813	0.0477	0.0647	0.0588	0.0584	0.0696	0.0607
W30	0.0615	0.0553	0.0000	0.0594	0.0530	0.0771	0.0734	0.0576	0.0588	0.0605	0.0816	0.0480	0.0650	0.0592	0.0587	0.0699	0.0610
W31	0.0588	0.0526	0.0503	0.0506	0.0502	0.0744	0.0706	0.0548	0.0560	0.0577	0.0789	0.0453	0.0622	0.0564	0.0559	0.0671	0.0582
W32	0.0591	0.0529	0.0507	0.0450	0.0506	0.0747	0.0710	0.0552	0.0564	0.0581	0.0792	0.0456	0.0626	0.0567	0.0563	0.0675	0.0586
W33	0.0595	0.0533	0.0510	0.0394	0.0509	0.0751	0.0713	0.0555	0.0567	0.0584	0.0796	0.0460	0.0629	0.0571	0.0566	0.0678	0.0589
W34	0.0598	0.0536	0.0514	0.0337	0.0513	0.0754	0.0717	0.0559	0.0571	0.0588	0.0799	0.0463	0.0633	0.0574	0.0570	0.0682	0.0593
W35	0.0602	0.0540	0.0517	0.0281	0.0516	0.0758	0.0720	0.0562	0.0574	0.0591	0.0803	0.0467	0.0636	0.0578	0.0573	0.0685	0.0596
W36	0.0605	0.0543	0.0521	0.0225	0.0520	0.0761	0.0724	0.0566	0.0578	0.0595	0.0806	0.0470	0.0640	0.0581	0.0577	0.0689	0.0600
W37	0.0609	0.0547	0.0524	0.0169	0.0523	0.0765	0.0727	0.0570	0.0581	0.0598	0.0810	0.0474	0.0643	0.0585	0.0580	0.0692	0.0603
W38	0.0612	0.0550	0.0528	0.0112	0.0527	0.0768	0.0731	0.0573	0.0585	0.0602	0.0813	0.0477	0.0647	0.0588	0.0584	0.0696	0.0607
W39	0.0616	0.0554	0.0531	0.0056	0.0530	0.0772	0.0734	0.0577	0.0588	0.0605	0.0817	0.0481	0.0650	0.0592	0.0587	0.0699	0.0610
W40	0.0619	0.0557	0.0535	0.0000	0.0534	0.0775	0.0738	0.0580	0.0592	0.0609	0.0820	0.0484	0.0654	0.0595	0.0591	0.0703	0.0614
W41	0.0587	0.0525	0.0503	0.0566	0.0449	0.0743	0.0706	0.0548	0.0560	0.0577	0.0788	0.0452	0.0622	0.0563	0.0559	0.0671	0.0582
W42	0.0590	0.0528	0.0506	0.0569	0.0399	0.0746	0.0709	0.0551	0.0563	0.0580	0.0791	0.0455	0.0625	0.0567	0.0562	0.0674	0.0585
W43	0.0594	0.0532	0.0509	0.0572	0.0349	0.0749	0.0712	0.0554	0.0566	0.0583	0.0795	0.0458	0.0628	0.0570	0.0565	0.0677	0.0588
W44	0.0597	0.0535	0.0512	0.0575	0.0299	0.0753	0.0715	0.0557	0.0569	0.0586	0.0798	0.0462	0.0631	0.0573	0.0568	0.0680	0.0591
W45	0.0600	0.0538	0.0515	0.0578	0.0249	0.0756	0.0718	0.0560	0.0572	0.0589	0.0801	0.0465	0.0634	0.0576	0.0571	0.0683	0.0594
W46	0.0603	0.0541	0.0518	0.0581	0.0199	0.0759	0.0721	0.0564	0.0575	0.0592	0.0804	0.0468	0.0637	0.0579	0.0574	0.0686	0.0597
W47	0.0606	0.0544	0.0521	0.0584	0.0150	0.0762	0.0724	0.0567	0.0579	0.0595	0.0807	0.0471	0.0640	0.0582	0.0577	0.0689	0.0601
W48	0.0609	0.0547	0.0525	0.0587	0.0100	0.0765	0.0727	0.0570	0.0582	0.0599	0.0810	0.0474	0.0644	0.0585	0.0581	0.0693	0.0604
W49	0.0612	0.0550	0.0528	0.0590	0.0050	0.0768	0.0731	0.0573	0.0585	0.0602	0.0813	0.0477	0.0647	0.0588	0.0584	0.0696	0.0607
W50	0.0615	0.0553	0.0531	0.0594	0.0000	0.0771	0.0734	0.0576	0.0588	0.0605	0.0816	0.0480	0.0650	0.0591	0.0587	0.0699	0.0610
W51	0.0589	0.0527	0.0504	0.0567	0.0503	0.0666	0.0707	0.0550	0.0561	0.0578	0.0790	0.0454	0.0623	0.0565	0.0560	0.0672	0.0583
W52	0.0593	0.0531	0.0509	0.0572	0.0508	0.0592	0.0712	0.0554	0.0566	0.0583	0.0794	0.0458	0.0628	0.0570	0.0565	0.0677	0.0588
W53	0.0598	0.0536	0.0514	0.0576	0.0513	0.0518	0.0716	0.0559	0.0571	0.0588	0.0799	0.0463	0.0632	0.0574	0.0569	0.0681	0.0593
W54	0.0603	0.0541	0.0518	0.0581	0.0517	0.0444	0.0721	0.0563	0.0575	0.0592	0.0804	0.0468	0.0637	0.0579	0.0574	0.0686	0.0597
W55	0.0607	0.0545	0.0523	0.0586	0.0522	0.0370	0.0726	0.0568	0.0580	0.0597	0.0808	0.0472	0.0642	0.0583	0.0579	0.0691	0.0602
W56	0.0612	0.0550	0.0527	0.0590	0.0526	0.0296	0.0730	0.0573	0.0585	0.0601	0.0813	0.0477	0.0646	0.0588	0.0583	0.0695	0.0606
W57	0.0617	0.0555	0.0532	0.0595	0.0531	0.0222	0.0735	0.0577	0.0589	0.0606	0.0818	0.0481	0.0651	0.0593	0.0588	0.0700	0.0611
W58	0.0621	0.0559	0.0537	0.0599	0.0536	0.0148	0.0739	0.0582	0.0594	0.0611	0.0822	0.0486	0.0656	0.0597	0.0593	0.0705	0.0616
W59	0.0626	0.0564	0.0541	0.0604	0.0540	0.0074	0.0744	0.0587	0.0598	0.0615	0.0827	0.0491	0.0660	0.0602	0.0597	0.0709	0.0620
W60	0.0630	0.0568	0.0546	0.0609	0.0545	0.0000	0.0749	0.0591	0.0603	0.0620	0.0831	0.0495	0.0665	0.0607	0.0602	0.0714	0.0625
W61	0.0589	0.0527	0.0504	0.0567	0.0503	0.0744	0.0632	0.0549	0.0561	0.0578	0.0790	0.0453	0.0623	0.0565	0.0560	0.0672	0.0583
W62	0.0593	0.0531	0.0508	0.0571	0.0507	0.0749	0.0562	0.0554	0.0566	0.0582	0.0794	0.0458	0.0627	0.0569	0.0564	0.0676	0.0587
W63	0.0597	0.0535	0.0513	0.0576	0.0512	0.0753	0.0492	0.0558	0.0570	0.0587	0.0798	0.0462	0.0632	0.0573	0.0569	0.0681	0.0592
W64	0.0602	0.0540	0.0517	0.0580	0.0516	0.0758	0.0421	0.0562	0.0574	0.0591	0.0803	0.0467	0.0636	0.0578	0.0573	0.0685	0.0596
W65	0.0606	0.0544	0.0522	0.0584	0.0521	0.0762	0.0351	0.0567	0.0579	0.0596	0.0807	0.0471	0.0641	0.0582	0.0578	0.0690	0.0601

Continue of Table F1

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17
W66	0.0611	0.0548	0.0526	0.0589	0.0525	0.0766	0.0281	0.0571	0.0583	0.0600	0.0812	0.0475	0.0645	0.0587	0.0582	0.0694	0.0605
W67	0.0615	0.0553	0.0530	0.0593	0.0529	0.0771	0.0211	0.0576	0.0588	0.0604	0.0816	0.0480	0.0649	0.0591	0.0586	0.0698	0.0609
W68	0.0619	0.0557	0.0535	0.0598	0.0534	0.0775	0.0140	0.0580	0.0592	0.0609	0.0820	0.0484	0.0654	0.0595	0.0591	0.0703	0.0614
W69	0.0624	0.0562	0.0539	0.0602	0.0538	0.0780	0.0070	0.0584	0.0596	0.0613	0.0825	0.0489	0.0658	0.0600	0.0595	0.0707	0.0618
W70	0.0628	0.0566	0.0544	0.0606	0.0543	0.0784	0.0000	0.0589	0.0601	0.0618	0.0829	0.0493	0.0662	0.0604	0.0599	0.0711	0.0623
W71	0.0588	0.0526	0.0503	0.0566	0.0502	0.0743	0.0706	0.0490	0.0560	0.0577	0.0789	0.0452	0.0622	0.0564	0.0559	0.0671	0.0582
W72	0.0591	0.0529	0.0506	0.0569	0.0506	0.0747	0.0709	0.0436	0.0564	0.0580	0.0792	0.0456	0.0625	0.0567	0.0562	0.0674	0.0586
W73	0.0594	0.0532	0.0510	0.0573	0.0509	0.0750	0.0713	0.0381	0.0567	0.0584	0.0795	0.0459	0.0629	0.0571	0.0566	0.0678	0.0589
W74	0.0598	0.0536	0.0513	0.0576	0.0512	0.0754	0.0716	0.0327	0.0570	0.0587	0.0799	0.0463	0.0632	0.0574	0.0569	0.0681	0.0592
W75	0.0601	0.0539	0.0517	0.0579	0.0516	0.0757	0.0719	0.0272	0.0574	0.0591	0.0802	0.0466	0.0636	0.0577	0.0573	0.0685	0.0596
W76	0.0605	0.0543	0.0520	0.0583	0.0519	0.0760	0.0723	0.0218	0.0577	0.0594	0.0806	0.0470	0.0639	0.0581	0.0576	0.0688	0.0599
W77	0.0608	0.0546	0.0523	0.0586	0.0523	0.0764	0.0726	0.0163	0.0581	0.0598	0.0809	0.0473	0.0642	0.0584	0.0579	0.0691	0.0603
W78	0.0611	0.0549	0.0527	0.0590	0.0526	0.0767	0.0730	0.0109	0.0584	0.0601	0.0812	0.0476	0.0646	0.0588	0.0583	0.0695	0.0606
W79	0.0615	0.0553	0.0530	0.0593	0.0529	0.0771	0.0733	0.0054	0.0587	0.0604	0.0816	0.0480	0.0649	0.0591	0.0586	0.0698	0.0609
W80	0.0618	0.0556	0.0534	0.0596	0.0533	0.0774	0.0737	0.0000	0.0591	0.0608	0.0819	0.0483	0.0653	0.0594	0.0590	0.0702	0.0613
W81	0.0588	0.0526	0.0503	0.0566	0.0502	0.0744	0.0706	0.0548	0.0501	0.0577	0.0789	0.0453	0.0622	0.0564	0.0559	0.0671	0.0582
W82	0.0591	0.0529	0.0507	0.0569	0.0506	0.0747	0.0709	0.0552	0.0445	0.0581	0.0792	0.0456	0.0626	0.0567	0.0563	0.0675	0.0586
W83	0.0595	0.0533	0.0510	0.0573	0.0509	0.0750	0.0713	0.0555	0.0390	0.0584	0.0796	0.0460	0.0629	0.0571	0.0566	0.0678	0.0589
W84	0.0598	0.0536	0.0514	0.0576	0.0513	0.0754	0.0716	0.0559	0.0334	0.0588	0.0799	0.0463	0.0633	0.0574	0.0570	0.0681	0.0593
W85	0.0602	0.0540	0.0517	0.0580	0.0516	0.0757	0.0720	0.0562	0.0278	0.0591	0.0803	0.0466	0.0636	0.0578	0.0573	0.0685	0.0596
W86	0.0605	0.0543	0.0521	0.0583	0.0520	0.0761	0.0723	0.0566	0.0223	0.0595	0.0806	0.0470	0.0639	0.0581	0.0576	0.0688	0.0600
W87	0.0609	0.0547	0.0524	0.0587	0.0523	0.0764	0.0727	0.0569	0.0167	0.0598	0.0810	0.0473	0.0643	0.0585	0.0580	0.0692	0.0603
W88	0.0612	0.0550	0.0527	0.0590	0.0527	0.0768	0.0730	0.0573	0.0111	0.0602	0.0813	0.0477	0.0646	0.0588	0.0583	0.0695	0.0607
W89	0.0616	0.0553	0.0531	0.0594	0.0530	0.0771	0.0734	0.0576	0.0056	0.0605	0.0816	0.0480	0.0650	0.0592	0.0587	0.0699	0.0610
W90	0.0619	0.0557	0.0534	0.0597	0.0534	0.0775	0.0737	0.0580	0.0000	0.0608	0.0820	0.0484	0.0653	0.0595	0.0590	0.0702	0.0613
W91	0.0588	0.0526	0.0503	0.0566	0.0502	0.0744	0.0706	0.0548	0.0560	0.0516	0.0789	0.0453	0.0622	0.0564	0.0559	0.0671	0.0582
W92	0.0591	0.0529	0.0507	0.0570	0.0506	0.0747	0.0710	0.0552	0.0564	0.0459	0.0792	0.0456	0.0626	0.0567	0.0563	0.0675	0.0586
W93	0.0595	0.0533	0.0510	0.0573	0.0509	0.0751	0.0713	0.0556	0.0568	0.0402	0.0796	0.0460	0.0629	0.0571	0.0566	0.0678	0.0589
W94	0.0599	0.0536	0.0514	0.0577	0.0513	0.0754	0.0717	0.0559	0.0571	0.0344	0.0800	0.0463	0.0633	0.0575	0.0570	0.0682	0.0593
W95	0.0602	0.0540	0.0518	0.0580	0.0517	0.0758	0.0720	0.0563	0.0575	0.0287	0.0803	0.0467	0.0637	0.0578	0.0574	0.0686	0.0597
W96	0.0606	0.0544	0.0521	0.0584	0.0520	0.0762	0.0724	0.0566	0.0578	0.0229	0.0807	0.0471	0.0640	0.0582	0.0577	0.0689	0.0600
W97	0.0609	0.0547	0.0525	0.0588	0.0524	0.0765	0.0728	0.0570	0.0582	0.0172	0.0810	0.0474	0.0644	0.0585	0.0581	0.0693	0.0604
W98	0.0613	0.0551	0.0528	0.0591	0.0527	0.0769	0.0731	0.0574	0.0585	0.0115	0.0814	0.0478	0.0647	0.0589	0.0584	0.0696	0.0607
W99	0.0616	0.0554	0.0532	0.0595	0.0531	0.0772	0.0735	0.0577	0.0589	0.0057	0.0817	0.0481	0.0651	0.0593	0.0588	0.0700	0.0611
W100	0.0620	0.0558	0.0536	0.0598	0.0535	0.0776	0.0738	0.0581	0.0593	0.0000	0.0821	0.0485	0.0654	0.0596	0.0591	0.0703	0.0615
W101	0.0589	0.0527	0.0505	0.0567	0.0504	0.0745	0.0707	0.0550	0.0562	0.0579	0.0707	0.0454	0.0623	0.0565	0.0560	0.0672	0.0584
W102	0.0594	0.0532	0.0509	0.0572	0.0509	0.0750	0.0712	0.0555	0.0567	0.0583	0.0628	0.0459	0.0628	0.0570	0.0565	0.0677	0.0589
W103	0.0599	0.0537	0.0514	0.0577	0.0513	0.0755	0.0717	0.0560	0.0571	0.0588	0.0550	0.0464	0.0633	0.0575	0.0570	0.0682	0.0593
W104	0.0604	0.0542	0.0519	0.0582	0.0518	0.0760	0.0722	0.0565	0.0576	0.0593	0.0471	0.0469	0.0638	0.0580	0.0575	0.0687	0.0598
W105	0.0609	0.0547	0.0524	0.0587	0.0523	0.0765	0.0727	0.0569	0.0581	0.0598	0.0393	0.0474	0.0643	0.0585	0.0580	0.0692	0.0603
W106	0.0614	0.0552	0.0529	0.0592	0.0528	0.0769	0.0732	0.0574	0.0586	0.0603	0.0314	0.0479	0.0648	0.0590	0.0585	0.0697	0.0608
W107	0.0619	0.0557	0.0534	0.0597	0.0533	0.0774	0.0737	0.0579	0.0591	0.0608	0.0236	0.0483	0.0653	0.0595	0.0590	0.0702	0.0613
W108	0.0623	0.0561	0.0539	0.0602	0.0538	0.0779	0.0742	0.0584	0.0596	0.0613	0.0157	0.0488	0.0658	0.0600	0.0595	0.0707	0.0618
W109	0.0628	0.0566	0.0544	0.0607	0.0543	0.0784	0.0747	0.0589	0.0601	0.0618	0.0079	0.0493	0.0663	0.0604	0.0600	0.0712	0.0623
W110	0.0633	0.0571	0.0549	0.0612	0.0548	0.0789	0.0752	0.0594	0.0606	0.0623	0.0000	0.0498	0.0668	0.0609	0.0605	0.0717	0.0628
W111	0.0587	0.0525	0.0502	0.0565	0.0502	0.0743	0.0705	0.0548	0.0560	0.0576	0.0788	0.0404	0.0621	0.0563	0.0558	0.0670	0.0582
W112	0.0590	0.0528	0.0505	0.0568	0.0504	0.0746	0.0708	0.0551	0.0562	0.0579	0.0791	0.0359	0.0624	0.0566	0.0561	0.0673	0.0584
W113	0.0593	0.0531	0.0508	0.0571	0.0507	0.0748	0.0711	0.0553	0.0565	0.0582	0.0794	0.0314	0.0627	0.0569	0.0564	0.0676	0.0587
W114	0.0595	0.0533	0.0511	0.0574	0.0510	0.0751	0.0714	0.0556	0.0568	0.0585	0.0796	0.0269	0.0630	0.0572	0.0567	0.0679	0.0590
W115	0.0598	0.0536	0.0514	0.0576	0.0513	0.0754	0.0717	0.0559	0.0571	0.0588	0.0799	0.0225	0.0633	0.0574	0.0570	0.0682	0.0593
W116	0.0601	0.0539	0.0516	0.0579	0.0516	0.0757	0.0719	0.0562	0.0574	0.0591	0.0802	0.0180	0.0635	0.0577	0.0572	0.0684	0.0596
W117	0.0604	0.0542	0.0519	0.0582	0.0518	0.0760	0.0722	0.0565	0.0576	0.0593	0.0805	0.0135	0.0638	0.0580	0.0575	0.0687	0.0598
W118	0.0607	0.0545	0.0522	0.0585	0.0521	0.0763	0.0725	0.0567	0.0579	0.0596	0.0808	0.0090	0.0641	0.0583	0.0578	0.0690	0.0601

End of Table F1

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17
W119	0.0609	0.0547	0.0525	0.0588	0.0524	0.0765	0.0728	0.0570	0.0582	0.0599	0.0810	0.0045	0.0644	0.0586	0.0581	0.0693	0.0604
W120	0.0612	0.0550	0.0528	0.0590	0.0527	0.0768	0.0731	0.0573	0.0585	0.0602	0.0813	0.0000	0.0647	0.0588	0.0584	0.0696	0.0607
W121	0.0588	0.0526	0.0504	0.0566	0.0503	0.0744	0.0706	0.0549	0.0561	0.0578	0.0789	0.0453	0.0557	0.0564	0.0559	0.0671	0.0583
W122	0.0592	0.0530	0.0507	0.0570	0.0506	0.0748	0.0710	0.0553	0.0565	0.0581	0.0793	0.0457	0.0495	0.0568	0.0563	0.0675	0.0586
W123	0.0596	0.0534	0.0511	0.0574	0.0510	0.0752	0.0714	0.0556	0.0568	0.0585	0.0797	0.0461	0.0433	0.0572	0.0567	0.0679	0.0590
W124	0.0600	0.0538	0.0515	0.0578	0.0514	0.0756	0.0718	0.0560	0.0572	0.0589	0.0801	0.0465	0.0371	0.0576	0.0571	0.0683	0.0594
W125	0.0604	0.0541	0.0519	0.0582	0.0518	0.0759	0.0722	0.0564	0.0576	0.0593	0.0805	0.0468	0.0309	0.0580	0.0575	0.0687	0.0598
W126	0.0607	0.0545	0.0523	0.0586	0.0522	0.0763	0.0726	0.0568	0.0580	0.0597	0.0808	0.0472	0.0247	0.0583	0.0579	0.0691	0.0602
W127	0.0611	0.0549	0.0527	0.0589	0.0526	0.0767	0.0730	0.0572	0.0584	0.0601	0.0812	0.0476	0.0186	0.0587	0.0583	0.0695	0.0606
W128	0.0615	0.0553	0.0531	0.0593	0.0530	0.0771	0.0733	0.0576	0.0588	0.0605	0.0816	0.0480	0.0124	0.0591	0.0587	0.0699	0.0610
W129	0.0619	0.0557	0.0534	0.0597	0.0533	0.0775	0.0737	0.0580	0.0592	0.0608	0.0820	0.0484	0.0062	0.0595	0.0590	0.0702	0.0613
W130	0.0623	0.0561	0.0538	0.0601	0.0537	0.0779	0.0741	0.0584	0.0595	0.0612	0.0824	0.0488	0.0000	0.0599	0.0594	0.0706	0.0617
W131	0.0588	0.0526	0.0503	0.0566	0.0502	0.0744	0.0706	0.0548	0.0560	0.0577	0.0789	0.0453	0.0622	0.0504	0.0559	0.0671	0.0582
W132	0.0591	0.0529	0.0507	0.0569	0.0506	0.0747	0.0709	0.0552	0.0564	0.0581	0.0792	0.0456	0.0626	0.0448	0.0563	0.0675	0.0586
W133	0.0595	0.0533	0.0510	0.0573	0.0509	0.0751	0.0713	0.0555	0.0567	0.0584	0.0796	0.0460	0.0629	0.0392	0.0566	0.0678	0.0589
W134	0.0598	0.0536	0.0514	0.0576	0.0513	0.0754	0.0716	0.0559	0.0571	0.0588	0.0799	0.0463	0.0633	0.0336	0.0570	0.0682	0.0593
W135	0.0602	0.0540	0.0517	0.0580	0.0516	0.0758	0.0720	0.0562	0.0574	0.0591	0.0803	0.0467	0.0636	0.0280	0.0573	0.0685	0.0596
W136	0.0605	0.0543	0.0521	0.0583	0.0520	0.0761	0.0723	0.0566	0.0578	0.0595	0.0806	0.0470	0.0640	0.0224	0.0577	0.0689	0.0600
W137	0.0609	0.0547	0.0524	0.0587	0.0523	0.0765	0.0727	0.0569	0.0581	0.0598	0.0810	0.0474	0.0643	0.0168	0.0580	0.0692	0.0603
W138	0.0612	0.0550	0.0528	0.0590	0.0527	0.0768	0.0730	0.0573	0.0585	0.0602	0.0813	0.0477	0.0647	0.0112	0.0584	0.0696	0.0607
W139	0.0616	0.0554	0.0531	0.0594	0.0530	0.0772	0.0734	0.0576	0.0588	0.0605	0.0817	0.0481	0.0650	0.0056	0.0587	0.0699	0.0610
W140	0.0619	0.0557	0.0535	0.0597	0.0534	0.0775	0.0737	0.0580	0.0592	0.0609	0.0820	0.0484	0.0654	0.0000	0.0591	0.0703	0.0614
W141	0.0588	0.0526	0.0503	0.0566	0.0502	0.0744	0.0706	0.0548	0.0560	0.0577	0.0789	0.0453	0.0622	0.0564	0.0500	0.0671	0.0582
W142	0.0591	0.0529	0.0507	0.0569	0.0506	0.0747	0.0709	0.0552	0.0564	0.0581	0.0792	0.0456	0.0626	0.0567	0.0444	0.0675	0.0586
W143	0.0595	0.0533	0.0510	0.0573	0.0509	0.0750	0.0713	0.0555	0.0567	0.0584	0.0796	0.0459	0.0629	0.0571	0.0389	0.0678	0.0589
W144	0.0598	0.0536	0.0514	0.0576	0.0513	0.0754	0.0716	0.0559	0.0571	0.0588	0.0799	0.0463	0.0632	0.0574	0.0333	0.0681	0.0593
W145	0.0602	0.0540	0.0517	0.0580	0.0516	0.0757	0.0720	0.0562	0.0574	0.0591	0.0803	0.0466	0.0636	0.0578	0.0278	0.0685	0.0596
W146	0.0605	0.0543	0.0520	0.0583	0.0520	0.0761	0.0723	0.0566	0.0578	0.0595	0.0806	0.0470	0.0639	0.0581	0.0222	0.0688	0.0600
W147	0.0609	0.0546	0.0524	0.0587	0.0523	0.0764	0.0727	0.0569	0.0581	0.0598	0.0809	0.0473	0.0643	0.0585	0.0167	0.0692	0.0603
W148	0.0612	0.0550	0.0527	0.0590	0.0526	0.0768	0.0730	0.0573	0.0585	0.0601	0.0813	0.0477	0.0646	0.0588	0.0111	0.0695	0.0606
W149	0.0615	0.0553	0.0531	0.0594	0.0530	0.0771	0.0734	0.0576	0.0588	0.0605	0.0816	0.0480	0.0650	0.0592	0.0056	0.0699	0.0610
W150	0.0619	0.0557	0.0534	0.0597	0.0533	0.0775	0.0737	0.0580	0.0591	0.0608	0.0820	0.0484	0.0653	0.0595	0.0000	0.0702	0.0613
W151	0.0588	0.0526	0.0504	0.0567	0.0503	0.0744	0.0707	0.0549	0.0561	0.0578	0.0789	0.0453	0.0623	0.0564	0.0560	0.0601	0.0583
W152	0.0593	0.0531	0.0508	0.0571	0.0507	0.0748	0.0711	0.0553	0.0565	0.0582	0.0794	0.0457	0.0627	0.0569	0.0564	0.0534	0.0587
W153	0.0597	0.0535	0.0512	0.0575	0.0511	0.0753	0.0715	0.0557	0.0569	0.0586	0.0798	0.0462	0.0631	0.0573	0.0568	0.0467	0.0591
W154	0.0601	0.0539	0.0516	0.0579	0.0515	0.0757	0.0719	0.0562	0.0573	0.0590	0.0802	0.0466	0.0635	0.0577	0.0572	0.0401	0.0595
W155	0.0605	0.0543	0.0521	0.0583	0.0520	0.0761	0.0723	0.0566	0.0578	0.0595	0.0806	0.0470	0.0639	0.0581	0.0576	0.0334	0.0600
W156	0.0609	0.0547	0.0525	0.0587	0.0524	0.0765	0.0728	0.0570	0.0582	0.0599	0.0810	0.0474	0.0644	0.0585	0.0581	0.0267	0.0604
W157	0.0613	0.0551	0.0529	0.0592	0.0528	0.0769	0.0732	0.0574	0.0586	0.0603	0.0814	0.0478	0.0648	0.0590	0.0585	0.0200	0.0608
W158	0.0618	0.0556	0.0533	0.0596	0.0532	0.0773	0.0736	0.0578	0.0590	0.0607	0.0819	0.0482	0.0652	0.0594	0.0589	0.0134	0.0612
W159	0.0622	0.0560	0.0537	0.0600	0.0536	0.0778	0.0740	0.0582	0.0594	0.0611	0.0823	0.0487	0.0656	0.0598	0.0593	0.0067	0.0616
W160	0.0626	0.0564	0.0541	0.0604	0.0540	0.0782	0.0744	0.0587	0.0598	0.0615	0.0827	0.0491	0.0660	0.0602	0.0597	0.0000	0.0620
W161	0.0588	0.0526	0.0503	0.0566	0.0502	0.0744	0.0706	0.0549	0.0560	0.0577	0.0789	0.0453	0.0622	0.0564	0.0559	0.0671	0.0521
W162	0.0591	0.0529	0.0507	0.0570	0.0506	0.0747	0.0710	0.0552	0.0564	0.0581	0.0792	0.0456	0.0626	0.0568	0.0563	0.0675	0.0463
W163	0.0595	0.0533	0.0510	0.0573	0.0510	0.0751	0.0713	0.0556	0.0568	0.0585	0.0796	0.0460	0.0629	0.0571	0.0566	0.0678	0.0405
W164	0.0599	0.0537	0.0514	0.0577	0.0513	0.0755	0.0717	0.0559	0.0571	0.0588	0.0800	0.0464	0.0633	0.0575	0.0570	0.0682	0.0347
W165	0.0602	0.0540	0.0518	0.0581	0.0517	0.0758	0.0721	0.0563	0.0575	0.0592	0.0803	0.0467	0.0637	0.0578	0.0574	0.0686	0.0289
W166	0.0606	0.0544	0.0521	0.0584	0.0520	0.0762	0.0724	0.0567	0.0578	0.0595	0.0807	0.0471	0.0640	0.0582	0.0577	0.0689	0.0231
W167	0.0610	0.0547	0.0525	0.0588	0.0524	0.0765	0.0728	0.0570	0.0582	0.0599	0.0810	0.0474	0.0644	0.0586	0.0581	0.0693	0.0174
W168	0.0613	0.0551	0.0529	0.0591	0.0528	0.0769	0.0731	0.0574	0.0586	0.0603	0.0814	0.0478	0.0648	0.0589	0.0585	0.0697	0.0116
W169	0.0617	0.0555	0.0532	0.0595	0.0531	0.0773	0.0735	0.0577	0.0589	0.0606	0.0818	0.0482	0.0651	0.0593	0.0588	0.0700	0.0058
W170	0.0620	0.0558	0.0536	0.0599	0.0535	0.0776	0.0739	0.0581	0.0593	0.0610	0.0821	0.0485	0.0655	0.0596	0.0592	0.0704	0.0000

Table F2. The scenarios for changing expert weight coefficients

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12
T0	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T1	0.2250	0.2583	0.2583	0.2583	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T2	0.2000	0.2667	0.2667	0.2667	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T3	0.1750	0.2750	0.2750	0.2750	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T4	0.1500	0.2833	0.2833	0.2833	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T5	0.1250	0.2917	0.2917	0.2917	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T6	0.1000	0.3000	0.3000	0.3000	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T7	0.0750	0.3083	0.3083	0.3083	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T8	0.0500	0.3167	0.3167	0.3167	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T9	0.0250	0.3250	0.3250	0.3250	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T10	0.0000	0.3333	0.3333	0.3333	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T11	0.2583	0.2250	0.2583	0.2583	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T12	0.2667	0.2000	0.2667	0.2667	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T13	0.2750	0.1750	0.2750	0.2750	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T14	0.2833	0.1500	0.2833	0.2833	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T15	0.2917	0.1250	0.2917	0.2917	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T16	0.3000	0.1000	0.3000	0.3000	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T17	0.3083	0.0750	0.3083	0.3083	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T18	0.3167	0.0500	0.3167	0.3167	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T19	0.3250	0.0250	0.3250	0.3250	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T20	0.3333	0.0000	0.3333	0.3333	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T21	0.2583	0.2583	0.2250	0.2583	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T22	0.2667	0.2667	0.2000	0.2667	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T23	0.2750	0.2750	0.1750	0.2750	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T24	0.2833	0.2833	0.1500	0.2833	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T25	0.2917	0.2917	0.1250	0.2917	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T26	0.3000	0.3000	0.1000	0.3000	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T27	0.3083	0.3083	0.0750	0.3083	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T28	0.3167	0.3167	0.0500	0.3167	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T29	0.3250	0.3250	0.0250	0.3250	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T30	0.3333	0.3333	0.0000	0.3333	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T31	0.2583	0.2583	0.2583	0.2250	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T32	0.2667	0.2667	0.2667	0.2000	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T33	0.2750	0.2750	0.2750	0.1750	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T34	0.2833	0.2833	0.2833	0.1500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T35	0.2917	0.2917	0.2917	0.1250	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T36	0.3000	0.3000	0.3000	0.1000	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T37	0.3083	0.3083	0.3083	0.0750	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T38	0.3167	0.3167	0.3167	0.0500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T39	0.3250	0.3250	0.3250	0.0250	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T40	0.3333	0.3333	0.3333	0.0000	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500
T41	0.2500	0.2500	0.2500	0.2500	0.2250	0.2583	0.2583	0.2583	0.2500	0.2500	0.2500	0.2500
T42	0.2500	0.2500	0.2500	0.2500	0.2000	0.2667	0.2667	0.2667	0.2500	0.2500	0.2500	0.2500
T43	0.2500	0.2500	0.2500	0.2500	0.1750	0.2750	0.2750	0.2750	0.2500	0.2500	0.2500	0.2500
T44	0.2500	0.2500	0.2500	0.2500	0.1500	0.2833	0.2833	0.2833	0.2500	0.2500	0.2500	0.2500
T45	0.2500	0.2500	0.2500	0.2500	0.1250	0.2917	0.2917	0.2917	0.2500	0.2500	0.2500	0.2500
T46	0.2500	0.2500	0.2500	0.2500	0.1000	0.3000	0.3000	0.3000	0.2500	0.2500	0.2500	0.2500
T47	0.2500	0.2500	0.2500	0.2500	0.0750	0.3083	0.3083	0.3083	0.2500	0.2500	0.2500	0.2500
T48	0.2500	0.2500	0.2500	0.2500	0.0500	0.3167	0.3167	0.3167	0.2500	0.2500	0.2500	0.2500
T49	0.2500	0.2500	0.2500	0.2500	0.0250	0.3250	0.3250	0.3250	0.2500	0.2500	0.2500	0.2500
T50	0.2500	0.2500	0.2500	0.2500	0.0000	0.3333	0.3333	0.3333	0.2500	0.2500	0.2500	0.2500
T51	0.2500	0.2500	0.2500	0.2500	0.2583	0.2250	0.2583	0.2583	0.2500	0.2500	0.2500	0.2500
T52	0.2500	0.2500	0.2500	0.2500	0.2667	0.2000	0.2667	0.2667	0.2500	0.2500	0.2500	0.2500
T53	0.2500	0.2500	0.2500	0.2500	0.2750	0.1750	0.2750	0.2750	0.2500	0.2500	0.2500	0.2500

Continue of Table F2

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12
T54	0.2500	0.2500	0.2500	0.2500	0.2833	0.1500	0.2833	0.2833	0.2500	0.2500	0.2500	0.2500
T55	0.2500	0.2500	0.2500	0.2500	0.2917	0.1250	0.2917	0.2917	0.2500	0.2500	0.2500	0.2500
T56	0.2500	0.2500	0.2500	0.2500	0.3000	0.1000	0.3000	0.3000	0.2500	0.2500	0.2500	0.2500
T57	0.2500	0.2500	0.2500	0.2500	0.3083	0.0750	0.3083	0.3083	0.2500	0.2500	0.2500	0.2500
T58	0.2500	0.2500	0.2500	0.2500	0.3167	0.0500	0.3167	0.3167	0.2500	0.2500	0.2500	0.2500
T59	0.2500	0.2500	0.2500	0.2500	0.3250	0.0250	0.3250	0.3250	0.2500	0.2500	0.2500	0.2500
T60	0.2500	0.2500	0.2500	0.2500	0.3333	0.0000	0.3333	0.3333	0.2500	0.2500	0.2500	0.2500
T61	0.2500	0.2500	0.2500	0.2500	0.2583	0.2583	0.2250	0.2583	0.2500	0.2500	0.2500	0.2500
T62	0.2500	0.2500	0.2500	0.2500	0.2667	0.2667	0.2000	0.2667	0.2500	0.2500	0.2500	0.2500
T63	0.2500	0.2500	0.2500	0.2500	0.2750	0.2750	0.1750	0.2750	0.2500	0.2500	0.2500	0.2500
T64	0.2500	0.2500	0.2500	0.2500	0.2833	0.2833	0.1500	0.2833	0.2500	0.2500	0.2500	0.2500
T65	0.2500	0.2500	0.2500	0.2500	0.2917	0.2917	0.1250	0.2917	0.2500	0.2500	0.2500	0.2500
T66	0.2500	0.2500	0.2500	0.2500	0.3000	0.3000	0.1000	0.3000	0.2500	0.2500	0.2500	0.2500
T67	0.2500	0.2500	0.2500	0.2500	0.3083	0.3083	0.0750	0.3083	0.2500	0.2500	0.2500	0.2500
T68	0.2500	0.2500	0.2500	0.2500	0.3167	0.3167	0.0500	0.3167	0.2500	0.2500	0.2500	0.2500
T69	0.2500	0.2500	0.2500	0.2500	0.3250	0.3250	0.0250	0.3250	0.2500	0.2500	0.2500	0.2500
T70	0.2500	0.2500	0.2500	0.2500	0.3333	0.3333	0.0000	0.3333	0.2500	0.2500	0.2500	0.2500
T71	0.2500	0.2500	0.2500	0.2500	0.2583	0.2583	0.2583	0.2250	0.2500	0.2500	0.2500	0.2500
T72	0.2500	0.2500	0.2500	0.2500	0.2667	0.2667	0.2667	0.2000	0.2500	0.2500	0.2500	0.2500
T73	0.2500	0.2500	0.2500	0.2500	0.2750	0.2750	0.2750	0.1750	0.2500	0.2500	0.2500	0.2500
T74	0.2500	0.2500	0.2500	0.2500	0.2833	0.2833	0.2833	0.1500	0.2500	0.2500	0.2500	0.2500
T75	0.2500	0.2500	0.2500	0.2500	0.2917	0.2917	0.2917	0.1250	0.2500	0.2500	0.2500	0.2500
T76	0.2500	0.2500	0.2500	0.2500	0.3000	0.3000	0.3000	0.1000	0.2500	0.2500	0.2500	0.2500
T77	0.2500	0.2500	0.2500	0.2500	0.3083	0.3083	0.3083	0.0750	0.2500	0.2500	0.2500	0.2500
T78	0.2500	0.2500	0.2500	0.2500	0.3167	0.3167	0.3167	0.0500	0.2500	0.2500	0.2500	0.2500
T79	0.2500	0.2500	0.2500	0.2500	0.3250	0.3250	0.3250	0.0250	0.2500	0.2500	0.2500	0.2500
T80	0.2500	0.2500	0.2500	0.2500	0.3333	0.3333	0.3333	0.0000	0.2500	0.2500	0.2500	0.2500
T81	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2250	0.2583	0.2583	0.2583
T82	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2000	0.2667	0.2667	0.2667
T83	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.1750	0.2750	0.2750	0.2750
T84	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.1500	0.2833	0.2833	0.2833
T85	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.1250	0.2917	0.2917	0.2917
T86	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.1000	0.3000	0.3000	0.3000
T87	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.0750	0.3083	0.3083	0.3083
T88	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.0500	0.3167	0.3167	0.3167
T89	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.0250	0.3250	0.3250	0.3250
T90	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.0000	0.3333	0.3333	0.3333
T91	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2583	0.2250	0.2583	0.2583
T92	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2667	0.2000	0.2667	0.2667
T93	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2750	0.1750	0.2750	0.2750
T94	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2833	0.1500	0.2833	0.2833
T95	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2917	0.1250	0.2917	0.2917
T96	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3000	0.1000	0.3000	0.3000
T97	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3083	0.0750	0.3083	0.3083
T98	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3167	0.0500	0.3167	0.3167
T99	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3250	0.0250	0.3250	0.3250
T100	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3333	0.0000	0.3333	0.3333
T101	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2583	0.2583	0.2250	0.2583
T102	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2667	0.2667	0.2000	0.2667
T103	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2750	0.2750	0.1750	0.2750
T104	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2833	0.2833	0.1500	0.2833
T105	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2917	0.2917	0.1250	0.2917
T106	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3000	0.3000	0.1000	0.3000
T107	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3083	0.3083	0.0750	0.3083

End of Table F2

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12
T108	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3167	0.3167	0.0500	0.3167
T109	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3250	0.3250	0.0250	0.3250
T110	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3333	0.3333	0.0000	0.3333
T111	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2583	0.2583	0.2583	0.2250
T112	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2667	0.2667	0.2667	0.2000
T113	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2750	0.2750	0.2750	0.1750
T114	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2833	0.2833	0.2833	0.1500
T115	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2917	0.2917	0.2917	0.1250
T116	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3000	0.3000	0.3000	0.1000
T117	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3083	0.3083	0.3083	0.0750
T118	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3167	0.3167	0.3167	0.0500
T119	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3250	0.3250	0.3250	0.0250
T120	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.3333	0.3333	0.3333	0.0000
T121	0.2250	0.2583	0.2583	0.2583	0.2250	0.2583	0.2583	0.2583	0.2250	0.2583	0.2583	0.2583
T122	0.2000	0.2667	0.2667	0.2667	0.2000	0.2667	0.2667	0.2667	0.2000	0.2667	0.2667	0.2667
T123	0.1750	0.2750	0.2750	0.2750	0.1750	0.2750	0.2750	0.2750	0.1750	0.2750	0.2750	0.2750
T124	0.1500	0.2833	0.2833	0.2833	0.1500	0.2833	0.2833	0.2833	0.1500	0.2833	0.2833	0.2833
T125	0.1250	0.2917	0.2917	0.2917	0.1250	0.2917	0.2917	0.2917	0.1250	0.2917	0.2917	0.2917
T126	0.1000	0.3000	0.3000	0.3000	0.1000	0.3000	0.3000	0.3000	0.1000	0.3000	0.3000	0.3000
T127	0.0750	0.3083	0.3083	0.3083	0.0750	0.3083	0.3083	0.3083	0.0750	0.3083	0.3083	0.3083
T128	0.0500	0.3167	0.3167	0.3167	0.0500	0.3167	0.3167	0.3167	0.0500	0.3167	0.3167	0.3167
T129	0.0250	0.3250	0.3250	0.3250	0.0250	0.3250	0.3250	0.3250	0.0250	0.3250	0.3250	0.3250
T130	0.0000	0.3333	0.3333	0.3333	0.0000	0.3333	0.3333	0.3333	0.0000	0.3333	0.3333	0.3333
T131	0.2500	0.2500	0.2500	0.2500	0.2250	0.2583	0.2583	0.2583	0.2250	0.2583	0.2583	0.2583
T132	0.2500	0.2500	0.2500	0.2500	0.2000	0.2667	0.2667	0.2667	0.2000	0.2667	0.2667	0.2667
T133	0.2500	0.2500	0.2500	0.2500	0.1750	0.2750	0.2750	0.2750	0.1750	0.2750	0.2750	0.2750
T134	0.2500	0.2500	0.2500	0.2500	0.1500	0.2833	0.2833	0.2833	0.1500	0.2833	0.2833	0.2833
T135	0.2500	0.2500	0.2500	0.2500	0.1250	0.2917	0.2917	0.2917	0.1250	0.2917	0.2917	0.2917
T136	0.2500	0.2500	0.2500	0.2500	0.1000	0.3000	0.3000	0.3000	0.1000	0.3000	0.3000	0.3000
T137	0.2500	0.2500	0.2500	0.2500	0.0750	0.3083	0.3083	0.3083	0.0750	0.3083	0.3083	0.3083
T138	0.2500	0.2500	0.2500	0.2500	0.0500	0.3167	0.3167	0.3167	0.0500	0.3167	0.3167	0.3167
T139	0.2500	0.2500	0.2500	0.2500	0.0250	0.3250	0.3250	0.3250	0.0250	0.3250	0.3250	0.3250
T140	0.2500	0.2500	0.2500	0.2500	0.0000	0.3333	0.3333	0.3333	0.0000	0.3333	0.3333	0.3333
T141	0.2250	0.2583	0.2583	0.2583	0.2500	0.2500	0.2500	0.2500	0.2250	0.2583	0.2583	0.2583
T142	0.2000	0.2667	0.2667	0.2667	0.2500	0.2500	0.2500	0.2500	0.2000	0.2667	0.2667	0.2667
T143	0.1750	0.2750	0.2750	0.2750	0.2500	0.2500	0.2500	0.2500	0.1750	0.2750	0.2750	0.2750
T144	0.1500	0.2833	0.2833	0.2833	0.2500	0.2500	0.2500	0.2500	0.1500	0.2833	0.2833	0.2833
T145	0.1250	0.2917	0.2917	0.2917	0.2500	0.2500	0.2500	0.2500	0.1250	0.2917	0.2917	0.2917
T146	0.1000	0.3000	0.3000	0.3000	0.2500	0.2500	0.2500	0.2500	0.1000	0.3000	0.3000	0.3000
T147	0.0750	0.3083	0.3083	0.3083	0.2500	0.2500	0.2500	0.2500	0.0750	0.3083	0.3083	0.3083
T148	0.0500	0.3167	0.3167	0.3167	0.2500	0.2500	0.2500	0.2500	0.0500	0.3167	0.3167	0.3167
T149	0.0250	0.3250	0.3250	0.3250	0.2500	0.2500	0.2500	0.2500	0.0250	0.3250	0.3250	0.3250
T150	0.0000	0.3333	0.3333	0.3333	0.2500	0.2500	0.2500	0.2500	0.0000	0.3333	0.3333	0.3333
T151	0.2250	0.2583	0.2583	0.2583	0.2250	0.2583	0.2583	0.2583	0.2500	0.2500	0.2500	0.2500
T152	0.2000	0.2667	0.2667	0.2667	0.2000	0.2667	0.2667	0.2667	0.2500	0.2500	0.2500	0.2500
T153	0.1750	0.2750	0.2750	0.2750	0.1750	0.2750	0.2750	0.2750	0.2500	0.2500	0.2500	0.2500
T154	0.1500	0.2833	0.2833	0.2833	0.1500	0.2833	0.2833	0.2833	0.2500	0.2500	0.2500	0.2500
T155	0.1250	0.2917	0.2917	0.2917	0.1250	0.2917	0.2917	0.2917	0.2500	0.2500	0.2500	0.2500
T156	0.1000	0.3000	0.3000	0.3000	0.1000	0.3000	0.3000	0.3000	0.2500	0.2500	0.2500	0.2500
T157	0.0750	0.3083	0.3083	0.3083	0.0750	0.3083	0.3083	0.3083	0.2500	0.2500	0.2500	0.2500
T158	0.0500	0.3167	0.3167	0.3167	0.0500	0.3167	0.3167	0.3167	0.2500	0.2500	0.2500	0.2500
T159	0.0250	0.3250	0.3250	0.3250	0.0250	0.3250	0.3250	0.3250	0.2500	0.2500	0.2500	0.2500
T160	0.0000	0.3333	0.3333	0.3333	0.0000	0.3333	0.3333	0.3333	0.2500	0.2500	0.2500	0.2500

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The authors report there are no competing financial, professional, or personal interests to declare.

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