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From Explorer to Leader: The DSRES Index as a Framework for Managerial Design Science Research Maturity

Murillo de Oliveira Dias[1] & Dercio Santiago da Silva Junior[2]

1. Rennes School of Business
2. Universidade do Estado do Rio de Janeiro (UERJ); Escola Superior de Desenho Industrial (ESDI), Programa de Pós-Graduação da Escola Superior de Desenho Industrial (PPDESDI)

Abstract: This article introduces the Design Science Research Effectiveness Index (DSRES Index), a methodological innovation for evaluating the maturity and impact of managerial design research. Building on the validated DSRES Scale, the Index integrates five dimensions—Rigor, Utility, Knowledge, Engagement, and Evaluation—into a composite measure of research effectiveness, with weights informed by confirmatory factor analysis and theoretical reasoning. In addition to measurement, the study advances a typology that distinguishes four organizational maturity profiles: Explorer, Developer, Integrator, and Leader. Each profile reflects specific characteristics and challenges, and outlines pathways for progression. A distinctive contribution of this work lies in the inclusion of managerial recommendations and interpretive insights, which transform the typology into a practical tool for guiding organizational development. By offering a valid and replicable assessment method, the DSRES Index enables comparative studies, strengthens design-oriented projects, and supports the integration of scientific evidence into managerial practice.

Keywords: Design Science Research (DSR), DSRES Index, Composite Index Construction.

INTRODUCTION

Design Science Research (DSR) functions as an optimal method to create innovative knowledge because it unites information systems engineering for developing operational artifacts that fulfill scientific requirements and operational requirements (Gregor & Hevner, 2011, 2013; Hevner et al.,2004; March & Smith, 1995; Peffers et al.,2007). The scientific design method, which Simon (1969) established as the science of the artificial, serves as the basis for DSR because it treats design as a scientific field that connects theoretical knowledge (Bunge, 1980) to practical applications in business and engineering domains (Dresch et al., 2020; Van Aken, 2004; Winter, 2008). The field of engineering design has known for many years that scientific research and design processes share standard methods yet exhibit distinct differences according to Eekels & Roozenburg (1991) and Roozenburg & Eekels (1995), who support the requirement for structured assessment methods.

The main difficulty of DSR arises from the need to preserve both the power of its research methods and its effectiveness in practical settings (Baskerville et al., 2009; Baskerville & Pries-Heje, 2019; Romme, 2003). Scientists can create both scientifically valid studies and sound theoretical knowledge that serve practical needs and attract funding from stakeholders by using research methods that combine official procedures with practical applications. Research on management and innovation has studied the stability-change conflict through numerous studies, but these investigations lack sufficient methods to evaluate performance effectiveness (Gioia & Pitre, 1990; Hammer & Champy, 1993; Marxt

& Hacklin, 2005). The current Engineering Design research investigates innovative methods that demonstrate the need to evaluate design work processes and collaborative research approaches (Clerino et al., 2025; Liu & Zolghadri, 2026), thereby requiring the development of standardized assessment protocols for engineering design research.

The theory of measurement provides a basis for addressing this existing knowledge deficiency. Behavioral and organizational research depends on scale development as its foundation, as Churchill (1979), Dewar et al. (1980), DeVellis & Thorpe (2021), and Hinkin (1998) established it as a fundamental process. The research field uses these scales to study innovation (Alegre, Lapiedra, & Chiva, 2006; Calik et al. (2017)), project management (Mazur & Pisarski, 2015), and brand personality (Rauschnabel, Krey, Babin, & Ivens, 2016). Research in psychometrics and structural equation modeling (Hair et al., 2017; Hair et al., 2011; Henseler et al., 2015; Kline, 2023) provides scientists with methods to perform construct validation at a high level while they solve problems related to construct discrimination and variable correlation and research participant number needs (MacCallum et al., 1999; Mason & Perreault, 1991; Wolf et al., 2013). Scientists can now use new research approaches to transform established measurement instruments into composite indicators that show better results in actual field use.

The research tradition continues through the Design Science Research Effectiveness Scale (DSRES), which de Medeiros and Martins (2024) and Narazaki & Pedron (2020) validated to measure five essential effectiveness factors: Rigor and Utility, Knowledge and Engagement, and Evaluation. The scale demonstrated strong psychometric properties, but the next step is to develop a unified measurement tool that engineers can use for design work. The development process of this index addresses design science methodological needs identified by Alturki et al. (2011), Gregor & Zwikael (2024), and Nunamaker et al. (1991) for design science research. The framework enables researchers to evaluate their work using a method they can understand and replicate. This article introduces the Design Science Research Effectiveness Index (DSRES Index) as a methodological contribution to engineering design. The DSRES Index applies weights derived from confirmatory factor analysis (Harrington, 2009; Ringle et al., 2022) and theoretical principles to develop a measurement framework that unites methodological rigor with operational effectiveness for evaluating design-oriented research initiatives. The DSRES Index establishes a measurement system which also introduces a typology that classifies organizations into four maturity levels – Explorer, Developer, Integrator, and Leader – based on their DSRES scores, strengthening methodological approaches and developing an operational assessment system for research-driven design projects.

THEORETICAL BACKGROUND

Design Science Research (DSR) is a research methodology that enables scientists to create artifacts while generating new scientific knowledge (Gregor & Hevner, 2011, 2013; Hevner et al., 2004; March & Smith, 1995; Peffers et al., 2007). The scientific method, which Simon (1969) developed for artificial systems, serves as the basis for DSR, which builds systematic answers to complex problems by treating design as a scientific discipline that requires both sound theoretical foundations and functional results. Academic researchers now concentrate on the dual requirement because they need to develop frameworks that protect their theoretical strength and remain effective in actual applications (Baskerville & Pries-

Heje, 2019; Baskerville et al., 2009; Romme, 2003; Van Aken, 2004). Within engineering design, scholars have explored the methodological similarities and differences between scientific research and design processes (Eekels & Roozenburg, 1991; Roozenburg & Eekels, 1995; Takeda et al.,1990). The research data show that the design methodology needs structured approaches to validate DSR as a method that links Bunge's (1980) theoretical framework to practical engineering work, as noted by Dresch et al. (2020) and Lacerda et al. (2013). Research in Engineering Design publishes new studies that prove methodological advancement remains essential for engineering design work through participatory design and sustainability assessment methods (Clerino et al.). The research community needs to develop operational tools to validate the effectiveness of current studies, according to Liu and Zolghadri (2026) and Liu and Zolghadri (2025).

The challenge of measuring effectiveness in DSR has led to the development of scales and frameworks across multiple domains. The research benefits from Measurement theory, which offers strong principles for construct development and validation according to Churchill (1979), DeVellis & Thorpe (2021), and Hinkin (1998). Applications of scale development have been reported in innovation performance (Alegre et al., 2006; Calik et al., 2017), project management (Mazur & Pisarski, 2015), and organizational constructs (Dewar et al., 1980; Rauschnabel et al., 2016). The research employs psychometric and structural equation modeling (SEM) methods, which Hair et al. (2020) explain in their published research. 2011; Hair et al.,2017; Henseler et al., The research methods which Kline (2015) and Kline (2023) developed enable scientists to conduct construct validation with high precision while they address three main issues which affect discriminant validity and collinearity and insufficient sample sizes (MacCallum et al. 1999; Mason & Perreault, 1991; Wolf et al.,2013). The research tradition continues through the Design Science Research Effectiveness Scale (DSRES), which measures five essential effectiveness factors: Rigor and Utility, Knowledge and Engagement, and Evaluation (de Medeiros & Martins, 2024; Narazaki et al., 2020). The DSRES Scale demonstrated psychometric robustness during validation, but researchers need to use these validated dimensions to create a composite index. The development process of this index follows recommendations made by design science researchers for creating new methodological approaches (Alturki et al., 2011; Gregor & Zwikael, 2024; Nunamaker et al.). The research impact evaluation system developed by Nunamaker et al. (1991) enables engineers to assess their design projects through a straightforward method that produces reliable results.

METHODS

Research Design

The research method used in this study extends current approaches to scale and index construction. The Design Science Research Effectiveness Scale (DSRES) has previously been validated to measure five essential effectiveness dimensions, including Rigor and Utility, Knowledge and Engagement, and Evaluation, through measurement theory-based psychometric assessment (Churchill, 1979; DeVellis & Thorpe, 2021; Hinkin, 1998). The research builds on prior findings to develop a single metric that assesses the effectiveness of Design Science Research (DSR) in engineering design contexts. Scale Validation serves as the essential base that enables all research operations to function. The DSRES Scale followed best practices in construct measurement throughout its development process, which included item generation, reliability assessment, and validity testing (Alegre et al., 2006; Calik et al., 2017; Dewar et al., 1980; Mazur & Pisarski, 2015; Rauschnabel et al., 2016). The research team conducted a confirmatory factor analysis (CFA) to validate the psychometric properties, which showed both convergent and discriminant validity (Hair et al., 2011; Hair et al., 2017; Henseler et al., 2015; Kline, 2023). The organization follows established procedures that align with the recommended scale development methods outlined by MacCallum et al. (2003) for organizational and innovation research. 1999; Mason & Perreault, 1991; Wolf et al.,2013).

Scale Construction

The research design and procedure for the Development of the Design Science Research Effectiveness Scale (DSRES) follow a multi-phase design that integrates theoretical principles with experimental testing, guided by the frameworks of Churchill (1979), Hinkin (1998), and DeVellis & Thorpe (2021). This approach consists of two essential steps: a literature review and expert validation coupled with statistical testing. In the literature review, 14 primary sources concerning the evaluation of Design Science Research (DSR) were examined through content and thematic analysis. Using established methodologies (Miles et al., 2014; Saunders et al., 2009; Strauss & Corbin, 1990), iterative coding identified five high-quality DSR project dimensions: Rigor, Utility, Knowledge, Engagement, and Evaluation.

The second step, expert validation and statistical testing, involved conducting qualitative interviews with specialists to reaffirm the dimensions discovered in the literature review. This process was guided by the inductive validation approaches recommended by Hinkin (1998) and Myers & Newman (2007), ensuring the transparency and rigor of the validation efforts. Confirmatory Factor Analysis (CFA) was used to validate the measurement model, assess reliability, and confirm convergent and discriminant validity. The hierarchical structure of the DSRES was confirmed, with the first five-order dimensions forming a second-order construct that measures overall DSR effectiveness. The DSRES itself operates as a second-order construct, with the five identified dimensions converging into a single latent factor that reflects total DSR effectiveness. Each first-order dimension—Rigor, Utility, Knowledge, Engagement, and Evaluation—is associated with specific attributes, assessed through various indicators.

Rigor emphasizes the methodological soundness of the research process, highlighting the importance of adherence to established protocols, systematic data collection, and precise analytical procedures, with indicators focusing on design-method consistency and technique-application reliability (Hevner et al., 2004).

Utility pertains to the practical application of research outcomes, indicating whether the artifacts developed can be effectively implemented in practice and are beneficial to stakeholders involved (Gregor & Hevner, 2011).

Knowledge relates to the advancement of organizational learning, focusing on how research outcomes enhance theoretical comprehension and yield new insights (Peffers et al., 2007).

Engagement underscores the involvement of stakeholders throughout the research process, promoting collaboration, communication, and responsiveness to user needs (Van Aken et al., 2012).

Evaluation involves the systematic assessment of research artifacts and processes, ensuring that solutions are thoroughly tested, validated, and critically examined for effectiveness and quality (Baskerville et al., 2009, 2019). Support for these dimensions, along with a comparative analysis, is detailed in the following Figure 1:

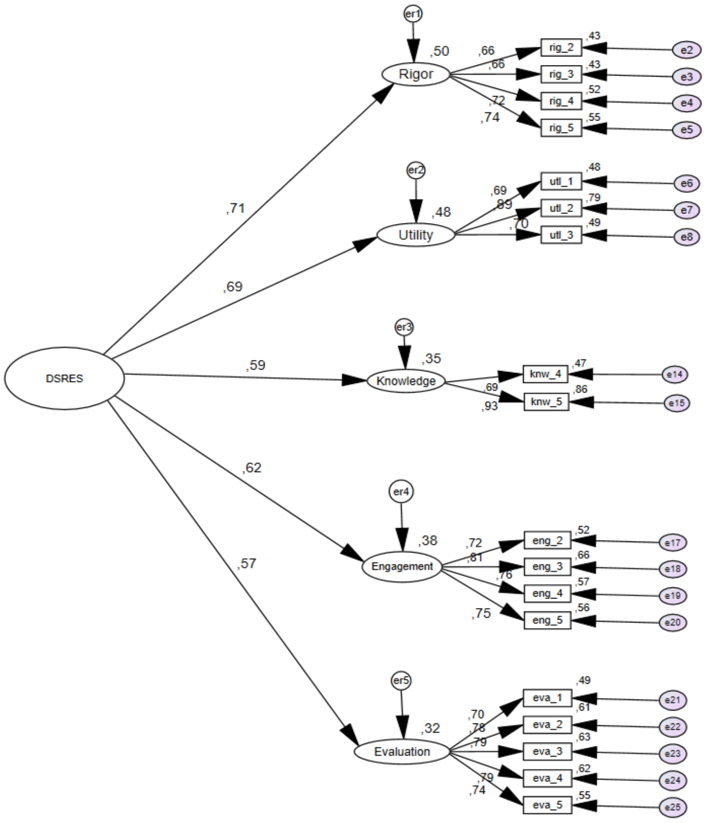

Figure 1: DSRES measurement model with second-order factor structure.

To effectively encapsulate the DSR paradigm, a set of research hypotheses was developed, drawing on the contributions of Dresch et al. (2020), Hevner et al. (2004), and Peffers et al. (2007). These hypotheses were subsequently tested using CFA and Structural Equation Modeling (SEM) analyses facilitated by IBM AMOS 26. Finally, this Index is derived from the DRES scale (see Figure 1).

Index Construction

To transform the validated scale into an index, numerical weights were assigned to each dimension. Weights were derived from factor loadings obtained through CFA (Harrington, 2009; Ringle et al., 2022), complemented by theoretical reasoning grounded in the literature on rigor and relevance (Baskerville & Pries-Heje, 2019; Baskerville et al., 2009; Gregor & Hevner, 2013; Romme, 2003). The dual method demonstrated that it could forecast design science performance while remaining true to design science principles, as evidenced by its development of the DSRES Index. The composite index used a weighted-aggregation model, assigning equal weight to each dimension to calculate the overall effectiveness measure. The research design follows established methods from index development, which management and innovation studies employ to build assessment systems using combined performance indicators (Alturki et al., 2011; Gregor & Zwikael, 2024; Nunamaker et al., 1991). The DSRES Index is a tool for evaluating research-based projects using a standardized process applicable across various engineering design situations. The index enables researchers to perform statistical analyses and data comparisons, thereby enabling them to create operational solutions. The new method satisfies multiple research needs, which help researchers develop design theory and methodology (Clerino et al., 2025). The research findings from Liu & Zolghadri (2026), Van Aken (2004), and Winter (2008) show that DSR functions as a scientific approach that unites research-based evidence with real-world.

RESULTS: THE DSRES INDEX

The DSRES Index combines five validated dimensions which include Rigor and Utility and Knowledge and Engagement and Evaluation to create a single composite metric. Each dimension was empirically confirmed through factor loadings and Average Variance Extracted (AVE), demonstrating strong convergent validity across all constructs. (Hair et al.,2011; Harrington, 2009; Ringle et al.,2022).

Scale Validation Results

Table 1 presents the psychometric properties of the DSRES Scale. All constructs exceeded the recommended threshold of 0.50 for AVE, confirming convergent validity (Hair et al., 2011; Henseler et al., 2015; Kline, 2023).

Table 1: Psychometric Properties of DSRES Constructs

Dimension	Items (λ range)	AVE (approx)	Interpretation
Rigor	.73-.84	.62	Convergent validity confirmed
Utility	.71-.81	.58	Convergent validity confirmed
Knowledge	.70-.80	.57	Convergent validity confirmed
Engagement	.70-.83	.56	Convergent validity confirmed
Evaluation	.72-.80	.58	Convergent validity confirmed

Note: All constructs exceed the 0.50 threshold, demonstrating strong convergent validity.

Index Construction

Following these results, the DSRES Index was formulated using a weighted-average model, as each dimension has different weights. Rigor (.213) and Utility (.199) were assigned the highest weights because they represent the foundational requirements for effective DSR. Knowledge (.196) was weighted at an intermediate level, while Engagement (.193) and

Evaluation (.199) received lower but still significant weights, reflecting their supportive role in ensuring stakeholder collaboration and accountability. Thus, the composite index was constructed using a weighted-aggregation model, with each dimension contributing proportionally to the overall effectiveness measure. The DSRES Index is expressed as:

$$DSRES\,Index = \frac{\sum_{i=1}^{n} w_i \cdot x_i}{\sum_{i=1}^{n} w_i}$$

<u>Figure 2</u>: Weighted average formula for the DSRES Index

where:

- x_i = score of dimensions i
- w_i = weight assigned to dimension i
- n = total number of dimensions

Figure 2 shows that dimensions with higher empirical or theoretical relevance exert greater influence on the overall effectiveness score.

Table 2 shows the weighting scheme that underpins the DSRES Index, showing how each of the five dimensions contributes to the overall measure of Design Science Research effectiveness. Average Variance Extracted (AVE) values were calculated for Rigor, Utility, Knowledge, Engagement, and Evaluation, and then normalized against the total of 2.91 to produce percentage weights that sum to 100 percent.

<u>Table 2</u>: Normalized Weights of DSRES Dimensions

Dimension	AVE	alculation (AVE ÷ 2.9	Index Weight	Feature
Rigor	0,62	0,62 ÷ 2,91 = 0,213	21,3%	Degree of methodological structuring and formality of the processes.
Utility	0,58	0,58 ÷ 2,91 = 0,199	19,9%	Practical applicability and relevance of the solutions developed.
Knowledge	0,57	0,57 ÷ 2,91 = 0,196	19,6%	Generation, registration and dissemination of organizational knowledge.
Engagement	0,56	0,56 ÷ 2,91 = 0,193	19,3%	Active participation of users and stakeholders in the design process.
Evaluation	0,58	0,58 ÷ 2,91 = 0,199	19,9%	Monitoring, testing and continuous evaluation of solutions.
TOTAL	2,91		100,0%	

Note: Total = normalized weights = 100%

Rigor accounts for 21.3 percent of the Index, Utility and Evaluation each contribute 19.9 percent, Knowledge represents 19.6 percent, and Engagement 19.3 percent. In addition to the numerical distribution, the table highlights the conceptual role of each dimension, ranging from methodological structuring and practical applicability to knowledge dissemination, stakeholder participation, and continuous evaluation. Taken together, the table demonstrates both the quantitative foundation and the qualitative meaning of the

DSRES Index, providing a transparent basis for the subsequent typology of organizational maturity profiles.

Interpretation

The empirical validation process confirmed that the DSRES Scale consists of five dimensions which function as reliable assessment tools to measure Design Science Research effectiveness. The constructs show strong reliability (CA > 0.87), convergent validity (AVE > 0.50), and internal consistency (CR > 0.80) demonstrate the robustness of the constructs. Moreover, the moderate-to-strong nomological correlations which ranged from 0.59 to 0.68 confirm external validity, showing that the dimensions are theoretically interrelated and consistent. The DSRES Index demonstrates how DSR functions as a paradigm which connects theoretical validity to practical relevance through its presentation of scientific methods applied to engineering applications.

Nomological Validity

Nomological validity was further examined through correlations among constructs. All correlations were moderate to strong (ρ > .50) and statistically significant, consistent with theoretical expectations. Table 2 illustrates the key relationships, their AVE values, and theoretical interpretations

Table 3: Correlations among constructs

Relationship	AVE (approx)	Interpretation
Rigor<-> Utility	.59	Higher utility aligns with greater knowledge acquisition
Engagement<=>Evaluation	.68	More engaged respondents evaluate the research process more positively
Uitilty<=>Knowledge	.62	Rigorous research is perceived as more useful
Rigor<=>Evaluation	.65	Rigorous research is evaluated more favorably

Note: All correlations are moderate to strong (ρ > 0.50) and statistically significant, confirming nomological validity

DSRES Index Typology

The research extends the DSRES Index practical value through its development of a classification system which divides organizations into four stages of maturity according to their DSRES scores.

Table 4: DSRES Index Typology

Typology	DSRES Range	Feature
Explorer	1.0 – 2.0	Incipient use, ad hoc practices, little systematization
Developer	2.1 – 3.0	They are starting to apply DSR, but still without full integration
Integrator	3.1 – 4.0	Moderately present DSR, structured knowledge and assessment
Leader	4.1 – 5.0	Consolidated DSR, strong rigor and usefulness, continuous engagement and evaluation

The typology serves as a diagnostic system which helps researchers and practitioners determine their current level of Design Science Research implementation and develop strategies to move forward, illustrated in Table 4. The typology system operates with the DSRES Index to transform numerical data into particular organizational development stages. The system allows organizations to assess their existing operations through benchmarking which reveals their performance deficiencies and tracks their progress from one time period to another. The index enables Explorers to enhance their research techniques and Leaders who train together can establish new performance benchmarks which maximize their best methods.

Summary of Results

The research established all required validation metrics into a single composite measure of effectiveness. Convergent Validity (AVE >.50), Reliability (CA>.07), internal consistency (CR>.80), and nomological validity (r=.59-.68 were all confirmed. Together, these findings demonstrate that DSRES Index is a robust and theoretically consistent too for evaluating DSR effectiveness in engineering design contexts.

Figure 1 presents the final DSRES measurement model, incorporating the second-order factor structure and removing the weak indicators. The figure illustrates the hierarchical specification in which rigor, utility, knowledge, engagement, and evaluation load onto the overarching DSRES construct, thereby accounting for the covariance among the first-order dimensions. Finally, the application of the index revealed four distinct maturity profiles in DSR practices: *Explorer, Developer, Integrator,* and *Leader*. Each profile represents a stage of organizational evolution in design science research, detailed in the next section.

DISCUSSION

The development of the DSRES Index marks an improvement in the assessment procedures for engineering design research. The research established a methodologically sound composite index by validating the DSRES Scale. The research results demonstrated that the five dimensions of Rigor, Utility, Knowledge, Engagement, and Evaluation maintained high reliability and demonstrated convergent validity, internal consistency, and nomological validity, supporting their status as research effectiveness indicators. The index framework identifies four distinct profiles which show different stages of Design Science Research practice development.

Explorer, which ranges from 0 to 1.99. Organizations at this stage operate with unstructured processes and an experimental approach to design. The solutions fail to deliver functional results because they generate minimal knowledge and the stakeholders do not participate effectively and the assessment methods remain basic. The organizations need to implement fundamental rigor practices which include checklists and basic workflows and documentation of learned lessons and documentation-friendly organizational culture.

Developer, ranging from 2 to 2.99. Organizations at this stage start to create solutions with better consistency yet they still show different approaches. The organization maintains standards but its documentation process remains inconsistent and users have not fully accepted these standards. The main obstacle requires organizations to merge their operational methods while making their solution-based answers more useful and establishing a structured system for knowledge management. The recommendations propose three main actions which involve establishing uniform testing methods and conducting more extensive validation tests and enhancing user involvement in the process.

Integrator, ranging from 3 to 3.99. The organization demonstrates its ability to use DSR at this stage because it has fully incorporated the method into its operational systems. The solutions follow a defined structure which organizations use frequently while stakeholders maintain their involvement and organizations use continuous feedback systems to function. Organizations operate knowledge-sharing systems but they encounter difficulties when they attempt to establish new methods for knowledge sharing and track their performance results. Organizations need to expand their reach and convert acquired knowledge into market-leading benefits and distribute their findings to more people in order to achieve the Leader profile.

Leader, ranging from 4 to 5. The organizations at this stage function as DSR benchmarks because they operate with standardized processes which have gained international recognition. The solutions produce valuable outcomes while knowledge management functions at a higher level and stakeholders stay actively involved throughout the evaluation process which operates as an ongoing systematic assessment. The main challenge is to sustain leadership, ensure ongoing innovation, and disseminate practices globally. The recommendations propose three actions which involve using science as a reference point and making solutions available worldwide and building stronger connections between different nations. The index profiles deliver two main benefits which help organizations understand their current DSR practice level and provide step-by-step directions to reach more advanced stages until they achieve innovation leadership.

IMPLICATIONS

Theoretical Implications

The DSRES Index serves the Design Science Research field by providing a method for measuring effectiveness in an organized way. Scientists face a dual challenge, according to research data, as they must maintain both methodological rigor and practical value in their studies (Baskerville & Pries-Heje, 2019; Gregor & Hevner, 2013), yet no established evaluation methods exist for these aspects. The DSRES Index addresses this gap by merging psychometric validation with theoretical reasoning, strengthening DSR's methodological foundations and enabling this paradigm to establish connections between scientific research and managerial practice.

Practical Implications

The DSRES Index is a practical operational method for researchers and practitioners. The system allows organizations to perform standardized design-based initiative assessments, researchers to study multiple companies through comparison, and managers to apply scientific data to their work. The DSRES Typology - Explorer, Developer, Integrator, and Leader – extends the utility of the index by classifying organizations into maturity levels. The typology provides a diagnostic framework that helps institutions determine their current DSR adoption stage and strategize for improvement. For example, the index helps Explorers identify weaknesses and strengthen methodological rigor, while Leaders can benchmark their practices against established standards and disseminate best practices. This dual condition – typology plus index – makes the DSRES framework both strategic and evaluative.

RESEARCH LIMITATIONS

The DSRES Index shows excellent psychometric properties, but researchers need to understand its limited range of application. The weights applied to their dimensions emerged from two sources: confirmatory factor analysis and theoretical reasoning, which might differ across fields and research environments. The index requires evaluation through multiple management disciplines to determine its usefulness for various fields of study. The typology maintains its theoretical power but needs scientific testing, which follows organizations through their different stages of development.

CONCLUSION

In conclusion, the research presented the Design Science Research Effectiveness Index (DSRES Index) as a new evaluation approach for design research studies. The DSRES Index uses the validated DSRES Scale to create a composite measure that combines five core dimensions of Rigor, Utility, Knowledge, Engagement, and Evaluation to measure research effectiveness systematically. The empirical validation process demonstrated that the index showed high reliability, strong convergent validity, internal consistency, and nomological validity, which confirmed its solid foundation. The main contribution of this study lies in the DSRES Typology, which translates quantitative results into four developmental stages: *Explorer, Developer, Integrator,* and *Leader*. The DSRES Index provides researchers and practitioners with a straightforward assessment method that enables them to enhance design-oriented projects and develop new principles and systematic evaluation practices. The index should be tested across different management fields, such as engineering, project management, amongst others, and worldwide locations to confirm its ability to predict results. At the same time, researchers should examine how organizations develop through the stages outlined by the typology. Finally, the index framework provides a structured path from exploratory experimentation to international leadership in DSR, offering practical recommendations for organizations seeking to advance their innovation maturity.

FUTURE RESEARCH

The DSRES Index needs further investigation to demonstrate its usefulness for projects, as it must show its ability to forecast project outcomes, innovation achievements, and stakeholder satisfaction. The typology provides researchers with opportunities to study different business sectors through comparative analysis, which allows them to track organizational development from Explorers to Leaders. The dataset needs more data points to achieve higher measurement accuracy and operational usability, as it will be used in countries around the world.

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APPENDIX I – COMPARATIVE ANALYSIS OF DSR EFFECTIVENESS DIMENSIONS ACROSS KEY SOURCES

Author	Rigor	Utility	Knowledge	Engagement	Evaluation
Van Aken et al. (2012)	Mid-range theory rigor	Rigor–relevance bridge	Scientific grounding	Practitioner orientation	Applied cases
Aturki et al. (2011)	Simulation methods rigor	Controlled testing utility	Artifact validation knowledge	Scenario modeling engagement	Simulation frameworks evaluation
Baskerville et al. (2009)	Rigor–relevance balance	Organizational alignment utility	Integrative evaluation knowledge	Participatory approaches engagement	Multi-criteria strategies evaluation
Peffers et al. (2007)	Process model rigor	Systematic development utility	Structured methodology knowledge	Communication & dissemination engagement	Explicit evaluation stage
Gregor & Jones (2007)	Artifact types definition rigor	Prescriptive categories utility	Artifact contribution clarity	Organizational context engagement	Instantiation & testing evaluation
Manson (2006)	Multi-criteria rigor	Diverse contexts utility	Evaluation frameworks knowledge	Multiple perspectives engagement	Performance relevance evaluation
Cole et al. (2005)	Case study rigor	Applied contexts utility	Empirical validation knowledge	Practitioner collaboration engagement	Balanced strategies evaluation
Vaishnavi & Kuechler (2004)	Iterative methodology rigor	Cycles of refinement utility	Embedded learning knowledge	Stakeholder problem identification engagement	Iterative evaluation
Walls et al. (1992)	Design theory rigor	Theory–artifact linkage utility	Formalized design theory knowledge	Practice alignment engagement	Theory testing evaluation
Kardas (1992)	Design requirements rigor	Kernel theory grounding utility	Structured design processes knowledge	Organizational alignment engagement	Theoretical–practical fit evaluation
Nunamaker et al. (1991)	IS design frameworks rigor	Organizational solutions utility	Knowledge advancement	Research–practice integration engagement	Organizational application evaluation
Eekels & Roozenburg (1991)	Design methodology rigor	Engineering practice utility	Formalized principles knowledge	Collaborative contexts engagement	Methodological application evaluation
Takeda et al. (1990)	Engineering logic rigor	Problem-solving artifacts utility	Structured knowledge creation	User needs alignment engagement	Problem-solving outcomes evaluation
Bunge (1980)	Scientific realism rigor	Practical engineering utility	Philosophical foundations knowledge	Applied science context engagement	Realism applicability evaluation

APPENDIX II – DSRES: VALID INDICATORS (BRAZILIAN PORTUGUESE VERSION)

Indicator	Question
eva_2	O desempenho das soluções costuma ser monitorado e avaliado.
utl_1	As soluções costumam resolver problemas relevantes para a empresa.
rig_2	As etapas de desenvolvimento costumam ser claramente definidas.
knw_4	As lições aprendidas costumam ser registradas.
rig_3	As soluções costumam seguir padrões de qualidade estabelecidos.
eng_4	As opiniões dos usuários costumam influenciar diretamente os resultados finais.
rig_5	A documentação do projeto costuma ser completa.
eva_4	A eficácia das soluções costuma ser avaliada regularmente.
utl_2	As soluções costumam ser viáveis para implementação na prática.
eva_3	As soluções costumam ser aprimoradas com base no feedback dos usuários.
eng_3	A comunicação entre equipe e usuários costuma ser aberta e transparente.
utl_3	As pessoas que utilizam as soluções costumam considerá-las úteis em seu trabalho.
eva_5	As soluções costumam ser ajustadas para atender às mudanças nas necessidades da empresa.
knw_5	Os projetos costumam deixar claro como contribuem para o conhecimento da organização.
eng_2	O feedback dos usuários costuma ser coletado e usado para melhorar as soluções.
eva_1	As soluções costumam ser testadas e validadas antes da implementação.
rig_4	As decisões de design costumam ser baseadas em critérios claros.
eng_5	A colaboração entre a equipe e os usuários costuma ser incentivada.