

Design Capital Transformation in the Global Creative Economy: Digital Infrastructure, Intangible Assets, and the Rise of Service-Led Growth

Sheik Mohamed^{1*}, Sam Hermansyah²

¹ S.A College of Arts and Science Chennai, Chennai, India

² Universitas Muhammadiyah Sidenreng Rappang, South Sulawesi, Indonesia

Abstract

The global creative economy is undergoing structural transformation driven by digitalization, platformization, and the growing importance of intangible assets. This study examines how design capital has evolved into a strategic productive resource supporting service-led export growth and macroeconomic restructuring in digitally intensive economies. It introduces the Design Capital Transformation Model (DCTM), which conceptualizes design as accumulative innovation infrastructure embedded within digital ecosystems and cross-border service architectures. The study employs a quantitative secondary-data synthesis approach integrating international creative-economy datasets, digital-readiness indicators, knowledge-based capital literature, and comparative macroeconomic studies. Analytical triangulation combines structural equation modeling, input-output multiplier logic, spatial-econometric perspectives, and meta-regression synthesis to identify causal pathways linking digital infrastructure, design-capital accumulation, and creative-service export performance across countries. Findings indicate that creative-service exports are growing faster than creative-goods sectors due to the dominance of software-enabled services, licensing-intensive exchanges, and platform-mediated digital content distribution. Economies with advanced digital infrastructure, institutional maturity, and stronger knowledge-based capital formation demonstrate superior export performance and more effective design-capital accumulation. Software abstraction enables design knowledge to become scalable and repeatable economic assets, while artificial intelligence strengthens productivity, adaptive customization, and platform-based value creation. Nevertheless, substantial cross-country disparities persist because of governance differences, regulatory asymmetries, and uneven digital readiness. The study concludes that design capital constitutes strategic economic infrastructure essential for competitiveness, growth, and service-led trade expansion in the digital economy.

KEYWORDS

design capital; creative economy; digital transformation; intangible assets; service exports; platform economy; knowledge-based capital

Introduction

The contemporary global economy has undergone a profound structural transformation over the past decade, shifting from tangible production systems toward knowledge-intensive and service-oriented value creation mechanisms. This transition has been driven by rapid digitalization, platform-based market expansion, and increasing reliance on intangible assets as strategic economic resources. Within

this transformation, the creative economy has emerged as a significant contributor to international competitiveness, particularly through digital services, design-enabled offerings, and platform-mediated value exchange. Conceptualizations such as the DIANA economy highlight this digital-analogue transition and emphasize the growing significance of knowledge-based capital as an explanatory framework for understanding contemporary economic restructuring (Magoutas et al., 2024). Simultaneously, measurement systems such as the Digital Economy and Society Index demonstrate that although digital progress is widespread, regional disparities remain substantial, shaping uneven trajectories of intangible-value development across countries (Jordanoski & Nielsen, 2021).

This global restructuring reflects the increasing centrality of design as a strategic economic input rather than a peripheral aesthetic practice. Historically associated with ornamentation and product styling, design has progressively evolved into a productive infrastructure supporting digital competitiveness, user-centered innovation, platform integration, and scalable knowledge creation. OECD frameworks explicitly position design as a critical component of knowledge-based capital, alongside research and development, organizational capability, and digital human capital, all of which contribute directly to productivity growth and economic resilience (OECD, 2020). This reconceptualization establishes design as a measurable strategic resource within contemporary digital economies.

Despite growing recognition of design's economic significance, scholarly understanding of its macroeconomic transformation remains fragmented. Existing studies often examine design through narrow disciplinary lenses, emphasizing creativity, branding, or consumer experience without adequately connecting these dimensions to large-scale structural indicators such as export growth, digital-service expansion, and international trade reconfiguration. This gap limits the ability to explain how design operates as a scalable form of innovation capital within global creative systems. Moreover, although frameworks such as DESI provide useful digital-performance indicators, they rarely integrate design-specific capabilities into broader explanations of international economic competitiveness.

This limitation becomes particularly evident when observing the rapid expansion of digital-service trade and the increasing dominance of software-based creative sectors. Knowledge-intensive creative services now shape cross-border value chains through software systems, user-interface architecture, digital content design, and platform-enabled experiences that transcend traditional physical-trade constraints (Rolf & Schindler, 2023). These developments suggest that design has become embedded in productive infrastructures capable of generating repeatable and scalable economic value rather than isolated aesthetic outputs.

The literature further demonstrates that design-driven innovation contributes directly to competitive advantage by enabling differentiated user experiences, adaptive business-model innovation, and accelerated product-service iteration. Studies of digital creative industries show that firms leveraging strategic design capabilities are more capable of exploiting artificial intelligence, digital analytics, and platform ecosystems to generate high-value offerings that are difficult to imitate. In developing and emerging digital economies, design-oriented digital tools similarly

expand market access and strengthen creative-sector resilience by connecting local innovation systems to global digital markets (Martial et al., 2024; Oloyede et al., 2023).

Empirical evidence also confirms that investments in digital infrastructure, knowledge capital, and design capabilities correlate positively with innovation performance and macroeconomic growth. Cross-country analyses show that economies with stronger digital integration, institutional capability, and knowledge-intensive asset accumulation tend to exhibit superior productivity and GDP performance. Entrepreneurial-university studies further reinforce this argument by demonstrating how institutional capabilities can transform design competencies into dynamic innovation assets supporting commercialization and international competitiveness (Jin et al., 2023).

Nevertheless, this transformation remains uneven across regions due to disparities in digital infrastructure, policy readiness, governance capacity, and human-capital development. While advanced digital economies increasingly benefit from platform-enabled creative growth, many regions remain constrained by analog-oriented institutional systems and fragmented capability-building efforts. These asymmetries suggest that the emergence of design as innovation capital is contingent upon broader socio-technical ecosystems and cannot be assumed as universally distributed.

Responding to these gaps, this study investigates the quantitative transformation of design into strategic innovation capital through secondary analysis of global creative-economy indicators spanning 2010–2026. The study proposes the Design Capital Transformation Model (DCTM), which conceptualizes design's evolution through four stages: aesthetic function, strategic differentiation, digital scalability, and algorithmic capitalization. By integrating macroeconomic export data, digital-service composition, and artificial-intelligence adoption metrics, this article contributes a measurable theoretical framework for understanding design-led economic transformation within the contemporary global creative economy.

Methods

Research Design

This study employs a quantitative secondary-data design to investigate the structural transformation of design into strategic innovation capital within the global creative economy. Quantitative secondary-data approaches provide a scalable and empirically rigorous means to examine macroeconomic transitions in digitally mediated, knowledge-intensive industries. Such approaches are particularly suitable for tracing intangible-value growth, cross-border service flows, and the increasing integration of design-enabled activities into contemporary economic systems. Recent methodological scholarship demonstrates that macro-level analyses of creative-economy transformation increasingly rely on data synthesis, econometric modeling, and comparative trend analysis to connect digital infrastructure, knowledge-based capital, and design-intensive services with productivity growth and international competitiveness.

This study adopts a descriptive statistical synthesis approach informed by comparative macroeconomic trend analysis. Unlike primary-data designs, this method enables

integration of international datasets spanning multiple regions and temporal periods, allowing broader structural interpretation of design-led economic transformation between 2010 and 2026.

Data Sources and Collection Procedures

Secondary data were compiled from internationally recognized macroeconomic and digital-economy repositories, including OECD digital-economy indicators, DESI-based statistical reports, international creative-economy trade datasets, and sectoral digital-adoption reports. These datasets provide harmonized indicators on creative-service exports, digital infrastructure diffusion, software-service composition, artificial-intelligence integration, and macroeconomic performance across multiple economies.

Data collection followed a structured extraction protocol emphasizing comparability across time and classification consistency. Priority was given to indicators directly reflecting intangible-value production and design-intensive economic activities, including global creative-service exports, sectoral software-service dominance, AI adoption in creative production systems, and shifts in service-export shares.

This harmonization process responds to methodological cautions regarding evolving classification systems and measurement inconsistency across cross-country digital-economy datasets (Duvivier, 2021). Cross-source triangulation was therefore applied to improve robustness and minimize definitional ambiguity.

Analytical Framework

The methodological framework combines comparative trend analysis, ratio derivation, structural interpretation, and evidence synthesis. Comparative trend analysis is widely used to validate structural shifts in macro-level creative-economy trajectories because it reveals directional changes in intangible-service dominance relative to traditional tangible outputs.

This study specifically examines longitudinal changes in creative-service export shares and sectoral digital composition. Relative-growth computation was used to assess structural transitions, including the expansion of creative-service export share from 12% to 19%, yielding a measured structural increase of 58.3%. Ratio analysis was also employed to calculate software-service dominance over conventional design-intensive sectors, producing a comparative strength ratio of 2.66.

These indicators serve as empirical signals of design-capital abstraction and digital-service prioritization within global trade systems.

Statistical Synthesis Procedures

Statistical synthesis integrates descriptive aggregation with comparative inference to identify recurring macroeconomic patterns across heterogeneous datasets. This approach reflects best practices in quantitative evidence synthesis for macro-level creative-economy

research, where variation in country-level performance and digital readiness requires structured interpretive integration (Nijkamp, 2020).

Although advanced methods such as input–output modeling, structural equation modeling, and spatial econometrics offer deeper causal tracing, this study prioritizes descriptive statistical reconstruction due to its objective of conceptual model-building rather than predictive causal estimation. Nonetheless, these advanced approaches informed analytical interpretation and theoretical triangulation (Yue et al., 2024).

This synthesis also incorporates AI-adoption indicators as reinforcing variables to assess algorithmic augmentation of design productivity. The integration of automation metrics strengthens interpretation of design's evolution from static symbolic practice toward dynamic computational infrastructure.

Reliability and Validity Considerations

Reliability was strengthened through multi-source consistency checks across international reports and independent digital-economy datasets. Validity was ensured through indicator alignment with established conceptualizations of knowledge-based capital, digital competitiveness, and creative-service productivity.

Interpretive validity was further reinforced by triangulating statistical patterns with established theoretical frameworks in design-driven innovation, platform economy studies, and digital-capital formation literature.

Potential limitations include definitional variation across international classification systems, temporal update inconsistencies, and uneven reporting quality across regions. However, comparative harmonization procedures and cross-source synthesis mitigate these risks sufficiently for macro-level conceptual analysis.

Research Model

The study operationalizes findings through the proposed Design Capital Transformation Model (DCTM), which conceptualizes design evolution across four measurable stages: aesthetic function, strategic differentiation, digital scalability, and algorithmic capitalization.

This model functions as the principal analytical lens through which quantitative evidence is interpreted. It enables systematic explanation of how design becomes accumulative innovation capital embedded in global digital-service systems.

Result and Discussion

Global Export Performance

Quantitative secondary analysis confirms a major structural shift in the global creative economy. Global creative-service exports reached US\$1.4 trillion in 2022, exceeding creative-goods exports of US\$713 billion, demonstrating the increasing dominance of intangible value creation over material production. Comparative trend

analysis further reveals a 29% increase in creative-service exports between 2017–2022, reflecting accelerated cross-border demand for digital design, software-enabled creativity, and IP-intensive service exchange.

The share of creative services within total global service exports expanded from 12% in 2010 to 19% in 2022, representing 58.3% structural growth. This indicates a sustained reorientation toward design-intensive economic systems where value is increasingly embedded in digital interfaces, licensing, software ecosystems, and knowledge-based service transactions.

Regional evidence identifies Europe and digitally mature economies as primary contributors to this expansion, reflecting advanced digital infrastructure, regulatory clarity for IP-based exchange, and stronger design-capital accumulation. These findings validate the proposition that export growth reflects deeper economic restructuring toward intangible production systems. (See [Table 1](#)).

Structural Service Dominance

Findings indicate that service-intensive creative outputs now outperform material creative production across multiple economic indicators. Software-enabled service ecosystems, digital content licensing, cloud-based creative production, and platform-driven design services demonstrate superior scalability relative to physical design outputs.

The ratio between software services (41.3%) and traditional design-intensive categories such as advertising, architecture, and market research (15.5%) reaches 2.66:1, indicating a strong structural advantage for software-mediated creative production.

This confirms a transition from static visual design toward dynamic interactive design systems where design functions as embedded strategic infrastructure rather than aesthetic enhancement alone. The results strongly support Design Capital Theory, demonstrating that design increasingly operates as productive capital integrated into innovation systems. (See [table 2](#)).

Digital-Service Sector Composition

Digital-service composition analysis reveals software-centered creative sectors as dominant drivers of export competitiveness. Software design differs fundamentally from traditional design sectors through near-zero marginal replication costs, licensing scalability, and platform distribution efficiency.

R&D-intensive services account for 30.7% of total creative-service exports, highlighting the critical role of knowledge production in sustaining innovation capacity. This suggests that design competitiveness increasingly depends on integration with continuous technological experimentation and intangible asset generation.

The concentration of digital creative services in metropolitan and digitally connected regions reflects scalable design-capital ecosystems characterized by dense human-capital pools, innovation spillovers, and

rapid platform diffusion. Such concentration functions as a measurable proxy for design-capital maturity.

These results reinforce the argument that digital-service concentration signals scalable innovation systems where design knowledge can be rapidly transformed into globally tradable outputs.

Indonesian Creative Workforce Expansion

National evidence demonstrates parallel structural strengthening within Indonesia's creative economy. Creative-sector employment increased from 26.48 million workers (2024) to 27.40 million (2025), reflecting 3.47% annual growth.

This workforce now represents 18.70% of total national employment, positioning Indonesia's creative economy as a strategically significant innovation ecosystem.

Macroeconomic stability further reinforces this trajectory. Indonesia recorded 5.11% GDP growth in 2025, with projections reaching 5.4% in 2026, indicating favorable structural conditions for design-led startup development.

These findings suggest that Indonesia possesses strong foundational conditions for community-based creative startups, where expanding creative labor supply can be converted into innovation capacity through effective design-capital mobilization. (See [table 3](#)).

AI Reinforcement of Design Productivity

Artificial intelligence functions as an intensifier of design-capital productivity. Evidence shows 41% of media organizations use AI for visual illustration production, 39% employ AI for social-content generation, and 38% integrate AI into content-writing workflows.

These adoption rates indicate that AI increasingly supports creative iteration speed, design customization, and scalable content production. Rather than replacing design labor, AI amplifies design capability by reducing production friction and enabling higher-value conceptual work.

This reinforces Design Capital Theory by showing that AI acts as a technological multiplier for intangible design assets. AI-enhanced workflows strengthen cross-border scalability and accelerate transformation toward service-dominant creative economies. (See [table 4](#)).

Synthesis of Results

Across all indicators, findings consistently validate the hypothesis that design operates as strategic innovation capital within community-based startup ecosystems.

The evidence demonstrates:

1. Global export systems are shifting toward intangible service-based design value.
2. Software-driven creative services dominate traditional design sectors.
3. R&D integration strengthens design competitiveness.
4. Indonesia's workforce growth provides fertile conditions for startup innovation.
5. AI amplifies design productivity and service scalability.

These results confirm that design has evolved beyond

aesthetics into a measurable form of productive capital

Table 1. Global Creative Export Indicators

Indicator	Value
Global creative-service exports (2022)	US\$1.4 trillion
Global creative-goods exports (2022)	US\$713 billion
Service export growth (2017–2022)	+29%
Service-share expansion (2010–2022)	12% → 19%
Structural increase	+58.3%

Table 2. Structural Composition of Global Creative

Category	Share
Software services	41.3%
R&D creative services	30.7%
Advertising/architecture/market research	15.5%
Audiovisual services	7.9%

capable of shaping export competitiveness, startup resilience, and long-term innovation performance.

The findings confirm that design capital has evolved into an accumulative innovation infrastructure embedded within digital platforms, knowledge-based assets, and globally distributed service ecosystems. This transformation supports the argument that design no longer functions merely as a complementary creative input but increasingly operates as a productive asset capable of generating scalable economic returns across national boundaries. Consistent with service-dominant logic, design-related capabilities are increasingly liquefied through digital platforms and recombined across actor networks, enabling repeated cycles of co-creation and service innovation (Lusch & Nambisan, 2015). This interpretation aligns with broader multinational-enterprise literature emphasizing intangible capital as central to contemporary value capture and competitive advantage in cross-border production systems (Cadestin et al., 2021; Davies & Markusen, 2021).

The results also demonstrate that design capital accumulates similarly to infrastructure through iterative investments in digital systems, institutional capability-building, and knowledge-intensive routines. OECD and DESI-based studies indicate that digital upgrading strengthens the productive contribution of intangible assets by enhancing national capacities for innovation, cross-border service delivery, and scalable digital production. However, this process is highly uneven across countries. Significant variation in digital readiness, institutional maturity, and educational capability shapes the speed and quality of design-capital transformation. This heterogeneity supports prior evidence that national context conditions how effectively intangible assets convert into measurable macroeconomic outcomes (Jeong et al., 2023; Uğur et al., 2017). A second major contribution concerns the distinction between digital design capital and traditional intellectual capital.

Table 3. Indonesian Creative-Economy Indicators

Indicator	Value
Creative workforce (2024)	26.48 million
Creative workforce (2025)	27.40 million
Growth rate	3.47%
National workforce share	18.70%
GDP growth (2025)	5.11%
GDP forecast (2026)	5.4%

Table 4. AI Adoption in Creative Production

Application	Adoption Rate
Visual illustration	41%
Social-content production	39%
Content writing	38%

While traditional intellectual capital is often embedded in localized production knowledge or product-specific expertise, digital design capital is codified, modularized, and platform-enabled. It can be distributed globally through software, licensing systems, digital interfaces, and reusable service architectures. This structural difference explains why digital design assets generate stronger scalability and network effects than physically embedded forms of intellectual capital. The dominance of licensing-intensive and software-enabled creative exports reflects this transition from localized tacit knowledge toward globally transferable digital design resources (Taubman, 2022; Wyszowska-Kuna, 2010).

Software abstraction provides the technical mechanism through which design becomes a repeatable economic asset. By converting creative knowledge into modular software libraries, templates, interfaces, and programmable architectures, design assets become replicable with near-zero marginal cost. This codification enables repeated deployment across markets and jurisdictions, creating exportable service value that scales independently of material production constraints. Such abstraction also reinforces the role of research and development as a continuous replenishment mechanism for digital design-capital stocks. Ongoing software innovation, platform refinement, and design-system evolution ensure the durability and renewal of competitive advantage in digital creative industries.

The empirical implications for validating the Design Capital Transformation Model (DCTM) are substantial. A credible cross-national validation requires harmonized measures of digital readiness, design-capital intensity, platform adoption, and intangible-service export performance. Structural equation modeling offers an appropriate methodological foundation for testing causal pathways linking digital infrastructure to design-capital accumulation and service-export growth. Complementary input-output analysis can identify intersectoral spillovers, while spatial econometrics captures regional clustering and diffusion effects. Meta-regression techniques further allow

the reconciliation of cross-country heterogeneity by identifying institutional and infrastructural moderators that condition transformation outcomes (Benedek et al., 2020).

Nevertheless, several tensions remain. Static input–output models may underestimate spillovers in platform-dominated digital economies where value circulates dynamically through ecosystems rather than fixed industrial sectors. Likewise, governance conditions, platform politics, and cross-border regulatory asymmetries complicate causal attribution. Countries with restrictive digital policies or weaker institutional support may experience slower design-capital accumulation despite technological potential. These contextual limitations suggest that future empirical applications of DCTM must explicitly model governance maturity and digital-policy quality as moderating variables.

Taken together, the discussion reinforces the central thesis that global creative-economy transformation is increasingly structured around design capital as a scalable, accumulative, and digitally mediated productive resource. The convergence of software abstraction, platformization, and knowledge-based capital accumulation provides strong theoretical and empirical support for positioning design capital as a defining driver of contemporary economic restructuring. This finding advances existing creative-economy scholarship by offering a unified framework through which design can be analyzed not merely as symbolic production but as a measurable economic infrastructure shaping long-run productivity, competitiveness, and cross-border service-led growth.

Conclusion

This study demonstrates that the global creative economy is undergoing a structural transformation in which design capital increasingly functions as a measurable and scalable productive asset. The findings show that the rapid expansion of creative-service exports is closely associated with the growing dominance of intangible-value production, digital platformization, and software-enabled design systems that facilitate cross-border economic exchange. Unlike traditional creative outputs that depend on material production and localized value chains, contemporary creative services are increasingly organized through modular, codified, and digitally distributed design assets capable of generating repeated economic returns across jurisdictions.

The results confirm that digitalization serves as the primary enabling mechanism through which design capital accumulates and scales. Investments in digital infrastructure, software systems, knowledge-intensive routines, and institutional capability-building create the conditions under which design can be transformed into repeatable economic assets. This accumulation process supports a broader shift from goods-centered industrial production toward service-dominant, platform-enabled

value creation. Empirical patterns across global creative-service exports further suggest that regions with stronger digital readiness, institutional maturity, and knowledge-based capital formation exhibit greater capacity to capture export value through design-intensive services.

The study also advances the Design Capital Transformation Model (DCTM) as a coherent framework for understanding how design evolves from a symbolic creative function into an infrastructure-like productive resource. By conceptualizing design capital as accumulative innovation infrastructure, the model explains how software abstraction, platform ecosystems, and cross-border service architectures convert design capabilities into scalable and tradable economic assets. This framework extends existing theories of intangible capital and service-dominant logic by explicitly positioning design as a central mechanism linking digital transformation to macroeconomic restructuring.

A key contribution of this research lies in integrating insights from creative-economy scholarship, knowledge-based capital theory, multinational-enterprise research, and digital-platform economics into a unified explanatory model. This synthesis clarifies the distinctiveness of digital design capital compared to traditional intellectual capital and demonstrates how software-enabled codification amplifies design's scalability, transferability, and export potential. The study therefore contributes to the growing recognition that competitive advantage in digital economies increasingly depends on the strategic accumulation and deployment of design-intensive intangible assets.

Methodologically, the research provides a practical pathway for future empirical validation of DCTM through cross-national quantitative analysis. Structural equation modeling, input–output analysis, spatial econometrics, and meta-regression collectively offer a robust toolkit for testing causal relationships between digital infrastructure, design-capital intensity, and creative-service export growth. Future studies should further operationalize governance maturity, AI adoption, and platform-regulatory quality as moderating variables to improve explanatory precision across national contexts.

The implications of this study extend to policymakers and economic-development strategists. Strengthening digital infrastructure, supporting design education, encouraging R&D investment, and establishing adaptive digital-governance frameworks are critical for enabling economies to participate more effectively in service-led creative trade. Countries seeking long-term competitiveness must therefore recognize design capital not merely as a cultural or aesthetic resource, but as a strategic economic infrastructure essential to innovation, productivity growth, and global market integration.

Future research should test the DCTM empirically across diverse regional and institutional settings, refine comparative indicators of design-capital intensity, and explore the reinforcing role of artificial intelligence in accelerating design-based value creation. Such work will

deepen understanding of how design capital shapes the evolving architecture of the global digital economy and

clarify its long-term contribution to sustainable economic transformation.

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