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A Hybrid Framework for Strategic Management of National Export Products: The Product Classification Matrix (PCM)[1]

Ülke İhraç Ürünlerinin Stratejik Yönetimi İçin Hibrit Bir Çerçeve Önerisi: Ürün Sınıflandırma Matrisi

Erol IŞIKÇI
Dr., Bağımsız Araştırmacı,
isikcierol@gmail.com
https://orcid.org/0000-0002-7597-3099

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ABSTRACT

The subject of this article is the development of the Product Classification Matrix (PCM) as a hybrid framework for the strategic management of national export portfolios. The aim of the study is to present an integrated analytical structure that evaluates a country's export products by jointly using Revealed Comparative Advantage values and the relative growth or decline tendencies of world markets. The significance of the study lies in its ability to classify export products not only according to their current competitive strength but also in relation to changes in global market conditions. Within this scope, the product classification approach derived from a doctoral dissertation is reconsidered in light of the literature on export competitiveness, economic transformation, export potential, and strategic management. The study develops PCM as a conceptual-methodological framework and demonstrates its practical use through an illustrative application to Türkiye's export portfolio. Methodologically, the study examines the competitiveness levels of products alongside the development direction of world markets, transforming this information into an integrated decision-support structure consisting of measurement, classification, interpretation, and policy prioritization stages. The main finding and proposal of the study is that the Product Classification Matrix is not a single calculation tool but rather a complementary hybrid framework applicable to export promotion, industrial policy, market diversification, product strategy, inter-institutional communication, and resource allocation decisions.

Anahtar Kelimeler:

Açıklanmış Karşılaştırmalı Üstünlükler (AKÜ),

Ürün Sınıflandırma Matrisi,

İhraç Ürünleri,

ÖZET

Bu makalenin konusu, ulusal ihracata konu olan ürün / ürün gruplarının stratejik yönetimi için hibrit bir çerçeve önerisi olarak Ürün Sınıflandırma Matrisi'nin (ÜSM) geliştirilmesidir. Çalışmanın amacı, bir ülkenin ihracat ürünlerini, ortaya çıkan karşılaştırmalı üstünlük değerleri ile dünya pazarlarının göreceli büyüme veya daralma eğilimlerini bir arada kullanarak değerlendiren entegre bir analitik yapı sunmaktır. Çalışmanın önemi, ihracat ürünlerini sadece mevcut rekabet güçlerine göre değil, aynı zamanda küresel piyasa koşullarındaki değişikliklere göre de sınıflandırabilmesinden kaynaklanmaktadır. Bu kapsamda, doktora tezinden türetilen ürün sınıflandırma yaklaşımı, ihracat rekabet gücü, ekonomik dönüşüm, ihracat potansiyeli ve stratejik yönetim literatürü ışığında yeniden ele alınmaktadır. Çalışma, Ürün Sınıflandırma Matrisi'ni kavramsal-metodolojik bir çerçeve olarak geliştirmekte ve Türkiye ihracat portföyüne yönelik açıklayıcı bir uygulama üzerinden pratik kullanımını göstermektedir. Metodolojik olarak, çalışma, ürünlerin rekabet güçlerini dünya pazarlarının gelişim yönüyle birlikte incelemekte ve bu bilgileri ölçüm, sınıflandırma, yorumlama ve politika önceliklendirme aşamalarından oluşan entegre bir karar destek yapısına dönüştürmektedir. Çalışmanın temel bulgusu ve önerisi, Ürün Sınıflandırma Matrisi'nin tek başına bir hesaplama aracı değil; ihracatın teşviki, sanayi politikası, pazar çeşitlendirme, ürün stratejisi, kurumlar arası iletişim ve kaynak tahsisi kararlarına uygulanabilir, tamamlayıcı nitelikte hibrit bir çerçeve olduğudur.

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1 This article is derived from Erol Işıkçı's doctoral dissertation titled "*Türkiye İhracatında Ürün/Ürün Grupları Rekabet Güçlerinin Açıklanmış Karşılaştırmalı Üstünlükler (AKÜ) Endeksi Kullanılarak Analizi*" completed at Gazi University, Institute of Social Sciences, Department of Business Administration, in 2013. The manuscript reformulates the dissertation's Product Classification Matrix as a theoretically grounded hybrid framework for export portfolio strategy.

1. INTRODUCTION

In today's globalized economy, characterized by rapid technological change, shifting consumer preferences, and evolving trade patterns, countries must continuously assess and adapt their export strategies to maintain and improve their competitive positions in world markets. The ability to identify which products offer the greatest potential for export success has become essential for effective trade policy formulation. Hence, international trade competitiveness remains a central concern for policymakers seeking to enhance economic growth, create employment, and achieve sustainable development. In open economies, national prosperity increasingly depends not only on what a country is able to produce and export, but also on whether those products are positioned in markets that are expanding, technologically upgrading, or structurally declining. The strategic management of national export portfolios therefore requires a framework that can connect current export strengths with the future direction of world demand.

The Revealed Comparative Advantage (RCA) index has long been one of the most widely used empirical indicators for identifying export specialization. Since Balassa's seminal contribution, RCA has offered a practical way to infer comparative advantage from observed trade patterns (Balassa, 1965, 1977). Its appeal is clear: it is transparent, replicable, and applicable across countries, sectors, and product classifications. Yet RCA is also limited because it only tells the analyst whether a country is relatively specialized in a product, but it does not reveal whether global demand for that product is expanding or contracting. A country may have a strong RCA in a shrinking market, while a product with weak current RCA may belong to a rapidly growing market that warrants capability-building investment.

This article addresses that limitation by developing the Product Classification Matrix (PCM) as a hybrid framework for the strategic management of national export portfolios. The framework is derived from Işıkçı's (2013) doctoral dissertation, which used the RCA index to analyze Türkiye's export competitiveness across SITC Rev. 3 product groups and introduced a product classification logic based on both comparative advantage and world market growth. The dissertation's distinctive contribution was to move beyond static RCA analysis by considering whether each product group belonged to a growing or declining world market. In this study, that original contribution is reformulated as a generalizable, theoretically grounded framework for trade-policy and export-portfolio analysis.

The key conceptual claim of the article is that PCM should be treated not merely as a calculation tool but as a framework that integrates measurement, classification, interpretation, and policy prioritization. It combines RCA-based competitiveness measurement, global market-growth analysis, and portfolio-strategy logic into a single decision-support architecture. In this sense, PCM is better described as a hybrid framework: it draws on international trade theory, strategic management, and policy analytics to translate trade data into differentiated strategic choices.

The article makes three contributions. First, it clarifies the theoretical position of PCM by explaining how it bridges supply-side comparative advantage and demand-side market attractiveness. Second, it compares PCM with related approaches found in the literature, including traditional RCA variants, BCG-style portfolio matrices, TradeCAN/Export Performance Dynamics, product-space and economic-complexity approaches, export potential methods, and recent machine-learning export recommendation systems. Third, it converts the dissertation's Türkiye-based product classification into a general framework that can be applied to any country's export portfolio using publicly available trade data. Methodologically, this paper makes a conceptual-methodological contribution and develops, positions, and theoretically validates a framework that can be applied to any country's export portfolio using publicly available trade data from sources such as UN Comtrade or WITS.

In the following sections of the article, Section 2 reviews the theoretical foundations of comparative advantage, RCA-based competitiveness analysis, and related strategic frameworks in the literature. Section 3 presents the methodology of the Product Classification Matrix, including the RCA calculation, threshold interpretation, market-growth dimension, and four-group classification logic. Section 4 discusses the theoretical contribution of the PCM, demonstrates its use through Türkiye's export portfolio, compares it with existing approaches, and evaluates evidence regarding its usability and applicability. Section 5 concludes by summarizing the framework's main contribution, policy relevance, communication function, limitations, and directions for future research.

2. THEORETICAL BACKGROUND

Since Balassa's seminal 1965 contribution, the Revealed Comparative Advantage (RCA) index has served as the dominant empirical tool for measuring export competitiveness (Balassa, 1965). The RCA index identifies products in which a country exhibits relative export specialization compared to the world average, providing valuable insights into patterns of comparative advantage. Empirical applications of RCA analysis have proliferated across countries, sectors, and time periods, establishing it as a standard diagnostic in trade economics (Mkrtchyan, 2024; Jalata, 2021). Recent studies continue to apply RCA and its variants, including Normalized RCA (NRCA), Revealed Symmetric Comparative Advantage (RSCA), and Vollrath's alternative indices, to assess competitiveness in diverse contexts ranging from agricultural commodities to manufactured goods and services (Baran Satılmış, 2025; Aktaş Çimen and Ertekin, 2023; Powrel and Mishra, 2024; Kathuria, 2018).

However, despite its widespread adoption and analytical utility, the traditional RCA framework suffers from fundamental limitations that constrain its effectiveness as a strategic planning tool. First, RCA analysis is inherently static, providing a snapshot of comparative advantage at a given point in time without capturing dynamic market trends or future growth prospects (Yalçın, 2024). A product may exhibit strong RCA today but face declining global demand, while another product with weak current RCA may be positioned in a rapidly expanding market segment. Second, RCA is one-dimensional, focusing exclusively on supply-side export specialization while ignoring demand-side market dynamics (Bojnec and Fertő, 2015; Irshad et al., 2017). This supply-centric perspective fails to account for global market growth rates, demand trends, or the strategic attractiveness of different product markets. Third, RCA-based diagnostics often fail to translate into actionable strategic guidance for policymakers, who require clear prioritization frameworks for resource allocation, export promotion, and industrial policy interventions (Putro et al., 2024; Stanojević, 2025).

These limitations have prompted researchers to develop complementary approaches. The economic complexity and product space literature, pioneered by Hausmann and Hidalgo, offers sophisticated network-based methods for identifying diversification opportunities based on productive capabilities and product proximity (Jain, 2023; Hausmann and Hidalgo, 2011; Hidalgo et al., 2007). These approaches have enriched our understanding of structural transformation and capability accumulation, guiding industrial policy in numerous countries (Estmann et al., 2022; Sankot et al., 2023). Similarly, recent studies have begun to integrate RCA diagnostics with market concentration metrics, destination mapping, and demand forecasts to create product-market matrices for strategic export planning (Kaur and Sarin, 2017; La and Kim, 2024). Yet despite these advances, a significant gap remains: no existing framework systematically combines RCA-based competitiveness assessment with global market growth analysis within a simple, replicable, and universally applicable strategic tool.

This article addresses this gap by introducing the Product Classification Matrix (PCM), a novel two-dimensional analytical framework that extends traditional RCA analysis by integrating the dynamics of global market growth. The PCM classifies a country's export products into four strategic quadrants based on two dimensions;

1. The product's RCA level (*competitive vs. non-competitive*).
2. The global market's growth trajectory (*growing vs. declining*).

This classification generates four product groups: Group A (*competitive products in growing world markets*), Group B *(non-competitive products in growing world markets*), Group C (non-*competitive products in declining world markets*), and Group D (*competitive products in declining world markets*), each implying different priorities for export promotion, capability development, transition management, or limited policy support.

The PCM makes several important contributions to the literatures on international trade and competitiveness. Theoretically, it extends comparative advantage analysis from a static, supply-side measure to a dynamic, two-dimensional strategic framework that incorporates both supply-side capabilities and demand-side market opportunities. Methodologically, it provides a simple, transparent, and replicable procedure for classifying export products that can be applied to any country using readily available trade data. Practically, it offers policymakers a clear strategic tool for prioritizing export promotion efforts, allocating resources, and formulating industrial policies that align national capabilities with global market opportunities.

2.1. Comparative Advantage, RCA, and Export Competitiveness

The principle of comparative advantage, first articulated by David Ricardo in 1817, remains the cornerstone of international trade theory. Ricardo demonstrated that countries benefit from specializing in and exporting goods in which they possess relative productivity advantages, even when they lack absolute advantages in any product. This fundamental insight has shaped trade policy and economic thinking for over two centuries, providing the theoretical foundation for arguments favoring trade liberalization and specialization.

Modern trade theory has extended and refined Ricardo's original framework through various models incorporating factors such as factor endowments (Heckscher-Ohlin), economies of scale, product differentiation, and firm heterogeneity. The neoclassical Heckscher-Ohlin model attributes comparative advantage to differences in factor endowments, predicting that countries will export goods that intensively use their abundant factors.

Despite these theoretical advances, empirically measuring comparative advantage has remained challenging. Traditional approaches based on autarky prices or factor content are impractical due to data limitations. This measurement challenge motivated the development of "*revealed*" comparative advantage indices that infer comparative advantage from observed trade patterns, leading to Balassa's influential contribution.

Balassa introduced the Revealed Comparative Advantage (RCA) index in 1965 as an empirical measure of comparative advantage based on observed export patterns (Balassa, 1965). The Balassa RCA index compares a country's share of world exports in a particular product to its share of total world exports across all products. An RCA value greater than unity indicates that the country has a revealed comparative advantage in that product, meaning it exports the product more intensively than the world average.

The Balassa RCA index has become the most widely used empirical measure of export competitiveness, applied extensively across countries, products, and time periods. Recent empirical studies continue to demonstrate its utility. However, researchers have identified several technical limitations of the original Balassa formulation. The index is asymmetric, ranging from zero to infinity for products with comparative advantage but bounded between zero and one for products without advantage. This asymmetry complicates statistical analysis and cross-product comparisons. Additionally, the Balassa RCA can be sensitive to country size and the level of aggregation (Suparmono et al., 2022).

These concerns have motivated the development of alternative and normalized RCA measures. Vollrath proposed three alternative indices: Relative Export Advantage (RXA), Revealed Competitiveness (RC), and Relative Import Penetration (RMP), which incorporate import data alongside exports to provide a more complete picture of trade performance (Vollrath, 1991). The Normalized RCA (NRCA) and Revealed Symmetric Comparative Advantage (RSCA) indices transform the Balassa RCA to achieve symmetry and bounded ranges, facilitating statistical analysis (Laursen, 2015). Additional complementary indices have been developed to capture different dimensions of competitiveness. The Comparative Export Performance (CEP) index measures a country's export performance relative to a reference group. The Trade Balance Index (TBI) assesses whether a country is a net exporter or importer of a product. The Grubel-Lloyd Index (GLI) measures intra-industry trade intensity. These indices are often used alongside RCA to provide a more comprehensive competitiveness assessment (Haque et all., 2013).

Despite these methodological refinements, all RCA-based measures share a fundamental limitation: they are supply-side, static indicators that do not account for market growth dynamics or future demand prospects. As Irshad et al. note in their analysis of Pakistan's external sector, RCA indices identify current export specialization patterns but do not necessarily predict future export success or market opportunities (Irshad et al., 2017). This limitation motivates the need for frameworks that integrate RCA diagnostics with demand-side market analysis.

2.2. Product Space and Economic Complexity Approaches

A significant advance in understanding export competitiveness and diversification opportunities came with the development of the product space and economic complexity frameworks by Hausmann, Hidalgo, and colleagues (Jain, 2023; Hausmann and Hidalgo, 2011). These approaches conceptualize the economy as a network of products connected by the capabilities required to produce them. Countries are more likely to develop comparative advantage in products that are "*nearby*" in the product space, products that require similar productive capabilities to those already present in the economy.

The Economic Complexity Index (ECI) measures the sophistication of a country's productive structure based on the diversity and ubiquity of its exports. Countries with high ECI export a diverse range of products that few other countries can produce, indicating sophisticated productive capabilities. The Product Complexity Index (PCI) measures the sophistication of individual products based on the capabilities required to produce them. These indices have been shown to predict future economic growth and income levels (Hausmann et al., 2014; Hausmann et al., 2007).

Recent applications demonstrate the policy relevance of these approaches. Estmann et al. (2022) developed a merchandise export diversification strategy for Tanzania by combining product space analysis with demand-driven gravity models, identifying industries that are both feasible given Tanzania's current capabilities and attractive given global demand patterns. El-Haddad (2020) used product space methodology to identify leading sectors for Egypt and Tunisia, recommending specific products for policy prioritization based on complexity, opportunity gain, and world trade share. Sankot et al. (2023) mapped Czechia's capabilities and export opportunities using PCI and product space methods, identifying optimal diversification paths toward more complex products.

The product space approach has also been extended and refined. Ren et al. (2020) introduced nestedness as an alternative measure of product complexity in multilayer trade networks, providing new insights into trade competitiveness and economic development. Brummitt et al. (2020) used machine learning to analyze export dynamics, finding that diversification, particularly into more sophisticated products, drives economic development. Shahmoradi et al. (2024) applied economic complexity under scenario-based planning to develop industrial policies for Iran, recommending prioritization based on Opportunity Gain Index (OGI) rather than PCI alone.

While the product space and economic complexity literature has significantly enriched our understanding of structural transformation and capability accumulation, these approaches have limitations for strategic export planning. They focus primarily on supply-side capabilities and product proximity, with less attention to demand-side market dynamics such as global market growth rates or market size. Additionally, the sophisticated network methods and data requirements may be challenging for policymakers in developing countries to implement. The PCM framework complements these approaches by providing a simpler tool that explicitly integrates market demand dynamics with competitiveness assessment.

2.3. Product-Market Matrices in Trade Strategy

Recognizing the limitations of one-dimensional competitiveness measures, recent applied research has developed product-market matrices that combine multiple dimensions to guide export strategy. These matrices typically integrate product competitiveness (*measured by RCA or similar indices*) with market characteristics such as growth potential, stability, and accessibility (Kaur and Sarin, 2017).

For example, Putro et al. (2024) developed an export destinations mapping framework for Indonesian tea products that combines RCA with market growth analysis and destination concentration metrics. Jain (2023) created a trade competitiveness and potential mapping for Indian exports, integrating RCA with market size and growth indicators to identify priority product-destination pairs. These studies demonstrate the practical value of multi-dimensional frameworks for strategic export planning.

The integration of RCA with market demand analysis has also appeared in policy-oriented research. Estmann et al. (2022) combined supply-side product space analysis with demand-driven gravity models to identify export opportunities for Tanzania that are both feasible (given current capabilities) and attractive (given market demand and trade resistance). Hausmann et al. (2020) developed a roadmap for Jordan's investment promotion and export diversification that considers both capability proximity and market attractiveness factors including labor skills, resource intensity, and FDI potential.

However, existing product-market matrices vary widely in their construction, dimensions, and classification schemes, limiting their comparability and replicability across countries. Many are country-specific applications without a clear universal framework. The PCM addresses this gap by providing a standardized, replicable two-dimensional classification based on two fundamental dimensions, *comparative advantage* and *market growth* that can be applied consistently across any country's export portfolio.

2.4. Limitations of Existing Approaches

Despite the substantial literature on export competitiveness measurement, several critical gaps remain. First, traditional RCA analysis is static, providing a snapshot of current comparative advantage without capturing dynamic market trends. As Bojnec and Fertő (2015) note in their analysis of EU fruit and vegetable exports, RCA values can fluctuate over time, and historical advantage does not guarantee future competitiveness. The static nature of RCA limits its utility for forward-looking strategic planning.

Second, RCA-based measures are supply-centric, focusing on a country's export specialization relative to the world without considering whether the global market for that product is growing or declining. A country may have strong RCA in a product facing declining global demand, or weak RCA in a product with explosive growth potential. As Suparmono et al. (2022) observe, RCA alone does not guarantee high export volumes or market success. This supply-side bias creates a blind spot in strategic export planning.

Third, existing frameworks lack a simple, universal classification scheme that translates competitiveness diagnostics into clear strategic categories. While product space and economic complexity approaches offer sophisticated analytical tools, their complexity and data requirements may limit accessibility for policymakers, particularly in developing countries. As Chakrabartty and Sinha (2022) note, there is a need for composite measures that integrate multiple dimensions of competitiveness in a transparent and interpretable manner.

Fourth, the connection between competitiveness analysis and strategic policy action remains underdeveloped. Many RCA studies identify products with comparative advantage but provide limited guidance on how to prioritize among them or what specific policy interventions are appropriate. As Stanojević (2025) observes in analyzing Serbian fruit exports to Egypt, identifying comparative advantage is only the first step; understanding market opportunities and formulating appropriate strategies requires additional analysis.

The Product Classification Matrix addresses these limitations by providing a dynamic, two-dimensional, universally applicable framework that integrates supply-side comparative advantage with demand-side market growth dynamics, generating clear strategic categories that guide policy prioritization and resource allocation decisions. By bridging the gap between competitiveness diagnostics and strategic action, the PCM transforms RCA from a descriptive measure into a prescriptive strategic tool.

2.5. RCA-Based Studies in the Literature

The Revealed Comparative Advantage (RCA) index has been widely used in academic articles, policy reports, sectoral analyses, and graduate research to evaluate export competitiveness across countries, sectors, and product groups. Its popularity derives from its transparent structure, reliance on observable trade data, and ability to compare a country's export specialization with the global export structure. However, the literature also shows that RCA is generally employed as a diagnostic indicator rather than as a complete strategic framework. This distinction is important for positioning the Product Classification Matrix (PCM), because the proposed framework builds on RCA but extends it by incorporating market dynamics, interpretive classification, and policy prioritization.

A first group of studies uses RCA mainly to identify sectoral or product-level competitiveness. French (2017) critically evaluates the usefulness of RCA indicators and argues that different RCA measures may be appropriate for different analytical purposes, including identifying comparative advantage patterns, assessing the effects of trade barriers, and detecting close competitors in specific markets. Shukla et al. (2023) examine agricultural trade between India and China by using RCA and RSCA indices, showing differences in export diversification and specialization patterns. These studies confirm the continued relevance of RCA as a basic competitiveness indicator.

A second group of studies combines RCA with additional indicators to produce a broader trade-performance assessment. Kang et al. (2022) analyze South Korea's product competitiveness and partner dependence by combining RCA with a nonlinear iterative method, showing that export competitiveness should be evaluated together with diversification and trade-dependence structures. Erokhin et al. (2020) use RCA together with Relative Trade Advantage, Lafay Competitive Advantage, and Domestic Resource Cost measures to assess competitive advantages in Central Asian agricultural value chains. Maryam et al. (2018) employ RCA together with trade intensity and export similarity indices to examine intra-BRICS trade patterns. These studies are relevant

because they show that RCA often needs to be complemented by other indicators to produce policy-relevant interpretations.

The Turkish literature also contains a substantial number of RCA-based studies. Sarıçoban et al. (2017) analyze Türkiye's export competitiveness in manufacturing product groups for the 1996–2015 period by using SITC Rev. 3 three-digit data and Vollrath-type RCA calculations. Their findings indicate that Türkiye had competitive advantage in 57 of 157 manufacturing product groups, while 100 product groups showed competitive disadvantage. This study is important because it evaluates competitiveness at a relatively disaggregated product-group level and therefore provides a close methodological context for product-based classification approaches.

Kesgingöz (2018) examines Türkiye's industrial competitiveness for the 2001–2017 period by using RCA, RSCA, and the Trade Balance Index at the HS two-digit level. The study reports that, among 73 industrial chapters, Türkiye had revealed comparative advantage in 34 chapters according to RCA, competitiveness in 31 chapters according to RSCA, and net-exporter status in only 19 chapters according to the Trade Balance Index. This finding is particularly important because it shows that revealed comparative advantage does not necessarily imply a strong net-export position, reinforcing the need for multi-layered interpretation.

Sector-specific Turkish studies further demonstrate the flexibility of RCA analysis. Başkol and Bektaş (2021) examine the Turkish iron and steel sector for the 2000–2019 period by using RCA, RSCA, the Trade Balance Index, and Widodo's product mapping method. Their findings show that some sub-sectors had both comparative advantage and net-exporter status, while others combined comparative advantage with net-importer status. This study is especially relevant for the PCM because it shows how RCA can be embedded in a product-mapping logic rather than used only as a stand-alone index.

Other studies apply RCA to strategically important or sector-specific areas in Türkiye. Serin and Yeldan (2023) examine Türkiye's competitiveness in selected defense industry products by using RCA and Comparative Export Performance indices. Their findings show that Türkiye achieved high competitive power in armored vehicle exports over the 2010–2020 period and displayed varying export performance across artillery, missile, and ship product groups. Similarly, Akyüz et al. (2020) analyze the competitiveness of Türkiye's forest products industry through the revealed comparative advantage approach and show that competitiveness varies significantly across sub-product groups. These studies indicate that RCA-based analysis can be applied not only to conventional manufacturing and agricultural sectors but also to strategic and resource-based industries.

Institutional reports and policy-oriented publications in Türkiye provide an additional layer of evidence. The Central Bank of the Republic of Türkiye has used RCA explicitly in its analysis of Türkiye's services exports. In that analysis, RCA values are calculated for twelve service sectors for the 2013–2019 period, and travel and transport services are identified as sectors in which Türkiye has high relative advantage, while insurance and maintenance/repair services show moderate relative advantage. This demonstrates that RCA is not confined to academic research; it is also used by policy institutions to assess sectoral strengths and export potential.

Some institutional competitiveness studies do not use RCA directly but provide complementary evidence for the strategic interpretation of export competitiveness. TÜSİAD's Cost-Based Competitiveness Index monitors production-cost trends in Türkiye's ten exporting manufacturing sectors relative to competitor countries by considering intermediate goods, energy, labor, and financing costs. This type of institutional work does not replace RCA analysis but helps explain why revealed comparative advantage may strengthen or weaken over time by adding cost and productivity-related dimensions.

KOSGEB's firm-level diagnostic work is also relevant as a complementary institutional source. Through its Business Evaluation Report initiative, KOSGEB provides exporting SMEs with information on their export ranking by sector and region, their export position over time, and firm-level assessments across multiple dimensions. Although this is not an RCA-based framework, it can complement product-level RCA analysis by connecting national or sectoral competitiveness findings with the capabilities and constraints of exporting enterprises.

Taken together, the literature indicates that RCA is a well-established and widely applied measure of export competitiveness in both international and Turkish contexts. However, most RCA-based studies either remain descriptive or need to be combined with other indicators to generate strategic implications. The Turkish evidence is particularly instructive: RCA has been used in manufacturing, industry, services, iron and steel, defense products, forest products, agriculture, and textile-related analyses, while institutional reports by organizations such as the Central Bank of the Republic of Türkiye, TÜSİAD, and KOSGEB provide complementary policy and firm-level perspectives. The Product Classification Matrix (PCM) contributes to this body of work by using RCA

as one analytical layer and combining it with world market growth trends, classification logic, interpretation, and policy prioritization. Therefore, the proposed matrix does not replace RCA-based analysis; rather, it transforms RCA from a single competitiveness indicator into part of a broader hybrid decision-support framework.

2.6. Related Frameworks in the Literature

The closest related approaches can be grouped into six families. First, RCA and RCA-variant studies provide the measurement foundation but do not typically generate a portfolio strategy. Second, BCG-inspired national or product portfolio studies provide the strategic logic but are not always grounded in a standardized RCA-market growth method. Third, TradeCAN and Export Performance Dynamics integrate market-share and demand movements but are more focused on export performance trajectories than on a general RCA-based policy classification. Fourth, product-space and economic-complexity approaches identify feasible diversification paths based on productive capabilities but are more computationally demanding and less immediately interpretable for a simple national export portfolio. Fifth, export potential approaches combine supply, demand, and market-access factors, often at product-destination level, but usually do not classify the whole export portfolio into four strategic categories. Sixth, machine-learning systems increasingly recommend export products, but their algorithmic sophistication may reduce transparency for policy communication.

Table 1. Related Approaches Compared with the Product Classification Matrix (PCM)

Approach	Main analytical logic	Contribution to PCM	Difference from PCM
RCA and RCA variants	Export specialization relative to the world average	Provide the competitiveness axis and measurement foundation	Do not include market growth or portfolio-specific policy categories
BCG growth-share matrix	Market growth and relative market share	Provides a portfolio language and strategic quadrant logic	Firm-level framework; not a national trade-competitiveness measure
TradeCAN / EPD	Market share and import-demand changes	Adds dynamic demand-performance logic	Less directly tied to RCA and less focused on a four-part policy framework
Product space / economic complexity	Product proximity, capabilities, complexity, and diversification feasibility	Useful for identifying which Potential products are feasible to develop	More complex and capability-centered; does not directly classify existing exports by RCA and market growth
Export potential tools	Supply capacity, demand, market access, and bilateral trade frictions	Useful for destination-level targeting after PCM classification	Does not usually classify the whole portfolio as Stars, Potential, Cash Cows, and Dogs
Machine-learning export portfolio tools	Algorithmic recommendation based on similarity, product space, or growth patterns	Can enrich PCM with predictive signals	Less transparent and less immediately communicable for policy stakeholders

Source: Prepared by the author based on the literature reviewed in this article.

Table 1 compares six established analytical approaches with the Product Classification Matrix (PCM) across three dimensions: their core logic, contribution to the PCM framework, and key differences. While each approach offers valuable insights ranging from RCA-based competitiveness measures to machine-learning algorithms, none individually captures the combination of export competitiveness and market growth dynamics that PCM integrates into a single four-category policy framework. The PCM thus synthesizes the strengths of these complementary approaches while maintaining transparency and direct policy applicability.

3. METHODOLOGY: CONSTRUCTING THE PRODUCT CLASSIFICATION MATRIX

Revealed comparative advantage (*RCA, often the Balassa index*) is widely used to measure a country's export specialization and competitiveness. Therefore, RCA has become a core empirical tool for linking classical comparative advantage theory with observed export specialization and competitiveness patterns. Building on Ricardo's notion that relative productivity shapes trade patterns, RCA exploits actual trade flows to infer the sectors in which a country appears to be competitively specialized (Shukla et al., 2023). The foundation of the Product Classification Matrix is the Balassa Revealed Comparative Advantage (RCA) index, which measures a country's export specialization in a particular product relative to the world average (Balassa, 1965). The RCA index is calculated as:

$$RCA_{ij} = \frac{X_{ij}/X_{iw}}{X_{wj}/X_{ww}}$$

X_{ij} = exports of product j by country i

X_{iw} = total exports of country i (all products) (1)

X_{wj} = world exports of product j (all countries)

X_{ww} = total world exports (all countries, all products)

The numerator represents country i's share of its total exports accounted for by product j, while the denominator represents product j's share of total world exports. The RCA index thus compares a country's export intensity in a product to the world's export intensity in that product. When the RCA value is greater than one,the country is interpreted as having a revealed comparative advantage in that product. Conversely, an RCA value below one indicates that the product is less represented in the country's export structure than in world trade, suggesting revealed comparative disadvantage.

Although the RCA index is valued for its simplicity and transparency, its interpretation requires caution. The original Balassa index is asymmetric and may be affected by product aggregation, country size, and the structure of trade flows. For this reason, the literature has proposed alternative and complementary indices, including Vollrath's revealed advantage measures, the Revealed Symmetric Comparative Advantage index, and more recent composite RCA approaches (Chakrabartty and Sinha, 2022; Laursen, 2015; Vollrath, 1991). These refinements do not reduce the relevance of the Balassa index; rather, they show that RCA should be treated as a diagnostic measure whose interpretation may be strengthened through classification, comparison, and contextual analysis (French, 2017; Leromain and Orefice, 2014).

For the interpretation of RCA intensity, this study follows the threshold logic commonly associated with Hinloopen and van Marrewijk (2001). This classification distinguishes between the absence of comparative advantage, weak comparative advantage, moderate comparative advantage, and strong comparative advantage. It is especially useful because it avoids treating all RCA values above one as equivalent. In export strategy, a product with an RCA value slightly above one does not have the same strategic meaning as a product with an RCA value substantially above four. The threshold structure used in this study is presented in Table 2.

Table 2. Interpretation of RCA Values

RCA Range	Interpretation
$0 < RCA <= 1$	No revealed comparative advantage; comparative disadvantage exists
$1 < RCA <= 2$	Weak revealed comparative advantage
$2 < RCA <= 4$	Moderate revealed comparative advantage
$RCA > 4$	Strong revealed comparative advantage

Source: Adapted from the threshold interpretation discussed by Hinloopen and van Marrewijk (2001)

The Product Classification Matrix (PCM) builds on this RCA logic but extends it by adding a second analytical dimension: the direction of the world market for each product or product group. In the original RCA framework, a product is classified only according to whether it has revealed comparative advantage. However, this provides limited strategic information. A product may be competitive for the country but located in a shrinking world market; similarly, a product may not yet be competitive but may belong to a rapidly expanding global market. The PCM therefore combines supply-side competitiveness with demand-side market dynamics.

For ease of strategic communication, this study adopts portfolio labels analogous to those used in BCG-style frameworks (Henderson, 1970): *Group A* products are referred to as Stars (competitive, growing market); *Group B* as Potential (non-competitive, growing market); *Group C* as Dogs (*non-competitive, declining market*) and *Group D* as Cash Cows (competitive, declining market). These labels are used interchangeably with the group designations throughout the remainder of the paper. In practical terms, the PCM classifies export products by considering both their RCA values and the change in the product's share or size in world trade over a selected period. This allows export products to be evaluated not only in terms of their existing competitive position but also in terms of their future market potential. The classification logic is presented in Table 3.

Table 3. Basic Logic of the Product Classification Matrix

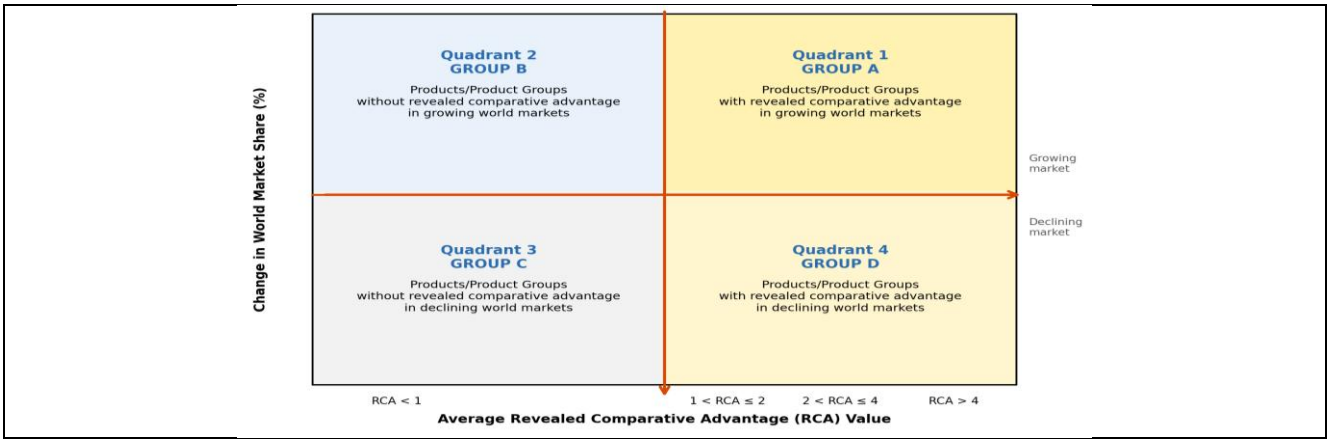
Competitiveness Position	Growing World Market	Declining World Market
$RCA > 1$	Group A: Products with revealed comparative advantage in growing world markets	Group D: Products with revealed comparative advantage in declining world markets
$RCA < 1$	Group B: Products without revealed comparative advantage in growing world markets	Group C: Products without revealed comparative advantage in declining world markets

Source: Prepared by the author based on the Product Classification Matrix developed in the doctoral dissertation.

In this classification, Group A includes products that combine revealed comparative advantage with a growing world market. These products represent the strongest strategic position because the country already has a competitive export base and the global market environment is favorable. Group B includes products for which the country does not yet have revealed comparative advantage but which are located in growing world markets. These products may be important for capability development, selective support, and future diversification strategies. Group C includes products that lack revealed comparative advantage and are also located in declining world markets. These products generally have lower strategic priority unless they are important for employment, regional policy, supply security, or other non-commercial reasons. Finally, Group D includes products in which the country has revealed comparative advantage but which are located in declining world markets. These products may still generate export revenue, yet they require careful monitoring because their long-term growth potential may be limited.

The matrix combines two dimensions: (i) the average revealed comparative advantage (RCA) value of a product or product group, and (ii) the direction of change in the corresponding world market. Products are classified into four groups according to whether they possess revealed comparative advantage and whether the world market is expanding or declining:

Figure 1. The Product Classification Matrix(*[2])



Source: Developed by the author

[2] *Explanatory Notes for the Figure:*

Horizontal axis: The horizontal axis represents the average revealed comparative advantage (RCA) value. Values below 1 indicate no revealed comparative advantage, while values above 1 indicate increasing levels of competitive strength.

Vertical axis: The vertical axis represents the direction of change in world market share. The upper half indicates growing markets, whereas the lower half indicates declining markets.

Group A: Products/Product Groups with revealed comparative advantage in growing world markets. These products occupy the strongest strategic position because they combine current competitiveness with favorable market dynamics.

Group B: Products/Product Groups without revealed comparative advantage in growing world markets. These products may be relevant for selective support, capability development, and future diversification strategies.

Group C: Products/Product Groups without revealed comparative advantage in declining world markets. These products generally have limited strategic importance and normally remain a low policy priority unless justified by non-commercial objectives.

Group D: Products/Product Groups with revealed comparative advantage in declining world markets. These products may still generate export earnings, but they should be monitored carefully because their long-term growth prospects are limited.

Figure 1 presents the Product Classification Matrix (PCM), which constitutes the core analytical model of this study. The matrix is constructed by combining two dimensions: the average revealed comparative advantage (RCA) value of each product or product group and the direction of change in the corresponding world market. The horizontal axis reflects the degree of export competitiveness, while the vertical axis indicates whether the relevant world market is expanding or declining. On this basis, products are classified into four groups:

Group A consists of products with revealed comparative advantage in growing world markets;

Group B includes products without revealed comparative advantage in growing world markets;

Group C covers products without revealed comparative advantage in declining world markets;

Group D contains products with revealed comparative advantage in declining world markets.

This classification enables the transformation of RCA from a one-dimensional indicator into a broader strategic framework for the assessment and prioritization of export products.

3.1. Data Logic and Measurement Layers

PCM requires two core inputs. The first is an indicator of product-level country competitiveness. The standard and most transparent option is Balassa's RCA index, although the framework can also accommodate RSCA, NRCA, composite RCA, or other validated competitiveness measures. The second input is a measure of global market growth, usually calculated as the change in world exports of a product over a selected period. The original dissertation used SITC Rev. 3 product groups and compared Türkiye's export position with changes in world market shares over the 2003-2012 period (Işıkçı, 2013). Future applications can use HS 4-digit or HS 6-digit data, depending on the desired level of granularity and data quality.

The RCA axis is interpreted as competitive position. When RCA is greater than one, the country is treated as having a revealed comparative advantage in the product. When RCA is below one, the country is treated as lacking revealed comparative advantage. The market-growth axis is interpreted as market attractiveness. Products whose world market is expanding are classified as belonging to growing markets; products whose world market is contracting or losing relative share are classified as belonging to declining markets.

The PCM therefore transforms the RCA index from a single measurement indicator into a broader interpretive framework. RCA alone identifies whether a country is relatively specialized in a product; the PCM adds the market dimension and translates the result into policy-relevant categories. In this sense, the PCM is consistent with the broader literature arguing that RCA analysis becomes more useful when it is embedded in multidimensional and policy-oriented competitiveness assessments (French, 2017; Laursen, 2015; Leromain and Orefice, 2014).

For use in empirical applications, the calculation procedure can be summarized in four steps. First, RCA values are calculated for each product or product group using the selected trade classification system, such as SITC or HS. Second, each product's world market trend is identified by examining whether the relevant world market expands or contracts over the selected period. Third, products are placed into one of the four PCM groups according to their RCA position and market direction. Fourth, the resulting classification is interpreted in relation to export promotion, industrial policy, market diversification, capability development, and resource allocation decisions. This procedure allows the analyst to move from descriptive measurement to strategic evaluation.

3.2. Methodological Strengths of RCA

RCA's enduring popularity rests largely on its *simplicity, low data requirements, and intuitive interpretation*. It uses readily available export data and yields a scalar signal of product-level competitiveness, making it attractive for policy and empirical work (Tampubolon, 2019). It also supports comparative assessment across products and countries and dynamic analysis over time, characteristics that make it a "*competent index*" for many academic and policy uses (Shukla et al., 2023).

If RCA_ij>1: Country i has a revealed comparative advantage in product j, meaning it exports this product more intensively than the world average. The country is relatively specialized in this product. If RCA_ij<1: Country i has a revealed comparative disadvantage in product j, meaning it exports this product less intensively than the world average. The country is relatively unspecialized in this product. If RCA_ij=1: Country i's export intensity in product j exactly matches the world average.

The RCA index is dimensionless and ranges from zero to infinity. Values significantly above unity indicate strong comparative advantage, while values close to zero indicate minimal or no export presence in that product. The threshold of unity provides a natural and widely accepted criterion for classifying products as competitive (RCA > 1) or non-competitive (RCA < 1) (Mkrtchyan, 2024; Jalata, 2021).

While alternative formulations such as NRCA, RSCA, and Vollrath's indices offer certain technical advantages, the original Balassa RCA remains the most widely used and easily interpretable measure (Baran Satılmış, 2025; Aktaş Çimen and Ertekin, 2023; Powrel and Mishra, 2024). Its simplicity, transparency, and extensive empirical validation make it the appropriate foundation for the PCM framework. For robustness, analysts may calculate multiple RCA variants and verify that product classifications are consistent across measures.

3.3. Limitations: Asymmetry, Scale, Aggregation, and Instability

The literature identifies several methodological limitations that constrain the use of Revealed Comparative Advantage (RCA) as a stand-alone measure of export competitiveness. A central concern is the asymmetric and highly skewed distribution of the Balassa RCA index, which ranges from zero to infinity and often produces unstable means and non-normal distributions. These properties may weaken its suitability for econometric analysis, ordinal comparison, and cross-product ranking, particularly when RCA values are used as explanatory or dependent variables in regression-based studies (Shukla et al., 2023). Although transformations such as the Revealed Symmetric Comparative Advantage (RSCA) index reduce asymmetry by converting RCA into a bounded and more symmetric scale, they do not fully eliminate the underlying sensitivity of revealed advantage measures to data structure, product coverage, and the distribution of export values.

A second group of limitations concerns ranking inconsistency, scale sensitivity, aggregation bias, and product-classification effects. Empirical studies show that RCA-based rankings do not always correspond to export-share rankings, which may generate misleading interpretations of competitiveness when large export sectors receive low RCA values or smaller niche products receive disproportionately high scores (Tampubolon, 2019). This problem is especially relevant when analyses are conducted across highly disaggregated product categories, where the choice of HS level, sectoral boundaries, and product inclusion criteria can materially affect results.

In response, some studies restrict the analysis to a narrower set of major export products to obtain more intuitive rankings; however, such adjustments also demonstrate that RCA outcomes are sensitive to sample selection and aggregation choices. Relatedly, Chakrabartty and Sinha (2022) argue that conventional Balassa-type RCA indices are not directly applicable to composite sector-level analysis without additional aggregation procedures, because they are originally defined at the product level and do not adequately capture sectoral comparative advantage over time. Their critique motivates the development of composite and dynamic RCA variants that attempt to measure broader and more temporally stable patterns of competitiveness.

Finally, standard RCA measures remain limited because they reveal observed trade performance rather than the structural foundations of competitiveness. Since RCA is calculated from realized export flows, it may be affected by exchange-rate movements, trade barriers, temporary price shocks, policy distortions, and short-term fluctuations in global demand rather than by underlying productivity, technology, cost efficiency, or capability-based advantages (Chakrabartty and Sinha, 2022; Leromain and Orefice, 2014).

In addition, the conventional RCA index is largely static and base-period dependent, making it insufficient for tracing the evolution or persistence of comparative advantage across time. Dynamic indices and micro-founded measures partially address these weaknesses, but they also increase methodological complexity and data requirements. Therefore, RCA is best understood as a useful diagnostic indicator of export specialization rather than a complete or definitive measure of national competitiveness. Its interpretation should be complemented with additional indicators such as market growth, export concentration, productivity, technological capability, product complexity, and resilience.

4. DISCUSSION

The Product Classification Matrix (PCM) represents a meaningful and timely advance in export competitiveness analysis. It transforms the widely used and well-validated Revealed Comparative Advantage index from a static, one-dimensional diagnostic into a dynamic, two-dimensional strategic tool that bridges comparative advantage theory with global market demand analysis. This section first discusses the theoretical contributions of the

framework , then illustrates its application to Türkiye's export portfolio, after than compares it with existing approaches, and finally reviews the evidence supporting its usability and applicability.

4.1. Theoretical Contributions of the PCM

The Product Classification Matrix (PCM) makes several foundational theoretical contributions to the international trade and competitiveness literature. At its core, the PCM transforms the Revealed Comparative Advantage index from a static, one-dimensional diagnostic into a dynamic, two-dimensional strategic instrument. The original Balassa (1965) formulation identifies products in which a country exhibits export specialization relative to the world at a given point in time, but provides no structural information about whether those advantages are positioned in expanding or contracting global markets. This constitutes a critical analytical blind spot. By explicitly integrating global market growth dynamics as a second axis, the PCM enables policymakers and analysts to distinguish between competitive products in growing markets (Stars) and competitive products in declining markets (Cash Cows) as a distinction that is entirely invisible in traditional RCA analysis yet decisive for strategic planning.

This theoretical extension responds to a well-documented limitation in the competitiveness literature. Bojnec and Fertő (2015) observe that RCA values fluctuate considerably over time and that historical comparative advantage does not reliably predict future export performance. Similarly, Suparmono et al. (2022) note that a positive RCA does not ensure export volume, market stability, or sustained revenue growth. These empirical observations collectively underscore the inadequacy of single-dimension RCA analysis for strategic export planning and validate the PCM's two-dimensional approach.

A second major theoretical contribution is the PCM's capacity to bridge supply-side and demand-side perspectives on export competitiveness. Traditional RCA analysis is inherently supply-centric: it measures what a country actually exports relative to the world, without accounting for global demand conditions (Laursen, 2015). The economic complexity and product space literature, while offering sophisticated insights into capability accumulation and productive knowledge, also focuses primarily on supply-side factors such as productive capabilities, product proximity, and economic fitness (Hausmann and Hidalgo, 2011; Hidalgo et al., 2007). The PCM complements these approaches by explicitly incorporating demand-side market dynamics, acknowledging that export success is a function of both competitive capability and market opportunity. This integration is conceptually aligned with calls in the literature for frameworks that combine supply and demand factors (Estmann et al., 2022; Hausmann et al., 2020) .

Third, the PCM establishes a clear, actionable typology for strategic prioritization. A persistent challenge in the applied competitiveness literature is the gap between analytical output and policy prescription: RCA studies identify products with comparative advantage but provide limited guidance on how to prioritize among them or what specific interventions are warranted (Stanojević, 2025; Putro et al., 2024; Stellian and Danna-Buitrago, 2022). The PCM's four-quadrant classification generates strategic categories -Stars, Potential, Cash Cows, and Dogs- each with distinct characteristics and corresponding policy responses. This typology provides a transparent, replicable framework for resource allocation grounded in objective, quantitative criteria, addressing the theory-to-practice gap that has limited the policy utility of traditional RCA analysis.

Finally, the PCM connects international trade theory with strategic management concepts, drawing on the structural logic of the Boston Consulting Group's growth-share matrix (Henderson, 1970) while grounding it in the rigorous empirical foundations of trade economics. This cross-disciplinary bridge enriches both fields: it introduces strategic management portfolio thinking to trade policy analysis, while anchoring strategic management concepts in the comparative advantage theory of international economics. The result is a framework that is simultaneously theoretically sound, empirically operational, and practically actionable.

4.2. Applying PCM to Türkiye's Export Portfolio

The practical value of PCM can be demonstrated through Türkiye's export portfolio by using the empirical foundations from which the framework was originally derived. Işıkçı's (2013) doctoral dissertation applied the classification logic to Türkiye's export products at the SITC Rev. 3 product-group level for the 2003-2012 period. The dissertation calculated average RCA values, compared product-group positions with changes in world-market shares, and classified products into four groups. The dissertation findings show why the matrix adds information beyond standard RCA analysis. Using the Balassa RCA thresholds, the study identified 21 SITC product groups

in which Türkiye had revealed comparative advantage and 43 product groups in which it had revealed comparative disadvantage for the 2003-2012 period. Among the advantaged product groups, 13 had weak comparative advantage, four had moderate comparative advantage, and four had strong comparative advantage (Işıkçı, 2013). However, the PCM logic went further by asking whether these product groups were located in relatively growing or declining world markets. For instance, product groups such as gold, inorganic chemical products, processed vegetable and animal oils, cereals, rubber articles, and iron and steel appeared in the growing-market / competitive region, whereas textile products, apparel, motor vehicles, tobacco products, furniture, fertilizers and mineral materials, and fruit and vegetables were positioned in the declining-market / competitive region. This distinction is precisely the strategic insight that RCA alone cannot provide.

A more recent policy-oriented RCA application by the Turkish Exporters Assembly also supports the practical relevance of the PCM logic. The RCA 1000 report first identified the world's 1,000 most imported products and then determined the products for which Türkiye had RCA values of one or above. As a result, 285 products were identified as products in which Türkiye had revealed comparative advantage within globally important import categories (Türkiye İhracatçılar Meclisi, 2019). These 285 products represented approximately USD 3.1 trillion in global imports, corresponding to 17.2% of world imports, while Türkiye's exports in these products amounted to approximately USD 90.9 billion and accounted for 57.9% of Türkiye's total exports in 2017. The report also identified products with RCA values below one but rising RCA performance and global import growth, such as GTIP 580131 and 847030, which resemble the PCM's potential category.

Taken together, the dissertation and the RCA 1000 report demonstrate the usefulness of combining competitiveness and market attractiveness. The dissertation provides the original PCM structure and shows how Turkish export product groups can be positioned across the four categories. The RCA 1000 report shows that RCA-based product selection can be linked to globally high-demand products and potential markets. PCM synthesizes these two logics in a transparent strategic map: Stars indicate products where current competitiveness and market growth are aligned; Potential products indicate future capability-building opportunities; Cash Cows indicate currently competitive products whose global demand conditions require transition management; and Dogs indicate products that usually deserve limited policy priority unless justified by employment, regional development, supply security, or other non-commercial objectives.

4.3. Comparison with Existing Frameworks

The Product Classification Matrix (PCM) builds on the Balassa Revealed Comparative Advantage (RCA) index but extends its analytical and strategic utility. As established in Section 3, PCM's value lies lies in combining measurement, classification, interpretation, and policy prioritization into a single decision-support architecture. Traditional RCA and its variants classify products according to whether they reveal comparative advantage, yet they remain essentially one-dimensional because they do not indicate whether the relevant global market is expanding or contracting (Balassa, 1965). Subsequent methodological refinements, including Vollrath's alternative revealed advantage indices, Laursen's symmetric RCA formulation, composite RCA measures, and contribution-to-trade-balance variants, have improved the statistical properties of competitiveness measurement (Chakrabartty and Sinha, 2022; Laursen, 2015; Stellian and Danna-Buitrago, 2022; Vollrath, 1991). These developments do not weaken the PCM approach; rather, they strengthen it by showing that the competitiveness axis of the matrix can be calibrated with different RCA-based indicators depending on the analytical context. In this respect, PCM is not tied to one single index. It uses RCA logic as a measurement layer and transforms it into a broader framework by adding market-growth dynamics and strategic interpretation.

PCM also has a clear relationship with the BCG growth-share matrix. The BCG matrix classifies business units according to relative market share and market growth, while PCM adapts this portfolio logic to export products by replacing business-unit market share with revealed comparative advantage and corporate market growth with global product-market growth (Henderson, 1970). Earlier studies have explored similar BCG-RCA hybrid applications. Schiele et al. (2014) developed a national competitiveness-based portfolio matrix for international strategic management, while Zdráhal et al. (2020) and Svatoš et al. (2010) used BCG-style comparative advantage mappings in agri-food and commodity trade contexts. PCM differs from these studies by proposing a more standardized and generalizable structure that can be applied to a country's export products across different sectors. Its contribution is therefore not the mere borrowing of BCG terminology, but the adaptation of portfolio logic to a trade-policy setting through measurable competitiveness and market-attractiveness dimensions.

Compared with product space and economic complexity approaches, PCM is simpler, more transparent, and more directly linked to policy prioritization. Product space analysis explains how countries diversify into products that

are close to their existing productive capabilities, while economic complexity measures the sophistication of a country's productive structure (Hausmann and Hidalgo, 2011; Hausmann et al., 2014; Hidalgo et al., 2007). These methods are highly valuable for identifying feasible diversification pathways, and recent applications combine capability proximity with demand-side or firm-level information to support industrial targeting (El-Haddad, 2020; Estmann et al., 2022; Sankot and Janda, 2023). However, they are computationally demanding and do not always provide a straightforward classification of existing export products according to current competitiveness and market direction. PCM should therefore be viewed as complementary rather than competing with product space methods: product space can deepen the analysis of capability feasibility, while PCM provides a clear strategic overview of where export products stand in relation to competitiveness and market growth.

Machine-learning-based export recommendation systems and composite trade performance indices also provide important comparators. Machine learning approaches can identify export opportunities and predict future export success with considerable sophistication, but they require large datasets, technical expertise, and careful interpretation (Brummitt et al., 2020; Che and Zhang, 2022). Similarly, the International Trade Centre's Trade Performance Index and related composite indicators offer multidimensional diagnostics but may be too complex for direct communication and policy prioritization (International Trade Centre [ITC], 2023). Studies that combine RCA with market share, export growth, or complementary competitiveness indicators show the value of multidimensional assessment, but they also demonstrate the risk of analytical complexity (Jain, 2023; Kaur and Sarin, 2017). PCM occupies a middle position: it is more informative than a single RCA calculation but more interpretable than complex composite or algorithmic systems.

Empirical evidence supports the usability of PCM's underlying logic. Studies using BCG-style RCA matrices show that combining revealed competitiveness with market growth can generate practical product classifications and policy recommendations (Schiele et al., 2014; Svatoš et al., 2010; Zdráhal et al., 2020). Other studies demonstrate that RCA becomes more policy-relevant when combined with market concentration, destination analysis, structural change, or global demand dynamics (Jalata, 2021; Mkrtchyan, 2024; Powrel and Mishra, 2024). Export diversification research further confirms that strategies combining supply-side capability assessment with demand-side market attractiveness can produce more feasible and effective policy recommendations than either dimension alone (Estmann et al., 2022; Hausmann et al., 2020). Overall, PCM's value lies in its ability to convert RCA from a descriptive competitiveness indicator into a hybrid decision-support framework. It does not replace RCA variants, product space models, machine-learning tools, or composite indices; instead, it offers a transparent and policy-oriented structure that integrates competitiveness measurement, market direction, classification, and strategic prioritization.

In summary, the distinctive contribution of PCM lies in its specific combination of three elements that are usually treated separately in the literature; accordingly, its differences from the main comparator approaches can be stated systematically. First, unlike traditional RCA-based approaches, PCM does not stop at identifying whether a country has revealed comparative advantage; it also asks whether that advantage is positioned in an expanding or declining world market. Second, unlike the BCG matrix, PCM is not a firm-level portfolio tool based on relative market share, but a national export-portfolio framework grounded in measurable trade-competitiveness indicators. Third, unlike product-space and economic-complexity approaches, PCM does not primarily model capability proximity or product sophistication; instead, it provides a simpler and more communicable classification that links current export competitiveness with global market direction and policy prioritization. Therefore, PCM's originality does not come from replacing these approaches, but from integrating their most policy-relevant insights into a transparent four-category framework for strategic export management.

4.4. Evidence Supporting PCM Usability and Applicability

A growing body of empirical literature provides direct and indirect support for the PCM's usability and policy relevance. This evidence comes from studies that have applied similar two-dimensional classification frameworks, from empirical validations of the underlying components (*RCA and market growth measures*), and from assessments of policy effectiveness in export promotion.

Direct empirical support for two-dimensional RCA-market growth classification frameworks comes from several applied studies. Zdráhal et al. (2020) demonstrate that a BCG-style RCA matrix successfully classifies agri-food products across EU28-EAC trade flows, identifying competitive and promising products with sufficient precision to generate actionable policy recommendations for EAC policymakers. Schiele et al. (2014) validate the national competitiveness-based portfolio matrix using TATA conglomerate data, demonstrating that the framework correctly identifies business units with strong versus weak strategic positioning. Indirect empirical support comes

from studies that validate the PCM's underlying components. Jalata (2021) demonstrates that RCA combined with market growth indicators provides superior predictive power for export performance compared to RCA alone in Ethiopian coffee exports, directly supporting the PCM's two-dimensional logic. Mkrtchyan (2024) applies product mapping combining RCA with market concentration and destination analysis to Armenian exports, demonstrating that multi-dimensional product classification generates more actionable insights than single-dimension RCA. Powrel and Mishra (2024) combine RCA with structural shift analysis and global market dynamics in India's honey exports, finding that products with high RCA in growing markets outperform those with high RCA in declining markets precisely the distinction the PCM is designed to capture.

Evidence on policy effectiveness provides further support for the PCM's practical value. Che and Zhang (2022) demonstrate empirically that countries whose export portfolios align with recommended high-performance structures achieve higher GDP growth and lower economic volatility, providing strong macroeconomic evidence for the value of strategic export portfolio management. Estmann et al. (2022) demonstrate that export diversification strategies informed by combined supply-demand analysis generate more effective industrial targeting than either supply-side or demand-side analysis alone, validating the PCM's integrative approach. Hausmann et al., 2020 (2020) show that Jordan's export diversification roadmap, which combines capability proximity with market attractiveness factors analogous to the PCM's two dimensions, generates more feasible and impactful recommendations than traditional RCA analysis.

The methodological robustness of the PCM's components has been extensively validated. Laursen (2015) demonstrates that RCA-based measures are robust to alternative formulations when properly normalized, providing confidence in the PCM's horizontal axis. Vollrath (1991) validates the theoretical foundations of revealed advantage measures and demonstrates their consistency with trade theory predictions. Multiple recent studies demonstrate that product-level competitiveness can be measured reliably using publicly available trade databases such as Trade Map and WITS (Baran Satılmış, 2025; Yalçın, 2024; Aktaş Çimen and Ertekin, 2023).

The usability and applicability of the PCM are supported by related empirical and methodological studies in export competitiveness, portfolio analysis, and diversification strategy. First, studies combining RCA with portfolio logic show that two-dimensional classifications can distinguish between competitive, promising, and strategically weaker product groups in ways that are useful for policy and managerial decision-making (Schiele et al., 2014; Svatoš et al., 2010; Zdráhal et al., 2020). Second, multi-dimensional RCA studies demonstrate that RCA becomes more policy-relevant when interpreted together with market growth, export concentration, destination structure, or demand-side indicators rather than as a stand-alone measure (Jalata, 2021; Mkrtchyan, 2024). Third, export portfolio and diversification research confirms that the composition and growth orientation of a country's export basket matter for long-run development, income growth, and economic resilience (Brummitt et al., 2020; Che & Zhang, 2022; Hausmann et al., 2007). Finally, methodological studies on RCA and revealed competitiveness indicators provide support for the use of comparative advantage measures while also emphasizing the need for careful interpretation, normalization, and dynamic assessment (Laursen, 2015; Vollrath, 1991; Stellian & Danna-Buitrago, 2022).

Taken together, this literature does not imply that PCM replaces RCA, BCG-type matrices, or economic complexity approaches. Rather, it supports the logic of integrating revealed competitiveness and global market direction into a transparent four-category framework. In this sense, PCM offers a practical decision-support tool that translates export data into strategic priorities and provides a common language for policymakers, trade agencies, chambers of commerce, and sector representatives.

5. CONCLUSION

This article introduced the Product Classification Matrix (PCM) as a conceptual-methodological framework for strategic export-portfolio management. The framework extends traditional Revealed Comparative Advantage (RCA) analysis by combining product-level competitiveness with the growth direction of world markets. In doing so, it addresses a central limitation of one-dimensional RCA analysis: a product may display revealed comparative advantage while being positioned in a declining market, or it may lack current competitiveness while belonging to an expanding market segment.

The distinctive contribution of PCM is not that it replaces RCA, BCG-type matrices, product-space analysis, or economic-complexity approaches. Rather, it integrates their most policy-relevant insights into a simple and transparent four-category framework. Unlike RCA-based approaches, PCM links competitiveness to global market direction; unlike the BCG matrix, it is designed for national export portfolios rather than firm-level

business units; and unlike product-space or economic-complexity methods, it prioritizes interpretability and direct policy communication over complex capability modelling.

In practical terms, PCM helps policymakers translate export data into strategic priorities. Stars indicate products where existing competitiveness and growing global demand are aligned. Potential products point to areas where selective capability-building and feasibility assessment may be justified. Cash Cows identify currently competitive products in declining markets, where upgrading, transition planning, or gradual diversification may be more appropriate than simple expansion. Dogs generally require limited public support unless non-commercial objectives such as employment, regional development, or supply security justify intervention.

Beyond product prioritization, one of the most distinctive practical contributions of PCM is its communication function. Export strategy involves ministries, trade-promotion agencies, development banks, chambers of commerce, sectoral associations, and firms. By providing a shared vocabulary, PCM can foster alignment among these actors regarding export priorities, resource allocation, and policy sequencing. This alignment operates through concrete channels. For ministries responsible for trade and industry, the matrix offers an evidence-based reference for designing incentive schemes and for sequencing industrial policy interventions across the four groups. For trade-promotion agencies, it provides a transparent criterion for allocating promotion budgets, trade-fair participation, and market-entry support, concentrating resources on Stars while directing capability-building programs toward Potential products. For chambers of commerce and sectoral associations, the four plain-language categories translate technical trade statistics into terms that member firms can readily understand, allowing these organizations to communicate national priorities to their members and to channel firm-level information back to policymakers. Because all of these actors work from the same classification, inter-institutional discussions can concentrate on evidence and thresholds rather than on competing vocabularies, which lowers coordination costs and supports the formation of a shared export agenda. This communication function is one reason why PCM should be understood as a strategic framework rather than merely as a calculation tool. Repeated over time, the matrix can also serve as a monitoring device by showing whether products move across categories and whether policy interventions coincide with changes in competitiveness or market positioning, thereby giving ministries, trade-promotion agencies, and chambers of commerce a common basis for jointly reviewing progress and revising export priorities.

The framework nevertheless has limitations. Results may vary according to product classification, aggregation level, time period, RCA formulation, and the measurement of world market growth. Export values may also reflect price changes, re-exports, trade-policy shocks, or temporary disruptions. Moreover, PCM deliberately remains parsimonious and does not directly incorporate destination-level market access, tariffs, non-tariff barriers, logistics costs, environmental constraints, or firm-level capabilities. For this reason, PCM should be used as an initial strategic map and combined with deeper feasibility, product-space, sectoral, and policy analysis when specific interventions are designed.

Future research should test PCM through systematic cross-country and sectoral applications, dynamic analyses of product movements across categories, and robustness checks for RCA and market-growth thresholds. Further work may also integrate PCM with economic-complexity, product-space, sustainability, and services-trade indicators. Because this study is primarily conceptual-methodological, its Türkiye-based illustration should be read as a demonstration of practical use rather than as a full econometric validation. Such empirical validation remains an important agenda for future studies.

Consequently, this article has introduced the Product Classification Matrix (PCM) as the novel analytical framework that extends traditional Revealed Comparative Advantage analysis by integrating global market growth dynamics into a systematic, two-dimensional strategic tool.

YAZAR BEYANI / AUTHORS' DECLARATION:

Bu makale Araştırma ve Yayın Etiğine uygundur. Beyan edilecek herhangi bir çıkar çatışması yoktur. Araştırmanın ortaya konulmasında herhangi bir mali destek alınmamıştır. Makale yazım ve intihal/benzerlik açısından kontrol edilmiştir. Yazar çalışmanın orijinal ve akademik mevzuata uygun olarak hazırlandığını beyan etmektedir. Makale, "*en az iki dış hakem*" ve "*çift taraflı körleme*" yöntemi ile değerlendirilmiştir. Makalede kullanılan ölçek için yazar tarafından ölçeğin orjinal sahibinden izin alındığı beyan edilmiştir. Bu çalışmanın bulgularını destekleyen veriler, makul talep üzerine sorumlu yazardan temin edilebilir. Yazar, dergiye imzalı "*Telif Devir Formu*" belgesi göndermiştir. Mevcut çalışma için mevzuat gereği etik izni alınmaya ihtiyaç yoktur. Bu konuda yazarlar tarafından dergiye "*Etik İznine Gerek Olmadığına Dair Beyan Formu*" gönderilmiştir. Bu çalışmanın hazırlanması sırasında yazar, yazma süreçlerinde üretken yapay zekâ ve yapay zekâ destekli teknolojiler kullanmadığını beyan etmiştir. Yazar, bu çalışmanın yayınlanmadığını veya herhangi bir yayın kuruluşuna yayınlanmak üzere gönderilmediğini kabul etmektedir. Yazar, çalışmanın tüm bölümlerine ve aşamalarına tek başına katkıda bulunmuştur. / This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support. The article has been checked for spelling and plagiarism/similarity. The author declare that the work is original and prepared in accordance with academic standards. The article was evaluated by "*at least two external referees*" and "*double blinding*" method. For the scale used in the article, it is declared by the author that permission was obtained from the original owner of the scale. Data supporting the findings of this study are available from the corresponding author upon reasonable request. The author sent a signed "*Copyright Transfer Form*" to the journal. There is no need to obtain ethical permission for the current study as per the legislation. The "*Declaration Form Regarding No Ethics Permission Required*" was sent to the journal by the authors on this subject. The author declare that they did not use generative artificial intelligence or AI-assisted technologies in the writing process of this study. Author acknowledged that this study has not been published or submitted to any publication outlets for publication. The author contributed to all sections and stages of the study alone.

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