

# **The Photochemical Industry: Historical Essays in Business Strategy and Internationalization\***

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As most of the information about the environment in which the human organism functions is perceived through the eyes, photographic images satisfy a quite fundamental, and therefore universal, human need. Ever since the production of such images was demonstrated to be feasible at a combined Paris meeting of the French Academies of Science and Fine Arts in 1839, the practice of photography has become widely diffused, encountering and subduing initial resistance in a variety of cultures along the way. Over time and as economic development permitted, the photographic image has come into such widespread use that it is difficult to imagine the contemporary world without it.

During its first five decades, the practice of photography was marked by a number of technological and economic fits and starts. The materials used in capturing images changed from silvered metal plates to glass plates to celluloid; the carrying agents for the chemicals used to sensitize printing papers changed from egg whites to collodion to gelatin. Each of these changes represented a major mutation in the technological conceptualizations as to how photography might be practiced more widely, more easily and more cheaply.

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Until this evolution had been undergone, photography largely remained the domain of individual artisans who were confined to performing the simplest of economic functions and maintaining the simplest of business relationships.

During the two decades following the invention of the gelatin dry plate in the 1870s, however, dozens of enterprises making photosensitive materials sprang up in Europe and America. Among the entrepreneurs starting such enterprises were a small handful who would transform what then was essentially a cottage industry into a global, mass production, mass consumption oligopoly. A major milestone marking the start of this transformation is the paper-based roll film and roll holder system developed by George Eastman and William H. Walker in 1884. This system was a precursor of the first Kodak camera and film system introduced in 1888 and modified a year later to incorporate a celluloid roll film base which quickly replaced the original paper base.

Photography, in short, provides a significant artifact of contemporary life, and it has been practiced long enough to arouse the curiosity of historians. The standard history of photography, however, is preeminently a history either of invention or of the development of a medium of artistic expression. With rare exception, the business and economic development of photography has largely been neglected by historians.

Among these rare exceptions, the brilliant contributions of Jenkins [6; 7; 8] to our understanding of how the American photographic industry developed up to the 1920s are notable. For background, Porter and Livesay [10, ch. 10], provide an indispensable guide to the changes in nineteenth-century American market practices and institutions. These changes made possible the rise, among others, of Eastman Kodak which was, in turn, a premier participant in bringing them about. The insight into this firm's role and significance provided by these scholars is penetrating.

The few scholarly works on this industry that have been published largely recite events that unfolded in the context of the American experience. This necessarily leaves a gap in our knowledge. Photography did, after all, originate in Europe, and international commerce in its goods and ideas has been conducted from its earliest days. Although some efforts, among which a recent work by Roosens [12] can be cited, to close the gap from the European side have been made, the international development of this industry has thus far remained unrecorded.

One objective of this thesis was to reconstruct the circumstances under which some half dozen prominent photochemical enterprises came to extend their business across national frontiers. The study was confined to those companies that turn ordinary materials, primarily paper and its derivatives and

plastics, into photosensitive materials. This is achieved by a series of coating operations. One of the coats applied contains certain silver halogens which are sensitive to light in that they darken when exposed to it. This is the property that makes the photographic image possible, and its exploitation provided the basis for the core business of the following enterprises at various stages in their development.

Firm	Domicile	Founded	Photochemical Industry Entry
Eastman Kodak Co.	U.S.	1880	1880
Agfa	Germany	1867	1888
Gevaert Photo-producten N.V.	Belgium	1894	1894
Ilford Ltd.	U.K.	1879	1879
Konishiroku Photo Industry Co. Ltd.	Japan	1873	1929
Fuji Photo Film Co. Ltd.	Japan	1934	1934

The experience of this industry is representative of much that economists have come to associate with the internationalization of business. At a minimum, the following characteristics are relevant. The industry has come to depend on scientific research and development for its technical and commercial progress. It began to institutionalize these functions quite early in its history to carry out policies of continuous innovation in products and processes. The industry enjoys very large scale economies in manufacturing, and it was among the pioneers in adapting capital intensive processes of continuous production. Its operations are intensive in mass marketing, particularly in activities that aim to achieve differentiation of product and producer. It is highly concentrated, fewer than a dozen enterprises accounting for nearly all the world's output. All of them sell their products more or less globally, and nearly all of them benefit from scope economies in their marketing operations.

The point of view adopted here is that these characteristics are not the result of inherent market infirmities as a great body of economic literature insinuates [2; 3; 4; 5; 9; 11]. They are, rather, seen to be of a consequence of the successful carrying out of strategic intents by the surviving enterprises. The implementation of such strategies by the members of this industry led them to incur costs that are invariant with unit volume within rather broad ranges. The certainty that such costs would be incurred once the strategies were adopted was quite out of balance with the uncertainty of their ability to generate revenues sufficient to recover them over the long run. This asymmetry set in motion powerful forces to restrain or eliminate competition

and to seek markets wherever they could be found. The search for markets quickly spilled across national frontiers, and in a number of instances, both goals were reached by the same means, namely foreign takeovers and mergers.

History does not, of course, unfold by formula. The foregoing interpretation serves merely as an organizing framework for presentation of a multitude of events, not as a formal proposition. The abundance of data that come to light in a study covering more than a century requires selection. It provides an opportunity to heed the advice given to budding historians by Barzun and Graff when they suggest that a selection "must fairly correspond to the mass of evidence, and it must offer a graspable design to the beholder" [1, p. 151].

The history of this industry is of special interest to students of international business. This is because those firms that eventually succeeded in becoming dominant in the industry were among the pioneers in the extension of business transactions and relationships beyond home country borders. The start of this industry's internationalization can be traced back to an era that is nearly contemporaneous with its emergence as a modern industry. The following summary is indicative.

The antecedent of the present Eastman Kodak Company established its first foreign sales branch in London in 1885, a mere five years after the company had been formed. Coincident with the introduction of the first Kodak system, the company set up a retail establishment in the same city in 1888. This latter step was followed in some 11 European cities and as far away as Melbourne, Australia before the turn of the twentieth century. During George Eastman's lifetime, it was repeated more than 200 times in nearly as many cities around the world. Before the outbreak of war in 1914, the company had established sales subsidiaries in nine countries. Most of these were in Europe although the network stretched from Canada to Australia. Kodak factories had also begun operations in the U.K., Australia and Canada, the first of these as early as 1890.

It is difficult, in the context of photographic enterprise, to speak of the internationalization of Agfa. This is because Agfa, like its competitor Bayer which later became its parent, already was a mature dye manufacturer operating on a global scale before it became a participant in the photographic industry. Nevertheless, it is noteworthy that Agfa cinefilm, the product which turned its maker into the second largest producer of photosensitive materials in the world, was an international product from its inception. The manufacturing complex southwest of Berlin where this product was made went into operation in 1909, when German cinema studios and theaters simply did not yet exist. Thus, all of its initial production was exported to neighboring European countries.

Within a year of the Gevaert company's formation, more than half of its photographic paper sales were being made to customers outside Belgium. From the company's factory in Antwerp, shipments went as far southwest as Lisbon and as far east as Berlin. Its network of foreign sales branches and distribution depots covered 11 countries by 1914, four of these branches having been established in South America.

With a 50 year time lag, which was needed to catch up with technical developments in photochemistry in the West, the two Japanese companies showed a similar disposition to globalize their markets once they felt ready to do so.

In the restraint and elimination of competition within this industry, as in many other arenas, Eastman Kodak led the way. During the decade starting in 1894, the company acquired some 19 competing U.S. manufacturers and 15 major photographic retailers. In most of these instances, the acquired entity was dissolved and its brands disappeared from the market. The former owners and officers were enjoined from future participation in the industry. The conditions of sale to the trade included a requirement that dealers were not to stock goods made by competitors.

Similar Kodak policies were carried out abroad although on a more modest scale. Several British producers were acquired, and an abortive attempt to take over Ilford, Ltd., then the largest producer in the U.K., was made in 1903. During the 1920s, Kodak control of the U.K. market was achieved through a controlling interest in 27 of the largest photofinishing laboratories. Half of these subsequently took on wholesaling functions for unexposed Kodak films. During the same decade, Kodak also acquired the largest film manufacturer in France and a new film factory that had been built for another company in Germany.

A worldwide market sharing agreement was concluded for cinefilm by Eastman Kodak and Agfa soon after the latter had emerged as a significant competitor in this field.

The photographic interests of Agfa and Bayer were consolidated and put under Agfa management following the formation of IG Farbenindustrie in 1925. Among the early next steps taken by IG Farbenindustrie was the acquisition of Ansco, then the second largest U.S. photographic producer. Eventually, Agfa and Gevaert concluded a historic transnational merger as a prelude to which seven other German producers had been acquired by Agfa.

During the 1920s, Ilford took a leaf out of the Eastman Kodak book and acquired some 15 British producers. By the time Ilford was through, it and Kodak were the British photochemical industry. Four decades later, Ilford it-

self succumbed and was taken over by Swiss based Ciba which consolidated it with its earlier acquisitions of Tellko in Switzerland and Lumiere in France.

The major themes of this thesis, in summary, are industry concentration and internationalization as consequences of the extraordinarily high fixed costs with which these enterprises loaded their operations. These themes are played with a great many variations in the thesis. The space limit imposed on this abstract does not permit an exposition or elaboration of these variations. Among the factors contributing their influence to these variations, the following should at least be mentioned. The clarity with which the industry's founders saw their opportunities and the alacrity with which they seized them; the development of the scientific and technological culture and infrastructure; the speed with which new technologies were adopted; the direct intervention of governments and their indirect roles in establishing the national and international business environments; the size of national markets and the timing and rate of their development: These were among the factors that contributed their influence to the emergence of this global oligopoly.

The experience of the photochemical industry suggests that several recently developed lines of economic thought might well be modified so as to broaden their generality or to deepen their insight. Analysis of the Williamson [13] markets and hierarchies model in light of this history, for example, suggests that in the exploration of the advantages enjoyed by managerial hierarchies over alternative institutions for executing transactions across national frontiers, a key issue is the choice between retention and externalization of resale rights inhering in prior ownership. Strategic considerations, which is to say concern with outcomes over the long run, militate in favor of retention. When the same model is summoned for analysis of the cost aspect of international transactions, it is useful to note that the model subsumes choices between perfect and highly imperfect market mechanisms on the one hand and on the other, between externalization of product resale rights and their retention by the manufacturer. Retention is a highly desirable, if not absolute necessary, condition for appropriating the benefit of large scale economies that can arise in performance of the marketing function.

Similarly, technical knowledge is retained by its original owner when externalization of the rights to its exploitation is perceived to diminish the original owner's long-term revenue potential. Strategic interest prompts internationalizing firms to retain product resale and knowledge exploitation rights because of the disparity in time and resources required between the shrinking of cultural distance and the acquisition of technical knowledge through research and experimentation.

The findings of the research done in preparation of this thesis are far from complete and, at least for this reason, far from conclusive. Nevertheless,

exploration of the foregoing ideas suggests that they provide a basis for fruitful further research into the development of industries with similar characteristics.

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