



# Technological M&A for Core Technology Change: A Feasible Strategy for Incumbent Firms to Overcome the Challenges in the Steel Industry

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**Abstract:** Firms in the steel industry facing the declining stage of the industry life cycle need to renew their core technology portfolio. Technological M&A is a popular corporate strategy for core technology change in other high tech industries such as biopharmaceuticals or information and telecommunications. However, the objectives of steel industry M&As are more focused on achieving economies of scale or entering into new markets, and a core technology change has rarely been a purpose of technological M&As in the steel industry. This research introduces technological M&A as a tool for core technology change, especially to the steel industry. Further, comparing with traditional M&A deals of the steel industry, the study suggests key factors for a successful core technology renewal through technological M&As.

**Keywords:** Technological M&A, Core technology portfolio renewal, Steel industry, Knowledge transfer, Knowledge relatedness, Innovation

**Technologische M&A für Veränderung der Kerntechnologien: Eine mögliche Strategie für etablierte Unternehmen, um die Herausforderungen in der Stahlindustrie zu überwinden**

**Zusammenfassung:** Unternehmen in der Stahlindustrie, die vor einer rückläufigen Phase des Lebenszyklus in der Branche stehen, müssen ihr Kerntechnologie-Portfolio erneuern. Technologische M&A sind eine beliebte Unternehmensstrategie für den Kerntechnologie-Wandel in anderen High-Tech-Branchen, wie z. B. Biopharmazeutika oder Informations- und Telekommunikation. In der Stahlindustrie

zielen M&As jedoch zumeist auf die Realisierung von Skaleneffekten oder den Eintritt in neue Märkte ab, während Kerntechnologie-Wandel in der Stahlindustrie selten die Motivation für technologische M&As darstellt. Diese Studie präsentiert technologische M&As als Werkzeug für den Kerntechnologie-Wandel, vor allem in der Stahlindustrie. Im Vergleich zu den traditionellen M&A-Transaktionen in der Stahlindustrie schlägt die Studie wichtige Faktoren für eine erfolgreiche Kerntechnologie-Erneuerung durch technologische M&As vor.

**Schlüsselwörter:** Technologische M&A, Kerntechnologie-Portfolio-Erneuerung, Stahlindustrie, Wissenstransfer, Wissensverwandtschaft, Innovation

## 1. Introduction

Immense challenges faced by the steel industry in the 21<sup>st</sup> century are becoming major obstacles for steel industry firms. According to Eurofer, 4.5 million tons of steel are imported into Europe, a 23% increase compared to the year before [1]. Due to Chinese firms' entry into the steel industry with a large support of their government, one can see oversupply and decreasing prices. Likewise, POSCO, the Korean steel giant, also recorded a deficit of around \$80 million in 2015 [2]. However, the path dependent nature of the steel industry makes it difficult for firms to overcome these circumstances. The incremental pace of innovation in the steel industry impedes the necessary core technology change of firms, which could allow them to cope with new dynamics in the industry [3].

Among the various external knowledge sourcing modes, technological M&As are one of the most efficient strategies for a firm's core technology renewal [4]. Technological M&A refers to M&A deals that mainly focus on assimilating the target firm's technological knowledge resources, thereby

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realizing synergies for subsequent innovation performance [5]. The distinctive characteristics of technological M&As is that they absorb the target firm's bundle of knowledge resources; including people, task, tools, and their networks [6]. This enables the acquirer firm to access target firm's tacit knowledge, which could be a significant source of new core technology innovation [7].

In the steel industry, which is well known for its large M&A deals, companies mainly use M&A deals to leverage economies of scale rather than for technological learning. Due to the high price competition within the industry and the stagnant pace of productivity improvement, firms in the steel industry need to renew their core technology portfolio and innovate their core business. In this regard, this paper suggests technological M&A as a core technology change strategy and provides implications for firms in the steel industry. Further, the paper also highlights key success factors when considering technological M&A as a core technology renewal strategy.

## 2. M&As in the Steel Industry

Firms in the steel industry utilize M&A deals to access new markets or assimilate economies of scale. Therefore, the size of the deal is often much larger than a typical technological M&A. For example, Tata Steel's acquisition of Corus in 2007 was motivated by the integrative and enlarged trend of the world steel industry [8]. The acquisition received large attention because of its relative size; the deal size was \$12 billion and the target firm Corus was four times larger than the acquirer firm Tata at the time of acquisition [9]. Tata expected to lead the economies of scale in the steel industry through the acquisition of Corus. However, the changing dynamics of the world economy and industry resulted in Tata failing to realize the expected outcomes.

Unlike other high technology industries such as the biopharmaceutical or IT industries, the steel industry is characterized by its long technology life cycle and low speed of innovation [10]. For instance, technologies such as open-hearth furnace (OHF) or continuous casting (CC) have maintained their status as core technologies for several decades [11]. Those characteristics made steel industry firms path dependent, resulting in them focusing their efforts competing for a higher productivity rather than technological development [12].

Firms in the steel industry also need to renew their core technology portfolio through technological M&As. The changing dynamics of the external environment, such as a long depression of world economies and Chinese firms' entry into the steel industry, results in firms struggling in the price-cutting race. To escape this imperfect market, firms need to evolve their core technology portfolio through technological learning and breakthrough innovation.

For firms in the steel industry which seek dynamic capabilities, this paper introduces the strategy of technological M&As. Technological M&A has several idiosyncratic characteristics and knowhow in comparison to the formal M&A that has previously been conducted in the steel industry. The paper suggests four stepwise success factors

for technological M&A, which needs careful consideration: the size of the deal, the knowledge relatedness between the acquirer and the target firm, post-M&A target firm inventor retention, and measuring the productivity to assess post-M&A performance.

## 3. Key Factors in Technological M&A

### 3.1 Step 1. Strategic Planning: Small & Frequent M&A Activities

Most of the steel industry M&As have large volumes and deal value. As a result, they are conducted at a relatively slow speed. For instance, Tata steel's acquisition of Corus was a \$12 billion acquisition, which ended up as a failure. Large and slow M&As possess a high risk, especially when the external environment is highly dynamic. Those M&A routines are, however, quite opposite in the case of technological M&As.

Target firms of technological M&As are typically small and technology intensive [13]. The innovation theory of the firm states that small firms (or start-ups) are more likely to produce radical innovation, thereby possessing a larger potential to create high impact technology [14]. Acquirer firms can utilize their resources to adopt the target firm's knowledge into their core technology [7]. Furthermore, when acquiring small firms, the acquirer firm can reduce its perceived risk of failure. A diversified portfolio of small and frequent M&As enables firms to make a number of small changes across the organization. Small changes are potential technologies which can be amplified to become future core technologies [15]. Therefore, for technological portfolio renewal through technological M&As, small and frequent M&A deals are more effective than larger ones.

### 3.2 Step 2. Target Firm Selection: Considering the Core Knowledge Relatedness Between the Acquirer and the Target Firms

Technological M&A leads to the integration of the target and the acquirer firms' knowledge bases [16]. The knowledge relatedness is a valuable concept to analyze the fit between two firms evaluating the potential for post-M&A synergy realization [5]. Scholars found out that the knowledge relatedness is one of the most significant factors influencing the post-M&A innovation performance of the combined firm [17]. Several scholars commonly argue that there is a trade-off relationship between knowledge redundancy and novelty [18]. If the target firm's knowledge base is distant to that of the acquirer firms, the novelty of the target firm knowledge base is high, which allows the acquirer firm to access distant and novel knowledge [13]. However, simultaneously, the lack of the acquirer firm's relative absorptive capacity makes the knowledge transfer more difficult. Without any common background or shared technological language, assimilating the target firm's knowledge is ineffective, no matter how high the novelty of the knowledge [16]. Conclusively, it is important to consider the knowl-

edge relatedness between the two firms according to the objective of the core technological M&A.

### 3.3 Step 3. Post-M&A Integration: Post-M&A Target Firm Inventor Retention

One of the most distinguishable features of technological M&As is that the acquirer firm can assimilate the target firm inventors [19]. Target firm inventors are an important knowledge reservoir that contains the tacit knowledge of the target firm's knowledge base. Target firm inventors have tacit skills and know-how, which can be a valuable source of novel recombination.

In addition, post-M&A target firm inventor retention would increase face to face communication between the two entities [20]. The increased interaction would promote novel recombination among the acquirer and the target firm inventors [21]. The increased knowledge recombination set would help the firm's core knowledge portfolio change by creating more possible breakthrough technologies.

### 3.4 Step 4. Post-M&A Performance Feedback: Measuring Post-M&A Firm Productivity

When considering the success or failure of technological M&As for core technology change, the firm should not focus on traditional measures of productivity. Especially firms in the steel industry, since the industry has been competing for efficiency and productivity for several decades, could possibly seek immediate improvement in their productivity after the M&A. However, the success or failure of a technological M&A should be measured as the value added to the firm after the M&A, i. e. how much value added innovation has been created. Lieberman and Kang measured the productivity level of steel industry firms and identified the advantage of multiple measures of firm productivity based on the value added [12]. Likewise, diagnosing the success of a technological M&A needs a multi-dimensional approach to cover the various aspects of technological performance.

## 4. Conclusion

For decades, the steel industry has been path dependent while major changes have been incremental [11]. However, because of the changing competitive dynamics and economies of scale reaching their margin, firms in the steel industry are encountering immense difficulties. Firms are finding an increasing need for innovative breakthrough and the renewal of the core technology portfolio.

This paper investigates technological M&A as a solution for a core technology portfolio renewal strategy. It identifies success factors of technological M&As when used as a core technology portfolio renewal strategy. Without stay-

ing in the traditional M&A routines of the industry, firms in the steel industry need to actively plan and manage transformation based on breakthrough innovation or technological convergence. Technological M&As could be a sufficient strategic solution for firms to change their core technology portfolio.

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