

企業変容、多角化、経営者の認識  
-ゼネラル・エレクトリックとウェスティングハウス  
・エレクトリックの比較研究-

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Corporate Transformation, Diversification, and Managerial Perception:  
A Comparative Study of General Electric Company and Westinghouse Electric Corporation

企業変容、多角化、経営者の認識：  
ゼネラル・エレクトリックとウェスティングハウス・エレクトリックの比較研究

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**Corporate Transformation, Diversification, and Managerial Perception:**

**A Comparative Study of General Electric Company and Westinghouse Electric Corporation**

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# Chapter 1

## Managerial Perception, Diversification, and Corporate Transformation

"As time passes, the sand piles up even thicker,

and occasionally it's blown away and what's below is revealed."

Haruki Murakami, *Colorless Tsukuru Tazaki and His Years of Pilgrimage*

### I. Divergence in Corporate Performance amongst Large U.S. Firms

This chapter provides the thesis research question, approach, and structure.

It is said that the 20th century was the American Century, a period which saw the U.S. rise to economic supremacy but also conversely descend to significant fiscal and trade uncertainty<sup>1</sup>. Large U.S. enterprises have played a central role in the development of the economy by establishing the modern, integrated, multiunit business structure in advance of any other country. Among them, it is the modern industrial enterprise that played a key role in transforming the U.S. economy into a modern industrial economy during a period when the U.S. economy was growing significantly through development of the industrial sector<sup>2</sup>. By the end of World War II, the enterprises established competitive advantages and increased their strength, even in international industrial markets<sup>3</sup>. After the war, the foundation set for U.S. industry to benefit from an extraordinary surge of growth during the postwar boom of the 1950s and 1960s<sup>4</sup>. While Europe and Japan had to focus immediate postwar efforts on extensive reconstruction, to

recover from the massive destruction caused by the war, U.S. enterprises assumed international leadership positions in many industries<sup>5</sup>. They subsequently dominated world trade under these rather unique circumstances<sup>6</sup>. U.S. enterprises were able to maintain business competitiveness, even after the economic recovery of other countries, because they had already established competitive advantages as first mover<sup>7</sup>.

As the world economy gradually and fully recovered from the effects of the war, however, U.S. enterprises declined its dominance, not only internationally but also in domestic markets<sup>8</sup>. Although large U.S. enterprises accounted for 78 out of the top 100 firms in 1956, by 1990 the number was reduced to 33 of the top 100 global mining and manufacturing firms<sup>9</sup>. American management, previously admired for its strikingly effective post-World War II performance, was now being regarded as the chief contributor to the American economic decline<sup>10</sup>. However, by the end of the twentieth century, there was uneven performance amongst U.S. enterprises. For example, while a number of large U.S. enterprises had dropped from the top 200 list by 1997, 28 enterprises with histories going back to 1880 remained in the ranking from 1917 to 1997<sup>11</sup>. Some of them continued to grow with a focus on generating new products, either developed internally or through acquisition, and others attempted to chart an evolutionary path to growth by combining their traditional and new businesses<sup>12</sup>. These developments raise the question of why some of the larger U.S. industrial enterprises continued to grow in an environment of change while others declined. In other words, why could some firms eliminate Leibenstein's X-inefficiency through innovation, in the entrepreneurial sense of Israel Kirzner, while others could not<sup>13</sup>.

With this question in mind, this thesis takes two large U.S. industrial enterprises to explore the historical corporate transformations of large industrial enterprises from 1946 to 2000. The next section begins with a review of Chandler's logic of corporate growth, sometimes

called Chandler's Model, and reactions from his critics. This confirms that neither side of the debate focused much on managerial capabilities, which is essential to understanding the divergence of large U.S. industrial firms by the end of twentieth century. Section III looks closely at perspectives related to the concept of managerial capabilities, in order to examine an approach for investigating managerial capabilities. The last section sets out the research approach used in this thesis to examine the divergence of large U.S. firms.

## **II. The Logic of the Competitive Advantage of Large U.S. Industrial Enterprises**

To examine the divergence of growth amongst large U.S. enterprises, Alfred D. Chandler, Jr. provides a starting point with his well-known logic of the large enterprise's growth and advantages, with Chandler being one of the world's most frequently cited social scientists from 1957 to 2007, ranking with Douglass C. North<sup>14</sup>.

### **1. The 'Early' Chandler's Model and the 'Later' Chandler's Model**

Chandler regarded large industrial enterprises to be the central institutions of capitalism and the key to explaining the growth of the advanced economy in the U.S., and examined how management transformed purchased inputs into sold outputs in order to generate high levels of productivity<sup>15</sup>. Through massive works over the years, he demonstrated the powerful logic that applies to growth and advantages of large enterprises, later known as Chandler's Model or the Chandlerian Model. Although the word of 'model' is used, his model has evolved and changed over the years<sup>16</sup>. In following his major works, the logic model can be generally divided into two distinct models. While the first model is drawn from *Strategy and Structure* in 1962, *The*

*Visible Hand* in 1977, and *Scale and Scope* in 1990, the second model is demonstrated in *Inventing the Electronic Century* in 2001 and *Shaping the Industrial Century* in 2005<sup>17</sup>. For convenience, the former model will be called the “early Chandler’s Model” and the latter, the “later Chandler’s Model”. Of course both models are completely related, but the focus shifts from the role of management in utilizing productive resources to the role of management in developing productive resources<sup>18</sup>.

#### (1) The Early Chandler’s Model

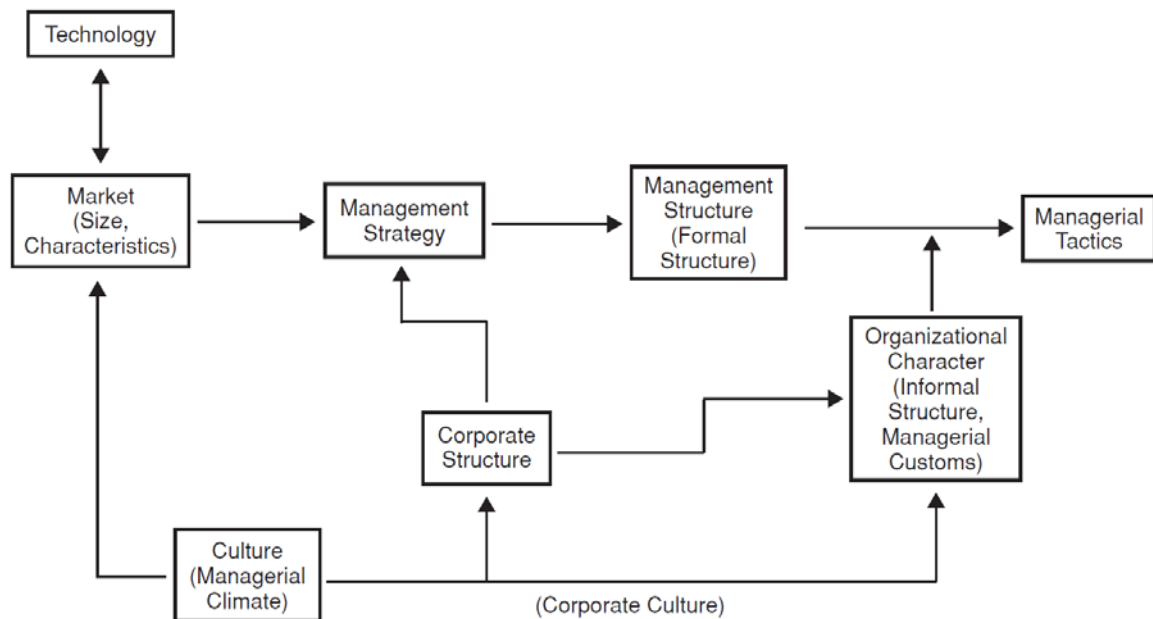
The early model is widely known as the logic of large enterprise advantages. Since there are a number of works that analyze his logic in detail, this describes his basic logic for the period of *Scale and Scope*, which covers the same time-frame (the 1880s-1930s) as the managerial revolution in American business in *The Visible Hand*, and the creation of the multidivisional structure in *Strategy and Structure*<sup>19</sup>. Before the 1990s, his main focus had been to explain the rise of the modern managerial enterprise or large industrial enterprise, which played a key role in the transformation of American and other country economies from one that was rural, agrarian and commercial into one that is modern, industrial and urban<sup>20</sup>. The reason major industries were dominated by large managerial enterprises in the industrial economy is that they could realize new greater productivity and not have to entirely rely on the market. Although the market remained the generator of the demand for goods and services, such enterprises took on the function of coordinating the flow of goods through existing processes of production and distribution, and of allocating funds and personnel for future production and distribution<sup>21</sup>.

The enterprises could achieve efficiencies when administrative coordination allowed for greater productivity, lower costs and higher profits and coordination through market mechanisms by adopting new strategies (i.e. related diversification) and new organizational structures (i.e. multidivisional structure), and only when salaried managers administrated these enterprises through the creation of a managerial hierarchy of lower, middle, and top managers<sup>22</sup>. Thus because salaried managers could now adopt the right strategy and right structure for corporate growth through a managerial hierarchy, this led large industrial enterprises to take a lead role in the development of the industrial economy and to dominate many sectors of the economy. In addition, they were able to maintain their dominance and competitive advantages over followers through their organizational capabilities, by being able to fully exploit economies of scale and scope and by being built through salaried manager decisions on long-term strategies of growth and three-pronged investments<sup>23</sup>. Such enterprises are called managerial enterprises, large industrial concerns in which operating and investment decisions are made by a hierarchy of salaried managers that are governed by a board of directors<sup>24</sup>.

Although different from gaining an understanding of the distinction between the early and the late Chandler models, Etsuo Abe provides a full representation of the early Chandler's Model, as shown in figure 1-1, which more concisely describes it.

He concludes that Chandler's argument is composed of four primary factors: market, strategy, management structure (e.g. organizational structure), and corporate structure (e.g. managerial firm)<sup>25</sup>. In response to developments in national markets, the enterprises adopted appropriate strategies to meet the needs of the evolving market<sup>26</sup>. With the strategies, they then developed a management structure that was aligned to the strategy<sup>27</sup>. In parallel to the development of the management strategy and structure, the corporate structure was developed at the firm level. As a result of this interactive development of both the management and corporate

structures, the separation of ownership and management led to the development of a cadre of professional managers and a managerial hierarchy<sup>28</sup>. Through the interaction of these four factors, there emerged a transition from coordination by market to coordination by administration<sup>29</sup>.



**Figure 1- 1. The Early Chandler's Model.**

Source: Etsuo Abe, "Alfred Chandler's Model of Business Enterprise Structure and the Japanese-Style Enterprise System: Are They Compatible?," *Japanese Research in Business History* 26, (2009b): figure 1, p.65.

Note: The figure is based on Chandler's works before *Scale and Scope*, because Etsuo Abe interprets that Chandler's framework began changing with *Scale and Scope*, which added the new concept of organizational capabilities.

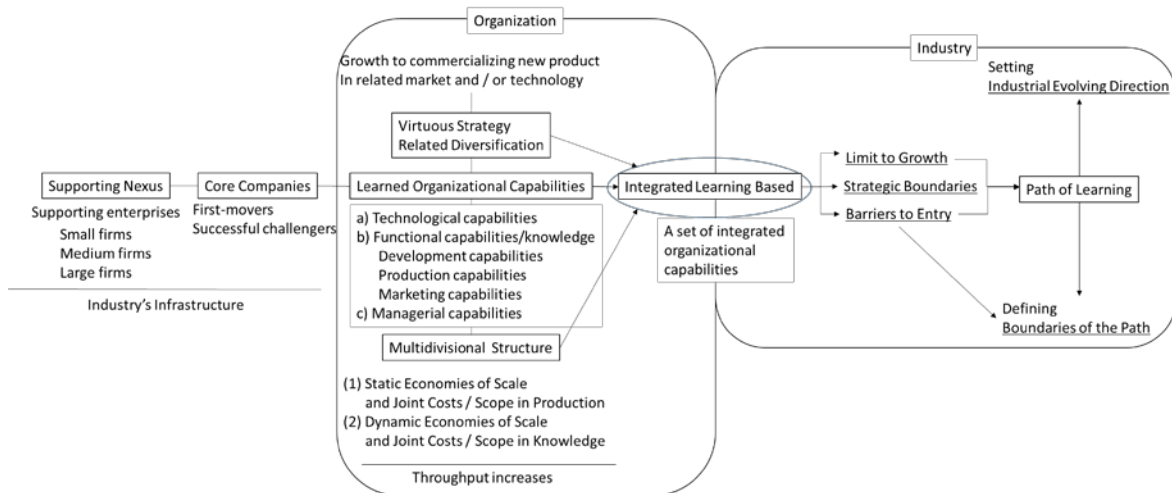
Thus the early Chandler's Model mainly provides the logic for large industrial enterprise efficiencies, with less direct attention paid to the market, and does not fully describe how they could develop such advantages. In his logic, they built advantages because they were first-movers and were first to invest in the industries<sup>30</sup>. In this explanation, it is not clearly indicated why and how first-movers established these advantages. This element became the main theme of Chandler's next research project<sup>31</sup>.

## (2) The Later Chandler's Model

After finished the *Scale and Scope* project, Chandler began working on a new project that focuses on American competitive capabilities under the question of “why have some American companies and some American industries been able to maintain their industrial heritage and competitive strength and others have not?”<sup>32</sup> *Inventing the Electronic Century* in 2001 and *Shaping the Industrial Century* in 2005 are the chief research results of this project. Although the set of works tried to introduce another logic for managerial enterprises, it has not been as widely referred to when compared to the earlier model. Given the detail provided in previous researches, the logic of his later model is examined<sup>33</sup>. He has described the success and failure of leading competitors in terms of technological achievement and financial success, by examining international competition in the high technology industries of consumer electronics, computers, chemicals and pharmaceuticals<sup>34</sup>. Figure 1-2 briefly summarizes his theoretical explanation. In *Scale and Scope* he developed his early logic based on an integrated learning base, which deepened the concept of organizational capabilities as a source of competitive advantage. Enterprises obtained first-mover advantage, which then created an integrated learning base by combining a number of learned capabilities. Once an integrated learning base is established, it can direct, but also somewhat limit, the evolution of the industry.

This is because an integrated learning base determines the barriers to entry, strategic boundaries, and limits to growth. Since the follower enterprises require a set of integrated capabilities to be able to compete with the first-movers in the industry, it is the integrated learning base that determines who are the players in the industry. The barriers to entry prevent startups from creating an effective integrated learning base, deemed to be essential to compete in the industry<sup>35</sup>. Thus first-movers that have become large industrial enterprises are able to maintain competitiveness in the long term. The barriers to entry now determined the strategic boundaries

that rule competition or competitive strategy, because the same players continuously compete with each other like a repeated game<sup>36</sup>. Under these conditions, the grouping of enterprises can limit growth of the industry as long as they can acquire new learning<sup>37</sup>. In other words, the integrated learning base indirectly determined the potential size of the market. Thus, as long as first-movers keep acquiring new knowledge and creating innovation through continuous investments, their advantages are maintained. If they do not take the right strategy, called virtuous strategy (i.e. related diversification), they can lose their first-mover advantage and open the door to increased competition.



**Figure 1- 2. The Later Chandler's Model.**

Source: Compiled from Alfred D. Chandler, Jr., *Inventing the Electronic Century: The Epic Story of the Consumer Electronics and Computer Industries* (Cambridge: Harvard University Press, 2005.): xii-xvii, pp.2-6; *Shaping the Industrial Century: The Remarkable Story of the Modern Chemical and Pharmaceutical Industries* (Cambridge: Harvard University Press, 2005.): pp.6-12.

This is his other logic of large enterprise's advantages. There are some similarities to the concept of integrated learning base found in Utterback and Abernathy's concept of dominant design<sup>38</sup>. Dominant design is defined as the development of a new product (or set of features) synthesized from individual technological innovations introduced independently in prior variations of the product<sup>39</sup>. If dominant design indicates a dominant design of product, integrated learning base can be said to be a dominant design of industry or a competitive advantage in the



industry. Enterprises that created an integrated learning base can survive as long as they acquire new learning and continuously improve their integrated learning base, while individual products disappear over the long term even though product categories are maintained.

The later Chandler's Model emphasizes the role of management in developing productive resources<sup>40</sup>. Through an historical examination of international competition between first-movers and successful challengers, it provides the logic for the preservation of large industrial enterprise advantages. As long as managerial enterprises keep investing in related technology and markets with the right organizational structure (i.e. multidivisional structure), they can continue to be dominant in the industry. Although his early model has turned into a more dynamic model, it does not clearly indicate the logic of why some managers of managerial enterprises successfully continued to make the right investment and others did not, nor how first-movers converted each learned organizational capability into the creation of or improvement to the integrated learning base. This is because he has intentionally decided not to examine this point. Although a consideration of managerial capabilities is needed in order to further explore the logic, to which Chandler would likely agree, he avoided focusing on that due to the difficulties associated with the need to generalize<sup>41</sup>. Thus, as Hikino points out, there remains the problem of knowing under what conditions salaried managers could apply their managerial knowledge to appropriate investments for corporate growth and profitability<sup>42</sup>.

## 2. Subsequent Debate over Chandler's Model

Because of the significant influence of Chandler's model it has been under criticism, beginning around the 1970s and accelerating into the 1990s, this after not only U.S. managerial enterprises but also those of other countries began losing their dominance<sup>43</sup>. While the early

criticisms were based on external factors which the model did not consider, such as the existence of small firms and the influence of government or antitrust laws, the criticisms then targeted the logic of large enterprise advantages or the early Chandler's Model. Since these criticisms have already been discussed in a number of informative papers<sup>44</sup>, focus is placed on reviewing recent major criticisms regarding the role of managers and managerial capabilities, which Chandler has not deeply examined.

Although no consensus has emerged as on the post-Chandler's model, there are two major perspectives proposed so far by Richard N. Langlois and Naomi R. Lamoreaux, Daniel M. G. Raff, and Peter Temin (hereafter LRT). Both proposals reflected on the decline of Chandlerian enterprises that followed his early model and the economic environmental changes in the late twentieth century, called the new economy. Yet they differ in what they emphasize. While Langlois emphasizes the change in the supply side and technology and the modularization of production while describing "in the end there are markets," LRT pays more attention to the change in the demand side and markets and to long-term informal relations, based on Oliver E. Williamson's theory of "in the beginning there were markets", in order to understand the economic and business changes<sup>45</sup>.

Langlois sees Chandlerian managers as specialized in management but possessing general management capabilities, since their function was to buffer uncertainty<sup>46</sup>. Through the wave of conglomerate activity in the 1960s, managers learned that they could move divisions around like pieces on a chessboard, in the first instance this is due to the modular structure of the M-form<sup>47</sup>. Yet managers were generally insulated from the vagaries of the environment, especially those caused by financial and other markets<sup>48</sup>. As he describes, when modularity reduced the need for management and integration to buffer uncertainty and the development of markets were creating new tradable units by the late twentieth century<sup>49</sup>, managers, who were

in a mix of division-modules enterprises including non-conglomerated, extended the logic of the idea of corporate specialization and decided to hive off not only unrelated divisions but also vertically related divisions as well<sup>50</sup>. Thus Langlois' view on managers is that managerial capabilities can be seen as specific-general knowledge, and that managers flexibly respond to environmental changes through either specializing or by integration of business for corporate growth.

Although LTR has not much referred like Langlois and mainly mentioned to the fault of managerial hierarchies, they raise some aspects of the role of the manager and managerial capabilities. After firms introduced the M-form, the role of top management was to focus on resource allocation and longer-term strategic concerns, while providing divisional managers the latitude to respond to changing conditions and opportunities in their area of responsibility<sup>51</sup>. However, when rising per-capita income shifted consumer preferences toward higher quality, more individualized goods, and markets became thicker and transaction-cost issues were greatly reduced by falling transportation and communication costs, this revealed different managerial capabilities between enterprises<sup>52</sup>. Instead of responding to these changes, Chandlerian-style top management that were leading mergers from central offices, especially in the case of conglomerates, rarely had much detailed knowledge of the businesses they acquired and, as a result, increasingly restricted themselves to assessing divisional manager's performance<sup>53</sup>. They seemed unable or unwilling to reform themselves in response to changed economic conditions, until shareholders forced top managers to take note of the financial sector's evaluation of decisions taken<sup>54</sup>. On the other hand, the top management of new or foreign enterprises responded to the diverse preferences of customers by adopting innovation and another coordination mechanism (i.e. long-term relationships)<sup>55</sup>. According to their analysis, Chandlerian-style management largely did not have managerial capabilities to adopt changes because of the

highly developed hierarchies they were in, while others built the capabilities by relying on a different coordination mechanism. Thus they see managerial capabilities as the adaptability and resilience of the manager, which is a factor to explain the divergence in growth of successful and unsuccessful enterprises.

Although there is some difference between Langlois and LTR in their perspectives of managerial capabilities in Chandlerian enterprises, both emphasize the influence of environmental changes and adaptability of managerial capabilities on the divergence in Chandlerian enterprises. In this sense, their views are much simpler on managerial capabilities and manager than is Chandler's Model. Hence they much less pay attention to individualized managerial capabilities.

In considering Chandler's models and the major challenges to Chandler's model, it confirms there is a need to understand what, why, and how top management made decisions in order to fully examine the divergence of growth among large U.S. enterprises in the late twentieth century. Because managerial motives within firms might not be so much based on economic efficiency, rather on political solutions,<sup>56</sup> and corporate objectives are often diversified<sup>57</sup>, it is helpful to introduce the approach of the managerial capabilities perspective in order to comprehend the divergence. Thus there is a need to look at the talents of managers, as Chandler described in *Strategy and Structure*:

“Although the enterprise undoubtedly had a life of its own above and beyond that of its individual executives, although technological and market requirements certainly set boundaries and limits to growth, nevertheless, its health and effectiveness in carrying out its basic economic functions depended almost entirely on the talents of its administrators.<sup>58</sup>”

### **III. Perspectives on Managerial Capabilities**

Although the talents of administrators range from top, middle to lower management, the top management capabilities (or managerial capabilities) are the most essential to successful maintenance of the long-term health and growth of the enterprise<sup>59</sup>. Managerial capabilities, which are based on management knowledge and experience, are learned in order to administer the activities of the functional operating units, to integrate their activities, and to coordinate the flow of goods from suppliers of raw materials through the processes of production and distribution to the retailers and final customers<sup>60</sup>. Among a number of functions of these capabilities, the core that determines the fate of the enterprise is decision-making on the allocation of business resources<sup>61</sup>. Decisions by top management have been a classic topic for examination up to the present.

#### **1. Managerial Capabilities in Business History**

In business history, decisions or decision-making have been a central theme for study from the early days<sup>62</sup> to the present<sup>63</sup>. More recent discussions have gradually recognized that business history should pay more attention to this aspect of management to avoid theological, deterministic or backward-looking history<sup>64</sup>. To examine the aspect of decisions, Arthur M. Johnson is considered an early scholar who has provided the framework<sup>65</sup>. He pointed out the importance of the perceptions of decision-makers, which influence and are influenced by the firm's organizational structure<sup>66</sup>. Certain types of perception (e.g. "compulsory" and "permissive") are associated with certain organizational changes<sup>67</sup>. Taking from Johnson's approach, Akio Okochi amplified the perceptual approach with thoughts of Japanese philosopher Miki

Kiyoshi, and developed a set of empirical studies that focus on perceptions and decision-making within business enterprises, through his approach called as *keiei-koso-ryoku* or entrepreneurial perception<sup>68</sup>. Even though a number of business historians intentionally or unintentionally mention the role of perceptions in their studies, there are seemingly few business history studies beyond Okochi that deal mainly with perceptions.

However, although the value of Okochi's studies has been greatly recognized, there are also limitations to his approach. Yonekawa, for instance, values his study as one that took a step forward in moving from abstract methodology of entrepreneurial history, but he raises that it does not cover the environmental factors of the firm's organization in its analysis, as his discussion did not much consider this aspect of the historical background<sup>69</sup>. Yonekura further criticized that Okochi's analysis of perceptions is far less analytical or historical and much more subjective, although it should be recognized as a novel study of individual decision-making processes<sup>70</sup>. While understanding the importance of the perceptual approach as one of methods for gaining an "ex ante" perspective, Suzuki concludes that it is difficult to describe a set of historical causes and effects solely through an accumulation of numerous elucidations of the decision-making process<sup>71</sup>. Instead, decisions can be better situated within the vital process of historical case and effect if examined along with institutional changes<sup>72</sup>.

While Jones and Wadhvani describe how the study of entrepreneurship has been conducted with broad literature review and Miyamoto bridges the historical and to present entrepreneurship study in Japan, entrepreneurial history, another prime research field in business history, has historically and more vigorously examined the cognitive actor<sup>73</sup>. To understand the entrepreneur as an agent of change in an economy, entrepreneurial history focuses not only on individuals and firms but also on temporal changes in the industries, markets, societies, econo-

mies, and political systems<sup>74</sup>. Wadhvani and Jones classify various approaches into three perspectives, one of which is the cognitive perspective, to understand the choices and actions of social and economic actors<sup>75</sup>. For the study of entrepreneurial history, Sasaki proposes factors to which researchers should pay attention, such as the subjective conditions and objective conditions of the entrepreneur<sup>76</sup>. While objective conditions are further distinguished as market conditions (i.e. demand and supply factors) and non-market condition (e.g. geographical, cultural, and legal factors), subjective conditions are divided into (1) individual competencies that lead to keiei-koso-ryoku, (2) individual competencies for organizing, and (3) individual competencies for practicing<sup>77</sup>. Through examining the interaction between subjective and objective conditions, it reveals the entrepreneur as an innovator. Studies of entrepreneurial history have been developed with adherence to these factors. However, entrepreneurial history tends to look more at successful individual entrepreneurs<sup>78</sup>, and also has lost traction as attention is focused on the corporation<sup>79</sup>. Moreover, because it is fragmented and usually on the margins of mainstream research agenda<sup>80</sup>, there does not appear to be an analytical framework although studies of entrepreneurial history provide great insights into decision-making.

Thus, although the importance of both decision-making and cognitive / perceptual aspects is sometimes integrally and other times separately claimed in business history, it does not seem to be reflected in an integrated analytical framework. As a result, these important aspects have been relatively less discussed or unaddressed with regards to fully understanding the disparity in Chandlerian firms in the second half of twentieth century.

## 2. Managerial Capabilities in Other Disciplines

### (1) Economics

Managerial capabilities and the disparity between enterprises has been discussed at length in economics. In her early influential study, *The Theory of the Growth of the Firm*, Penrose discussed managerial capabilities as managerial services. Although not clearly defined as such, the main function of managerial services is the creation and execution of plans for expansion and related decision-making<sup>81</sup>. With regard to the construction of an analytical framework for managerial capabilities, her study indicates that managerial capabilities cannot be understood at the level of the individual but rather as an aggregate of the management team<sup>82</sup>. In addition the study points out that the capacities of the existing available managerial personnel of the firm set a limit on any expansion of that firm<sup>83</sup>, in other words, the difference in the availability of managerial capabilities is a factor that can influence of the level of corporate growth. Thus it can be said that managerial capabilities, which the aggregate of management team, led to disparity in growth between enterprises.

Regarding the theory of the firm, Shimizu reviewed neoclassical economics (with emphasis on new institutional economics) and evolutionary economics, the latter on which, as Abe points out, Chandler later had an attraction<sup>84</sup>. In order to demonstrate the importance of taking an institutional political and economic approach to a firm, he indicates that evolutionary economics needs to investigate business concepts to allow an adequate explanation of the disparity between firms<sup>85</sup>. Witt introduces the notion of business concepts into evolutionary economics as a means for examining the neglected dimension of the evolutionary theory of the firm, which brings in the role of substantive / cognitive aspects or conceptions to organize meaningless or ambiguous information into significant agendas and action plans<sup>86</sup>. Through the discussion of disparities between enterprises in terms of economics, it is suggested that the one of the keys to understanding such disparities is to study both the decision-making and the cognitive aspects of the firm.



This aspect has also been explored in other school of economics. G. L. S. Shackle is the one of the notable economists who studies the theme of choice, decision and imagination<sup>87</sup>. Shackle describes the essential nature of choice as man's most direct, inescapable and imperious intuitions which reflect his own thought encompassing sense: perception, intellection, emotion, imagination, decision<sup>88</sup>. Although the views of Shackle and evolutionary economics seem fundamentally incompatible<sup>89</sup>, his findings do have commonality in terms of Witt's discussion.

## (2) Management Studies

Management studies have increasingly discussed and developed the concept of managerial capabilities and differences between firms since its inception. Regarding managerial capabilities and decision-making, Child's "strategic choice" perspective is the one of early influential concepts<sup>90</sup>. Quoting Chandler's analysis, Child argued that the ways in which organizations were structured was determined by strategic decision-making (i.e. strategic choice) of dominant coalition (e.g. top management) as a result of the political process which considered factors outside/inside the organization<sup>91</sup>. The work of Miles and Snow is regarded to be one of the achievements in this stream of study. While referring to Child's strategic choice and other concepts, such as Weick's environmental enactment and other studies (e.g. James Thompson and Chandler etc), Miles and Snow took the interactions between strategy and organizational structure into account<sup>92</sup>. They argued that the process of organizational adaptation is neither an uncontrolled phenomenon nor a process involving perfectly rational and efficient choice<sup>93</sup>. Their study raises that top management attention and decisions affect organizational adaptation and offers four unique types of adaptation: Defender, Prospector, Analyzer, and Reactor<sup>94</sup>. In other words, it supports that top management's decision-making is one of main factors for differences in firms.

The studies of dynamic capabilities theoretically examine the inside of managerial capabilities. Teece, Pisano and Shuen's paper, which was distributed as a working paper in 1990 and published in 1997, is the start to dynamic capabilities<sup>95</sup>. In his paper which discussed the relation between dynamic capabilities and Chandler's (managerial) capabilities, Teece notes that the concept of dynamic capabilities can be the capabilities (i.e. managerial capabilities) for the three-pronged investment emphasized by Chandler<sup>96</sup>. To analyze the capabilities, Teece proposes that it can be examined in terms of three capacities: (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and when necessary, reconfiguring the business enterprise's intangible and tangible assets<sup>97</sup>. The capacity to sense involves an analytical system's (and individual's) capacity to learn and to sense, filter, shape, and calibrate opportunities<sup>98</sup>. The capacity to seize is based on the quality of the enterprise's routines, decision rules, strategies, and leadership around evaluating new investment opportunities<sup>99</sup>. The capacity to reconfigure is the ability to recombine and to reconfigure assets and organizational structures as the enterprise grows, and as markets and technologies change, as they surely will<sup>100</sup>. To maintain competitive advantage, a business enterprise needs to maintain these capacities. In addition because these capacities are unlikely to be found in individual managers, the principal executive office must succeed in getting top management to operate as a team to maintain these capacities within the top management team at large<sup>101</sup>. In other words, since top management team maintains the capacities and plays the role of sensing, seizing, reconfiguring the business enterprise, it useful to examine perceptions and decisions related to these points in order to better understand managerial capabilities and disparities between enterprises.

Another perspective, which is different stream from dynamic capabilities, is the attention-based-view (hereafter ABV) proposed by William Ocasio<sup>102</sup>. Referring to cognitive science, social psychology, organizational theory, and strategy process perspectives, Ocasio emphasizes the importance of the distribution of the decision-maker's attention in order to understand firm behavior<sup>103</sup>. ABV provided a metatheory of organizational action and adaption that focused on attention and explained how attention in organizations shapes organizational adaption<sup>104</sup>. Among his arguments, it indicates how selective attention both facilitates and inhibits perceptions and actions on firm behavior<sup>105</sup>. Even though ABV does not refer to managerial capabilities, it provides some factors (i.e. attention, perception, and action) to examine decision-makers such as top management.

### 3. Analytical Framework for Managerial Capabilities in Business History

Although it has, to degrees, been separately discussed in business and entrepreneurial history, different schools of economics and management studies, this provides similar and useful points for the consideration of managerial capabilities. From the discussion above, at least three basic actions can be derived for managerial capabilities. That is what top management perceives from the external environment, what they see as prospects for the future, and what they take in terms of actual actions. Managerial visaction (the combination of vision and action) represents the set of the three top management actions, and is hereafter used to facilitate explanation. To empirically examine the disparity between business enterprises from a managerial capabilities perspective, the framework of visaction is one way to consolidate a variety of historical documents and materials for this purpose. Although some theoretical discussions provide more detail on analytical frameworks, difficulties can arise in an empirical examination with historical documents. Moreover, a looser framework can sometimes help to draw more historical dynamics in a long-term scope.

## **IV. Corporate Transformation on Chandlerian Firms**

### **1. Research Approach and Research Question**

To empirically examine the disparity of Chandlerian firms through business history relationships, decision-making and perceptual aspects of business enterprises, the methodology should consider research methods regarding decision-making and the selection of case study as follows.

To examine decision-making, not only the decision itself should be considered but also other factors related to the decision, such as perceptions and actual behaviors / actions. Thus the process that advanced perceptions into actions (i.e. managerial visaction) should be analyzed. To verify these actions of top management, one pays attention to the “language of business<sup>106</sup>,” namely how managers discuss and process signals that are emerging in their environment. The order in which they deconstruct the environment and address challenges allows for an investigation into disparities from the ex-ante perspective.

To adequately investigate disparity in business enterprises requires the study of at least more than one firm. However, there are practical difficulties involved in qualitatively examining numerous firms through research of historical materials. Hence the subject of research should allow for a representative case that can be conducted with quantitative research. In addition the object of the case should be significantly broad to allow an overall comparison of successful growth enterprises to failures, to avoid the trap of relying on a rational narrative<sup>107</sup>.

### **2. General Electric Company and Westinghouse Electric Corporation**

Following the above methodology, GE and WH are selected as the objects for this study. Both enterprises were considered to be Chandlerian firms. They were rivals and both were centered in the electric / electronics industry in the twentieth century, this provides for similar business structures to help reduce the bias of dissimilarity in the comparative research. In addition, these two enterprises took contrasting transformation paths toward the end of the century. Under the leadership of CEO Jack Welch, GE operations were reformed in the 1980s, it remained as “GE” and enjoyed re-growth in the 1990's. Conversely, WH not only changed its business structure but also its name, to “CBS<sup>108</sup>,” and CBS ultimately met its demise as an independent firm when it entered the new century. Even though some scholars cast doubt on whether the comparison should simply consider GE as a success and WH as a failure<sup>109</sup>, the comparison still provides clues to understanding the disparity between the firms by studying why and how this contrasting corporate transformation occurred.

Previous studies on GE and WH and the second half of twentieth century indicate that the firms had, in the background, grown quite different in terms of management practices, financial aspects, and corporate growth. In analyzing the transformation of U.S. industrial enterprises listed as Fortune 100 companies in 1974, Nohria, Dyer and Dalzell describe the divergence that emerged between GE and WH as a very symbolic case, while the U.S. was moving away from an industrial to a post-industrial economy. More specifically, they contend that GE was more than a step ahead of WH in terms of organizational control and with the introduction of strategic management processes during the period<sup>110</sup>. Sakamoto and Rothschild studies of GE provide more detailed descriptions<sup>111</sup>. To extricate itself from profitless growth in the late 1960s, GE drove to institutionalize advanced strategic management and planning<sup>112</sup>. For instance, each of the SBU strategies within GE was subject to a personal review and evaluation by the CEO himself<sup>113</sup>. GE recognized its own strategic management system to be distinct

when compared to other companies<sup>114</sup>. In this sense, GE and WH were diverging in terms of their respective approaches to organizational systems and strategic management.

With regard to financial aspects, O'Sullivan's analysis provides some indication. Using both companies to explore the relationship between their financial systems and corporate growth, she reveals that the financial behavior of the two companies, beginning in the mid-1970s, strikingly diverged<sup>115</sup>. One of her findings is that GE, toward the end of twentieth century, was more successful than WH at achieving efficiencies in the use of its working capital while WH continued with a higher financial dependence on working capital<sup>116</sup>. GE's relative financial dependence declined, even in periods of economic decline, suggesting that GE could manage financial aspects better than WH. Miyata's study supports her findings. His study confirms that GE and WH started diverging in their respective financial standings in the 1970s while their investment patterns were similar throughout the decade<sup>117</sup>.

An obvious fact is that GE outperformed WH in the 1970s. Regarding sustained corporate growth, Fleck's quantitative and descriptive examinations of GE and WH, from their foundations to the end of the 1990s, demonstrates that the already existing pre-1970s gap in growth gradually expanded during the 1970s<sup>118</sup>. She emphasizes top management coordination as a key factor, not to mention very distinct approaches to expansion and a dissimilar management of risk<sup>119</sup>.

However, these previous researches are less successful in explaining the relationship between top management and corporate transformation that is specific to either GE or WH. As an introductory story of the transformation of American enterprises after 1974, Nohria, Dyer and Dalzell's study is limited to describing an overview and does not provide analytical insight.

Although O'Sullivan conducted an in-depth study on GE and WH, her main concern is the relation between the U.S. financial system and corporate finance over a period covering almost 100 years. Her study does not specifically consider the dynamic of top management. On the other hand, although Miyata's study attempts to grasp top management decision-making in terms of investment, it is less successful in investigating the historical context of decisions. Fleck provides the most comprehensive understanding of the managerial capabilities on GE and WH, but her study lacks analytical detail on the process of visaction: how top management perceives, anticipates, and behaves.

### 3. Research Materials

The reason top management perceptions and behaviors have not been explored sufficiently is mainly due to a limitation of historical sources. This presentation uses a set of historical documents to overcome this limitation, as follows. For perceptions and conceptions of GE's top management in the 1950-70s, this is examined through Executive Speeches and Reports to Share Owners and the speech manuscript collection of GE's executives. For WH, an examination of the speeches collection is also pursued, found in the Records of the Westinghouse Electric Corporation and which consists of speeches given mostly by members of senior management from 1968 to 1980. In addition, Corporate Annual Reports, newspaper and magazine articles are used for other areas not covered by the speech collections. Even though the speech manuscripts and articles are public record, and do not provide an exact reflection of each executive's perception and conception, it can be considered as the consensus of GE's and WH's top management thinking at the time and allows a proxy for an analysis of changes in a company's perceptions and conceptions<sup>120</sup>.

Also used are strategic and R&D planning documents, M&A&D data, and financial data, to examine how top management's perceptions and conceptions reflect on corporate behavior. For instance, for GE, Moody's Industrial Manual, Corporate Annual Reports, the Downs Collection and R&D Planning Series are accessed, whereas for WH, Moody's Industrial Manual, Corporate Annual Reports and Series XIII. Research and Development/Science and Technology Center 1919-1998, the Records of the Westinghouse Electric Corporation are used. Most of the historical documents were collected by the author at the miSci Archives, Schenectady, NY, and the Library and Archives of the Heinz History Center, Pittsburgh, PA.



## Chapter 2

### Managing Expansion in the Wave of the “Golden Age”, from 1946 to 1970

"As we go through life we gradually discover who we are,

but the more we discover, the more we lose ourselves."

Haruki Murakami, *Colorless Tsukuru Tazaki and His Years of Pilgrimage*

#### I. Unrelated Diversification and Corporate Competitiveness

This chapter explores the development of a wider gap between GE and WH in corporate performance and business competitiveness in the domestic conventional steam turbine business during the 1950s and 1960s, and explores top management thinking and contextual variables<sup>121</sup> as contributors to this gap.

Since their establishment, GE and WH were first movers and lead firms in the field of modern American electrical-equipment<sup>122</sup>. Globally, they built dominant positions and, along with German first movers AEG and Siemens & Halske, formed the Big Four that dominated

until well after World War II<sup>123</sup>. Both American firms were powerfully competitive in the domestic and international markets for electrical equipment but their positions were not satisfactorily maintained in the post-war market. For example, even in the production of heavy generators, a capital and technologically intense business line that presents significant barriers to new entries, both firms were significantly challenged, losing approximately 30% of total domestic market shares to intensified competition.

The primary factor for the loss in market share during this period can be captured within the context of cause-and-effect, specifically the impact that overdiversification and the American antitrust policy had in the poor performance that ensued<sup>124</sup>. However, the firms did not lose their market shares strictly as a result of higher diversification. WH lost market share while GE, in the end, was able to maintain its share by 1970, this after implementing a similar diversification strategy and experiencing comparable fluctuations in its share of conventional steam turbines. Why do similar corporate strategies lead to the different consequences in traditional business lines for two of America's leading electrical manufacturers?

The U.S. conventional steam turbine business experienced two phases of competition during the same period. The first phase, lasting until the early 1960s, consisted of oligopolistic competition amongst domestic firms. This lasted until the 3rd ranked, Allis-Chalmers, exited

the business<sup>125</sup>. The second phase is characterized by international competition, which emerged when foreign firms accelerated their penetration into the U.S. market in the late 1960s. During each phase both firms pursued similar corporate strategies, namely expansion and diversification of business. In the two decades that followed, however, their respective corporate strategies wandered onto different paths. With symbolic phrases capturing their strategies, the two entities forged ahead with ambitious plans with titles such as the Expansion Program in the 1950s, and the total electrification and new venture programs during 1960s. The term “strategy” was not commonly used in business society at that time, however both firms expanded and diversified their businesses under the direction of their respective corporate programs. It is therefore essential to explore how and why they changed corporate strategies if we are to understand the striking differences that surfaced between firms as they moved away from their traditional business lines.

Although numerous researches reveal much about both firms for the period (notably GE), not much focus is placed on the influence corporate strategies had on business competitiveness and on the expanding gap that arose between these two first movers of the U.S. electric manufacturing industry.

Seminal work by Denise L. Fleck provides a holistic picture of the divergent developments of both firms, from foundation to the end of the twentieth century<sup>126</sup>. In terms of top management's link to sustainable growth, her quantitative and descriptive study of both firms does inform on contributors to divergent performance. That is, GE understood entrepreneurial behavior and consistently developed strong coordinating capabilities, while pursuing a systematic expansion to more high-tech diversification and hedging its risk under an integrated corporate strategy. Meanwhile, WH's initial piecemeal expansion went from mainly a non high-tech base (outside of electrical) to a strategy of low risk hedging, following a micro-based strategic plan that rewarded results and swung back and forth between tight and loose coordination. Fleck evaluates the impact of divergent corporate growth between the firms by exploring organizational coordinating capabilities, leaving room to examine how corporate strategies actually affected the business competitiveness of the two. Although GE possessed high-tech business lines and maintained strong coordinating capabilities, more than that of WH, GE also pursued nearly the same level of non high-tech diversification as WH during the 1960s. It would be insightful to examine the detail of this diversification and business competition over the 1950s-60s period in order to verify why similar corporate strategies led to different performances.

In terms of organizational structure, WH was more progressive than GE. For example, GE only took its reorganization to a multidivisional structure after the Second World War whereas WH had already introduced this in 1931<sup>127</sup>. If Alfred Chandler's thesis on strategy and structure is valid, that when a new organizational structure (multidivisional structure) follows a new strategy (diversification)<sup>128</sup> then economic performance follows, WH would therefore be superior to GE in terms of performance. However, as Aupperle, Acar and Mukherjee find through their statistical study, GE demonstrated consistently better performance than WH even when GE's structure was mismatched to the new strategy<sup>129</sup>. This suggests that fitting an organizational structure to a corporate strategy does not clearly link to performance<sup>130</sup>. At a certain level, this opens the possibility that the organizational structure did not much influence the different performances of GE and WH.

Mary O'Sullivan examines both firms from a corporate finance perspective, to propose insight from a micro-level study that shed light on the financial development and economic performance at the national level<sup>131</sup>. In her studies, GE and WH were in similar financial positions until the early 1970s, although WH tended to be more reliant on the financial system and larger deficits. For instance, although GE was consistently more profitable than WH, the difference in the average retention levels between the two was much smaller until the late 1960s. At

that time GE started distributing higher dividends, this was not only a reflection of GE generating higher profits because it was also distributing a relatively higher share of its profits to shareholders<sup>132</sup>. This implies the need to factor in other considerations beyond corporate finance to explain the growing gap between the 1950s to the 1960s.

Also during this period industrial relations issues, including outbreaks of strikes, arose as an additional concern to both firms. Soon after the end of the Second World War widespread strikes occurred, effectively shutting down every GE and WH plant in the U.S. and Canada<sup>133</sup>. It was the first great strike in the history of the industry and it prompted both top management teams to change their labor policies<sup>134</sup>. According to Ronald Schatz, when compared to GE, WH was already disadvantaged from the onset by its relatively higher labor costs<sup>135</sup>. WH then went on to take a severe loss during the 1955-56 strike while GE avoided the strike altogether, even though both firms offered the same settlement<sup>136</sup>. Another difference is that GE further distinguished its labor policy by applying product marketing to employment, later termed “Boulwarism” after Lemuel R. Boulware, which opened two-way communications between top management and employees<sup>137</sup>. This difference in employee relations over the period raises an evidence gap with regard to the respective organizational coordinating capabilities, it was

basically outside of Fleck's primary research to explore how differences in labor policy affected performance and competitiveness.

When compared to WH, there are numerous more researches on GE that cover this period, such as George Downing, Kesaji Kobayashi, Ronald Greenwood, Mary O'Sullivan, Kazuichi Sakamoto, William Rothschild, and William Ocasio and John Joseph<sup>138</sup>. Although the main drivers for these other specific research objectives were different, they commonly regard the organizational structure and new business ventures as vital factors that influenced GE over the period. In the process of converting to peacetime operations after the Second World War, under the helm of Ralf Cordiner GE introduced the multidivisional structure<sup>139</sup> and the new governance channel<sup>140</sup> to respond to increasing demands for electricity, electrical products, and war supplies<sup>141</sup>. This new controlled but decentralized organization encouraged adaptation rather than innovation<sup>142</sup>, and did not contribute much to corporate growth and profitability<sup>143</sup>. To accelerate corporate growth, Fred Borach, the successor to Cordiner, expanded into new businesses during the 1960s, such as nuclear power, jet engines, computers and some service businesses<sup>144</sup>. By increasing sales with lower profitability, these new ventures led to "growth without profit" until the end of the 1960s.<sup>145</sup> While it really depends on the individual re-

searcher to determine the degree to which the new organization positively affected GE's performance in the 1950s, there is some consensus that the new ventures (e.g. computer business) brought negative consequences to profitability<sup>146</sup>. However, these researches tend to examine the corporate level of GE, and do not delve into how top management decisions influenced core business competitiveness, as the rationale for entering into one new business over another.

Hence, although Fleck singles out organizational coordinating capabilities as a major contributor to the divergent corporate performance between the two giant electric firms over the two decades, these capabilities do not fully explain the wide gap that emerged.

To examine this further, the current chapter employs a variety of historical sources and books, as follows. For the market situation in the U.S. conventional steam turbine industry, it mainly uses data on Ralph G. M. Sultan's *Pricing in the Electrical Oligopoly, Vol. I and Vol. II*, which is based on a set of antitrust lawsuits against GE and WH: *Ohio Valley Electric v. General Electric* (SD.N.Y. 1965); *City of San Antonio v. Westinghouse* (W.E. Texas 1964); *Philadelphia Electric v. Westinghouse* (E.D. Pa. 1964)<sup>147</sup>, and legal data from LexisNexis Academic database and comparative analysis reports between GE and WH found in the Records of the Westinghouse Electric Corporation as its supplementations. For corporate strategy as a reflec-



tion of the perceptions and conceptions of GE's top management during the period, this is examined through Corporate Annual Reports for 1946-1970 and Executive Speeches and Reports to Share Owners, and the speech manuscript collection of GE's executives covering 1955-1970. For WH, an examination of corporate strategy and top management's perspective is pursued through Corporate Annual Reports for 1946-1970, newspaper and magazine articles, and some administrative meeting documents found in the Records of the Westinghouse Electric Corporation. Even though the statement of annual report and the speech manuscripts are given in public, and do not provide an exact reflection of each executive's perception and conception, it can be considered as a proxy of the consensus of GE's and WH's top management thinking at the time and allows an analysis of the changes in these perceptions and conceptions. Most of the historical documents were collected by the author at the miSci Archives (previously Schenectady museum archives), Schenectady, NY, and the Library and Archives of the Heinz History Center, Pittsburgh, PA<sup>148</sup>.

This chapter investigates why similar GE/WH corporate strategies for diversification led to different consequences in the conventional steam business and what influence top management had in terms of corporate strategy.

The next section starts by comparing financial and industrial data to verify the tendencies and differences in corporate performance and business competitiveness of the two firms over the two decades. It demonstrates that there was already a gap in the actual size of the number one and number two firms and, although it widened toward the end of the 1950s, the gap in financial standing had relatively narrowed but the market share in steam turbine business had been widened toward the end of the 1960s. The subsequent section then raises the impact of going from oligopolistic to international competition in the U.S. conventional steam turbine industry, a traditional core business during the period. This demonstrates that WH had already started losing its competitiveness during the 1950s while GE was leading the competition. An explanation is then offered on how corporate strategy influenced differences in the steam turbine business, as it is the result of top management perceptions and conceptions as applied to diversification for corporate growth and to address evolving social and governmental demands.

The conclusion drawn is that, even while both top managements responded with similar strategies to increasing demands, the accelerated gap between GE and WH in the U.S. conventional steam turbine was mainly a result of differences in levels of available resources.

## **I. Divergence in Business Competitiveness**

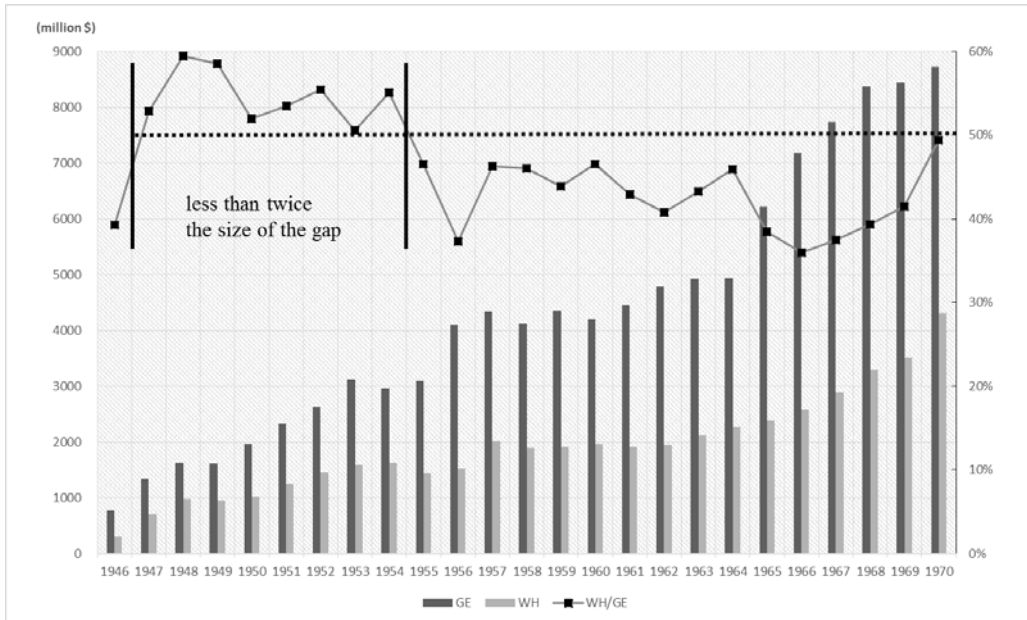
This section discusses the size and financial standings of both GE and WH during the period, using data on sales, profits, costs and growth ratios.

### **1. Traits of Corporate Performance, 1946-1970**

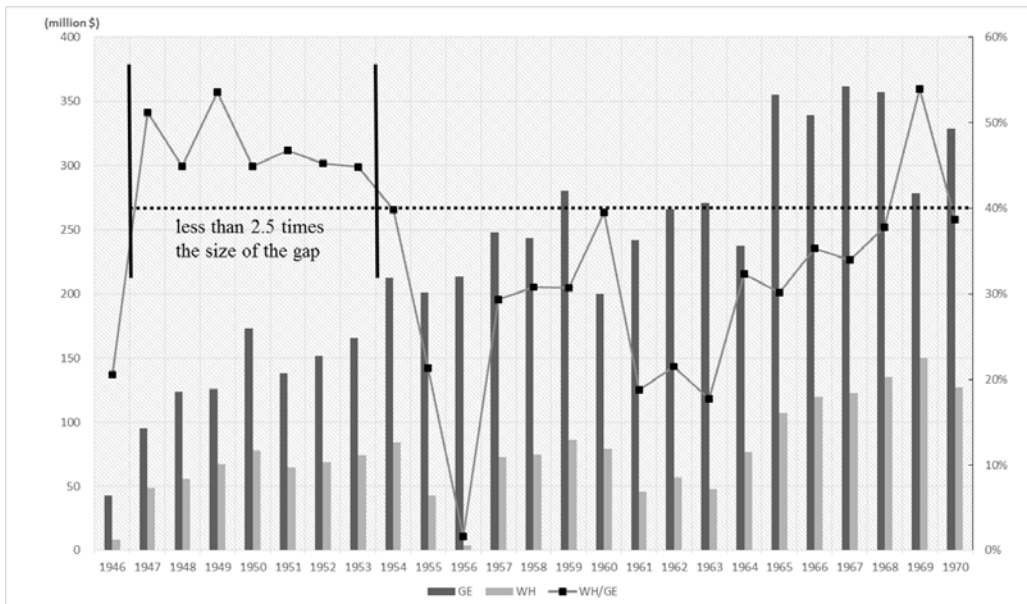
Over the long history of U.S. electrical manufacturing it becomes evident that GE was larger than WH in many regards, and remained the number one firm in the industry since the 1892 birth by merger of Edison General Electric and Thomson-Houston. As seen in figure 2-1, GE was 41-49% larger than WH in terms of sales until 1954, with the exception of just after the end of the war in 1946. From the mid-1950s, when WH was struggling with the labor strike<sup>149</sup>, a gap in sales volume developed. Although WH gradually closed the gap at the end of the 1960s, GE was still more than twice the size of WH toward 1970.

A similar tendency can be found in their net incomes, as shown in figure 2-2, but with a moderately larger gap. Although GE had already gained 46-55% more in net income from the late 1940s to middle 1950s, the gap was even more pronounced in terms of sales from the mid-1950s. GE averaged 70% more sales than WH between 1954 and 1970, although in the 1960s

WH gradually closed the gap and, by the late 1960s, was back to the same level seen in the early 1950s.



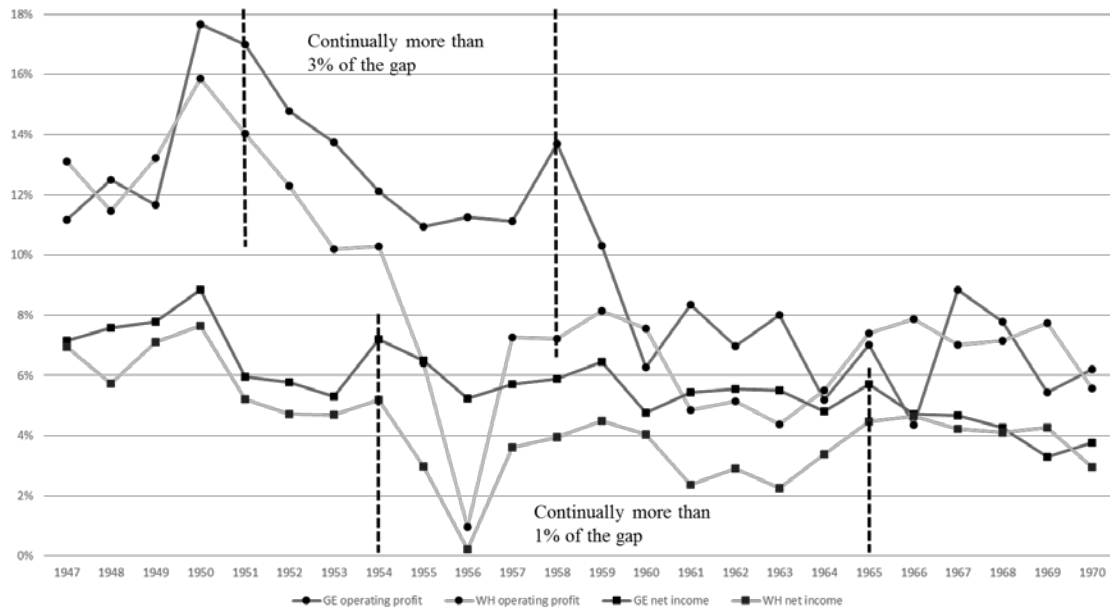
**Figure 2-1. Net sales (\$ million) for GE and WH and the resulting gap (WH/GE %), 1946-1970.**  
 Source: Compilation of data from GE, *Annual Reports*, various years and WH, *Annual Reports*, various years.



**Figure 2-2. Net income (\$ million) for GE and WH and the resulting gap (WH/GE %), 1946-1970.**  
 Source: Compilation of data from GE, *Annual Reports*, various years and WH, *Annual Reports*, various years.

Regarding the actual size of the firms, the post-war period can be divided into three time periods: the first goes until the mid-1950s, when the gap had GE about double the size; the second is the decade spanning the mid-1950s to the mid-1960s, a period during which the gap expanded even further; and the last period covers the second half of the 1960s, when WH closed the gap to levels that were seen prior to the mid-1950s.

The three periods are observed in terms of profitability in figure 2-3. The differences in the net income on sales ratio increased about 1% after the mid-1950s and then reduced from the mid-1960s. As for the operating profit on sales ratio, there is a slight difference. The growth in the gap started from the early 1950s and then shrank towards the end of 1950s. Aside from the differences that existed between firms, profitability was clearly declining for both firms by the 1970s. This was following the general trend for U.S. firms during the period, as they lost core business competitiveness to foreign rivals as a result of unrelated diversification<sup>150</sup>. Moreover, it also indicates that GE had entered more aggressively into a “growth without profit” strategy than did WH during the 1960s.



**Figure 2-3. Operating profit and net income on sales, 1947-1970.**

Source: Compilation of data from GE, *Annual Reports*, various years and WH, *Annual Reports*, various years.

Note: To allow a comparison between firms, the author calculates operating profit by the following method: GE operating profit is derived by subtracting compensation of employees, job dividends, materials etc., and depreciation charges from net sales data drawn from the annual report; WH's operating profit is derived by subtracting wages and salaries, employee insurance and pensions, social security taxes, materials and services from others, and wear of facilities from net sales data drawn from the annual report. To more clearly demonstrate the tendency, 1946 is excluded from the graph.

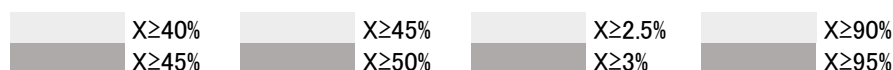
In terms of cost structure, the growth in the profitability gap is reduced, not because WH had improved its profitability but mainly because GE had moved more closer to WH's performance in the 1960s. Through 1946 to 1970, GE generally fell below WH in its cost to sales ratio (see table 2-1). However, along with WH, GE's ratio started to increase from around 1960.

Comparing the average labor and material costs of 1947-60 to that of 1961-70, GE's ratio increases from 39.1% to 41.7% and 45.8% to 48.2% respectively while WH increases went from 40.2% to 42.2% and 47.9% to 49.1% respectively. In addition, GE carried a larger depreciation

ratio than WH, and its level went considerably higher toward 1970 while WH's ratio was decreasing. Due mainly to increasing costs both firms trended to less profitability during the 1960s, with GE declining more than WH and leading to similar respective profitabilities until 1970.

**Table 2-1. Costs to sales, 1946-1970.**

|       | Labor cost |       | Material cost |       | Depreciation |      | Total |        |
|-------|------------|-------|---------------|-------|--------------|------|-------|--------|
|       | GE         | WH    | GE            | WH    | GE           | WH   | GE    | WH     |
| 1946  | 51.7%      | 65.1% | 44.2%         | 50.3% | 2.8%         | 2.2% | 99.8% | 119.8% |
| 1947  | 41.7%      | 43.3% | 45.0%         | 42.3% | 2.1%         | 1.3% | 89.1% | 90.1%  |
| 1948  | 40.4%      | 39.9% | 44.7%         | 47.5% | 2.3%         | 1.2% | 87.5% | 90.5%  |
| 1949  | 40.3%      | 39.4% | 45.1%         | 45.9% | 2.9%         | 1.5% | 88.3% | 89.1%  |
| 1950  | 35.5%      | 37.5% | 44.2%         | 45.2% | 2.6%         | 1.5% | 82.3% | 85.5%  |
| 1951  | 37.5%      | 38.0% | 43.1%         | 46.6% | 2.4%         | 1.4% | 83.0% | 87.0%  |
| 1952  | 37.2%      | 37.7% | 45.8%         | 48.5% | 2.3%         | 1.5% | 85.2% | 89.1%  |
| 1953  | 36.7%      | 38.5% | 47.5%         | 49.5% | 2.2%         | 1.8% | 86.3% | 91.4%  |
| 1954  | 37.8%      | 39.6% | 47.4%         | 47.8% | 2.7%         | 2.3% | 87.9% | 90.5%  |
| 1955  | 38.8%      | 40.2% | 47.4%         | 50.4% | 2.9%         | 3.0% | 89.1% | 95.3%  |
| 1956  | 37.4%      | 41.5% | 48.7%         | 54.4% | 2.7%         | 3.1% | 90.0% | 100.5% |
| 1957  | 39.6%      | 39.6% | 46.5%         | 50.7% | 2.8%         | 2.4% | 88.7% | 94.1%  |
| 1958  | 39.8%      | 41.3% | 43.5%         | 48.9% | 3.0%         | 2.5% | 88.8% | 94.1%  |
| 1959  | 41.0%      | 42.8% | 45.9%         | 46.6% | 2.8%         | 2.4% | 88.2% | 93.2%  |
| 1960  | 44.0%      | 43.9% | 46.9%         | 46.1% | 2.8%         | 2.4% | 91.7% | 93.8%  |
| 1961  | 42.7%      | 43.9% | 46.3%         | 48.7% | 2.6%         | 2.5% | 90.3% | 96.5%  |
| 1962  | 42.6%      | 44.3% | 47.8%         | 47.7% | 2.7%         | 2.9% | 90.2% | 96.2%  |
| 1963  | 43.1%      | 42.8% | 46.3%         | 50.1% | 2.6%         | 2.8% | 90.2% | 96.9%  |
| 1964  | 44.3%      | 41.3% | 47.9%         | 50.5% | 2.6%         | 2.7% | 91.8% | 94.9%  |
| 1965  | 40.7%      | 41.4% | 49.3%         | 48.5% | 3.0%         | 2.7% | 95.7% | 93.0%  |
| 1966  | 40.8%      | 42.7% | 51.6%         | 47.1% | 3.3%         | 2.3% | 96.4% | 92.5%  |
| 1967  | 39.8%      | 42.0% | 47.7%         | 49.1% | 3.6%         | 1.9% | 92.5% | 93.8%  |
| 1968  | 40.2%      | 40.3% | 48.5%         | 50.6% | 3.6%         | 2.0% | 89.8% | 93.6%  |
| 1969  | 41.6%      | 40.9% | 48.8%         | 49.4% | 4.2%         | 2.0% | 95.2% | 93.1%  |
| 1970  | 43.3%      | N/A   | 46.7%         | N/A   | 3.8%         | 2.0% | 94.9% | 95.8%  |
| 47-60 | 39.1%      | 40.2% | 45.8%         | 47.9% | 2.6%         | 2.0% | 87.6% | 91.7%  |
| 61-69 | 41.7%      | 42.2% | 48.2%         | 49.1% | 3.1%         | 2.4% | 92.5% | 94.5%  |
| 47-69 | 40.1%      | 41.0% | 46.8%         | 48.3% | 2.8%         | 2.2% | 89.5% | 92.8%  |



Source: Compilation of data from GE, *Annual Reports*, various years and WH, *Annual Reports*, various years.

Note: WH Material cost data from 1964 to 1969 is estimated each year through other data.

GE sustained more growth on sales and profits, along with increasing costs, until 1960.

WH, meanwhile, experienced more growth during the 1960s (refer to table 2-2). On average,

however, they have almost the same rate of growth in sales but not for profits, and GE success-

fully gained a better position on both operating profits and net income.

**Table 2-2. Growth rate of sales, profits and costs, 1947-1970.**

|       | Sales |       | Operating profit |        | Net income |       | Operating cost |       | Total cost |       |
|-------|-------|-------|------------------|--------|------------|-------|----------------|-------|------------|-------|
|       | GE    | WH    | GE               | WH     | GE         | WH    | GE             | WH    | GE         | WH    |
| 47-50 | 13.8% | 13.2% | 32.6%            | 20.6%  | 22.1%      | 16.9% | 10.9%          | 12.0% | 10.8%      | 11.2% |
| 51-55 | 7.5%  | 3.8%  | -3.7%            | -14.7% | 9.8%       | -9.8% | 9.4%           | 6.0%  | 9.4%       | 6.2%  |
| 57-60 | -1.1% | -0.9% | -18.3%           | 0.4%   | -6.9%      | 2.9%  | 0.7%           | -1.0% | 0.0%       | -1.0% |
| 61-65 | 8.7%  | 5.7%  | 4.0%             | 17.5%  | 10.1%      | 23.8% | 9.1%           | 5.0%  | 10.3%      | 4.7%  |
| 66-70 | 5.0%  | 13.7% | 14.8%            | 4.3%   | -0.8%      | 1.5%  | 4.5%           | 14.4% | 4.6%       | 14.7% |
| 47-60 | 9.2%  | 8.2%  | 4.5%             | 3.7%   | 5.9%       | 3.8%  | 9.7%           | 8.7%  | 9.5%       | 8.5%  |
| 61-70 | 7.8%  | 9.4%  | 4.3%             | 11.1%  | 3.4%       | 12.1% | 8.0%           | 9.4%  | 8.3%       | 9.4%  |
| 47-70 | 8.5%  | 8.2%  | 5.8%             | 4.3%   | 5.5%       | 4.2%  | 8.8%           | 8.6%  | 8.8%       | 8.5%  |

Source: Compilation of data from GE, *Annual Reports*, various years and WH, *Annual Reports*, various years.

Note: To calculate the comparative growth ratio, 1946 and 1956 are excluded, when WH profits are minus.

During the postwar economic growth of the U.S., a period later called the ‘golden age’, both firms grew but somewhat differently in some respects. The gap in size was maintained at around twice the volume in sales and profits, and did not lead to a larger difference in profitability and costs during 1946-1955. In the next term from the mid-1950s to the mid-1960s, however, the gap started expanding considerably. The reason for this growth in the gap is mainly due to the decline of WH. On the contrary, during the second half of the 1960s, GE started a downward turn in profitability while WH had recovered from its stagnation and returned the gap back to the same level as the early 1950s.

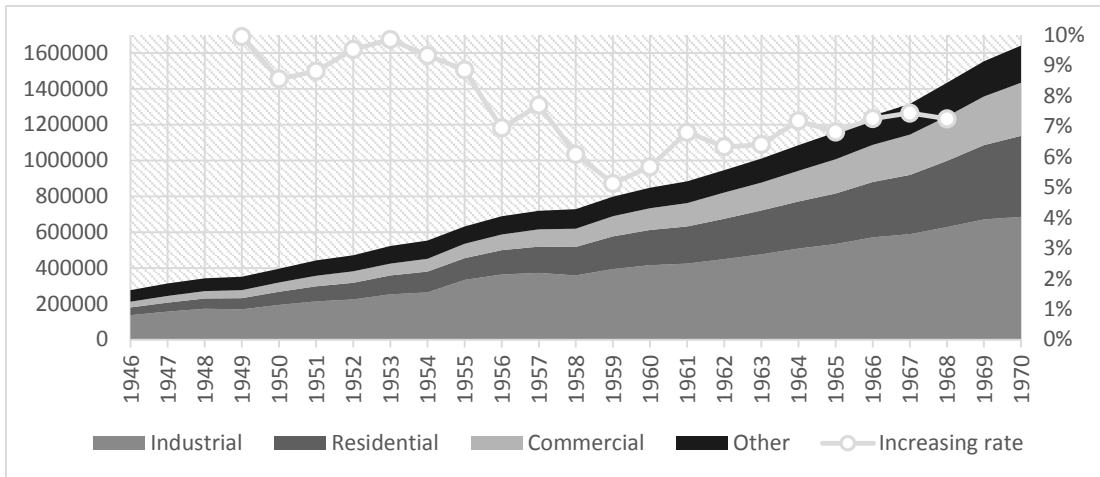


Nevertheless, GE was the number one firm in the industry during the period and consistently surpassed WH in many aspects. There was, however, a common problem for both of them in that they faced increasing costs and decreasing profitability towards the 1970's.

## 2. Competition in Conventional Steam Turbine Business, 1946-1970

Throughout the period GE and WH were the “Big Two” in the U.S. electrical machinery business. Unlike other industries, such as automobiles and aluminum, electrical machinery is more a web of industries with threads to a broad range of products, including electrical generating and distribution apparatus, other industrial equipment, consumer appliances and defense products<sup>151</sup>. A post-war increase in the demand for electricity that came along with economic growth saw a corresponding high growth in key sectors.

Electrical energy use has consistently grown since the war, stabilizing at around 7% after the mid-1950s (see figure 2-4). Industry took the lead in the consumption of electricity throughout the period, although its rate of increase declined toward 1970, from 9.5% (1946-57) to 5.6% (1958-70). Residential and commercial use were also driving-forces for electric consumption during the period: the rate of increase for residential use was 11.9% (1946-57) and 9.1% (1958-70) and for commercial use was 10.4% (1946-57) and 9.3% (1958-70).



**Figure 2-4. The use of electric energy, 1946-1970 (in millions of kilowatt-hours).**

Source: Compilation of data from the United States Bureau of the Census, *The Statistical History of the United States: from Colonial Times to the Present* (New York: Basic Books, 1976): S 120-132, p.828.

Note: Since the increasing rate takes a five-year moving average, it ranges from 1949 to 1968.

While rapidly electrifying society, the electrical machinery industry accelerated its economic growth, especially during the 1950s. While the value added by electrical machinery was 5.2% in 1947, within a decade it expanded to 6.6% of the total for all manufacturing in 1958<sup>152</sup>.

In terms of corporate sales, this radically rose from around 1950, as can be seen in figure 2-5.

The 1960 Fortune's list of the largest industrial companies had 12 electrical industry firms among the 100 largest industrial companies, another 9 companies followed in the next group of 100 largest, and a total of 45 electrical machinery firms were among the 500 largest industrial companies<sup>153</sup>.

The electrical machinery industry is fundamentally divided into two categories of products, products that produce electricity and products that use electricity. The former consists of goods such as generators, transformers, switchgear, distribution line equipment, and related

equipment infrastructure, generally called electric apparatus. The latter include household appliances, elevators and escalators, factory machinery, light bulbs, radios, television receivers, and electronic equipment<sup>154</sup>.

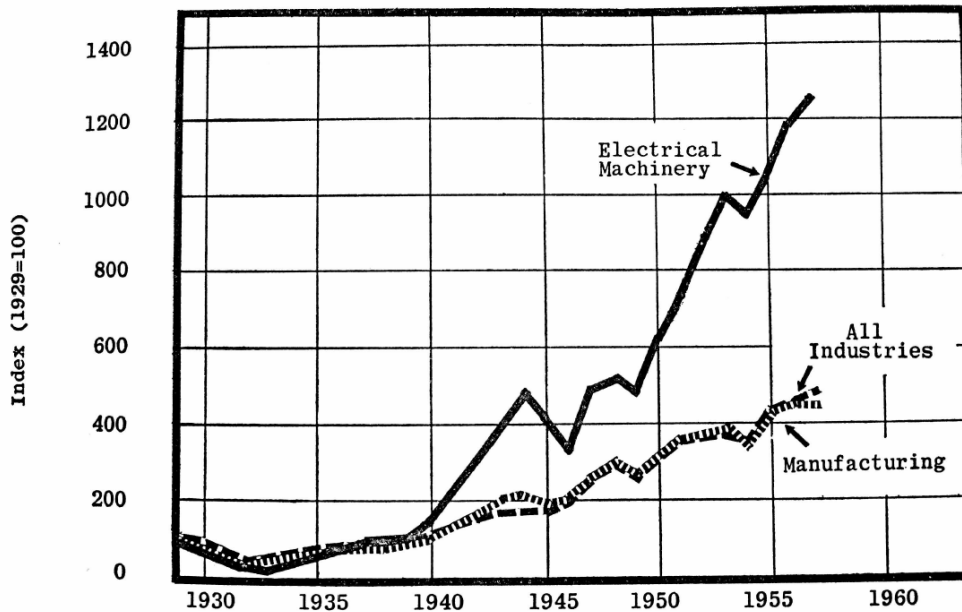


Figure 2-5. Corporate sales, 1929-1957.

Source: Jules Backman, *The Economics of the Electrical Machinery Industry* (New York: New York University Press, 1962): chart II-3, p.47.

Even though all these electrical machinery products were essentially introduced together postwar, there are slight variations amongst them when segregated. Table 2-3 shows the shipment value for four product groups, into which the number of products was 30 in 1947, 33 in 1958, 34 in 1963 and 1967. Through all the years, electrical apparatus consistently accounts for at least 25% or more of shipment values. On the other hand, electrical appliances saw its value go from 31% in 1947 down to 17% by 1967, while radio and television added to its value during the 1960s.

**Table 2-3. Shipments of electrical machinery, by main classes of products, 1947-1967<sup>155</sup>.**

|                      | 1947       |                  | 1958       |                  |
|----------------------|------------|------------------|------------|------------------|
|                      | Million \$ | Percent of Total | Million \$ | Percent of Total |
| Electrical apparatus | 2993       | 31%              | 5213       | 30%              |
| Electrical appliance | 3032       | 31%              | 3793       | 22%              |
| Radio and television | 1534       | 16%              | 3508       | 20%              |
| All other            | 2222       | 23%              | 4845       | 28%              |
| Total                | 9781       | 100%             | 17359      | 100%             |

|                      | 1963       |                  | 1967       |                  |
|----------------------|------------|------------------|------------|------------------|
|                      | Million \$ | Percent of Total | Million \$ | Percent of Total |
| Electrical apparatus | 6050       | 24%              | 9474       | 25%              |
| Electrical appliance | 4114       | 16%              | 6437       | 17%              |
| Radio and television | 8136       | 32%              | 11050      | 29%              |
| All other            | 7043       | 28%              | 11380      | 30%              |
| Total                | 25343      | 100%             | 38341      | 100%             |

Source: Compilation of data from U.S. Department of Commerce, Bureau of the Census, *Census of Manufactures: 1947, vol.2, Statistics by Industry* (Washington, D.C.: United States Government Printing Office, 1949): pp. 592, 603, 642, 684, 702, 704-05, 720-21, 733, 741, 748, 831; U.S. Department of Commerce, Bureau of the Census, *Census of Manufactures: 1958, vol.2, Industry Statistics, part 2, Major Groups 29 to 39* (Washington, D.C.: United States Government Printing Office, 1961): pp. 35A-9, 12, 35B-13, 21, 35E-12, 14, 20, 35G-17, 18, 20, 36A-14, 17-21, 36B-11, 14-17, 36C-10, 12, 14-15, 36D-13, 17, 19-20, 36E-9, 12-13; U.S. Department of Commerce, Bureau of the Census, *Census of Manufactures: 1967, vol.2, Industry Statistics, part 3, Major Groups 34-39 and 19* (Washington, D.C.: U.S. Government Printing Office, 1971): pp. 35A-10, 35B-16, 35E-17, 25, 35G-19, 20, 36A-19, 36B-15, 36C-12, 36D-21, 36E-12.

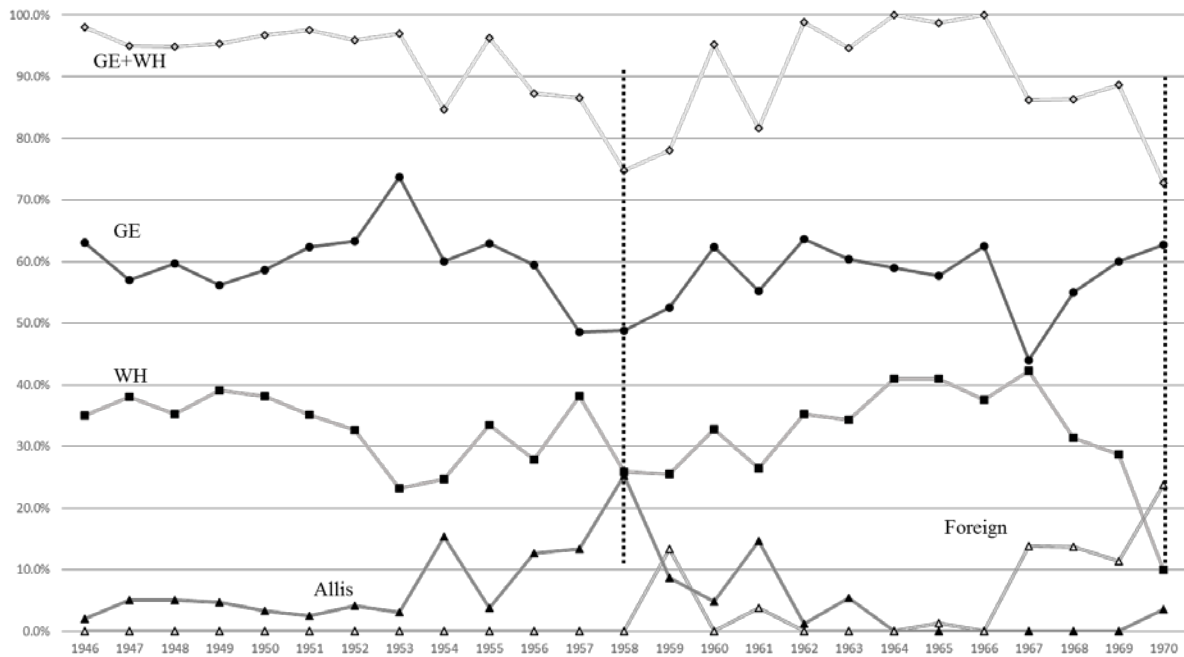
Note: Because many aspects of Census industry definitions changed between 1947 and 1958, the data demonstrated above do not cover exactly the same group of products.

In addition, different patterns of competition were laid down for each product group or for each product within a group. Although most of this industry did not require large amounts of capital, resulting in a low “barrier to entry,” categories such as a turbine generators maintained a high “barrier to entry” due to the requirement for large amounts of capital investment<sup>156</sup>. While a number of firms intensely competed in the low barrier to entry category, a few firms rolled out oligopolistic competition in the capital intense category. As a result, both large and small firms competed in the low-capital product category but not at all in the other

category, even though they were all electrical manufacturing firms. And GE and WH were the only two firms in the industry that provided the full-line of electric products over the period<sup>157</sup>.

Among the broad range of electrical product categories into which the two big firms were competing, electrical apparatus stands out, especially conventional steam turbines for generating electricity. This is where they held competitive advantage as first movers, mainly because the requirement for large amounts of capital and technical know-how made it difficult for new firms to enter<sup>158</sup>. Consequently, the conventional steam turbine business was dominated by the two firms and evolved into their traditional core business line<sup>159</sup>.

Through 1946 to 1970, the total collective market share for GE and WH accounted for more than 70% of the business, as shown in figure 2-6. In fact, looking at the graph it appears that the combined share never went below 75% until 1970, and was often in the upper 90% range. However, there have also been fluctuations in shares of market over the period. Postwar, three domestic firms, GE, WH and Allis-Chalmers, accounted for almost 100% of the steam turbine market. It was a tight domestic competition period between 1946 and 1958, with GE maintaining an average share of about 59.5% and WH holding 32.8%, about half the size of GE. When Allis started to increase its market share in the mid to late 1950s, both firms generally decreased their shares with GE losing a relatively greater share than WH.



**Figure 2-6. Market share of turbine generator orders, 1946-1970.**

Original source: Tabulation of Electrical Equipment Antitrust Actions data, filed at S.D.N.Y.

Source: Compilation of data from Ralph G. Sultan, *Pricing in the Electrical Oligopoly, Vol. 2* (Boston, MA: Division of Research, 1974): table 13.2., p.228.

Note: Orders by the U.S. utility and industrial organizations (aggregate kw. basis)

Starting in 1959 the industry faced major changes, mainly due to foreign firms entering the market and the impact of an antitrust lawsuit. With regard to competitiveness, the Tennessee Valley Authority (TVA), which had been a major customer for electrical machinery products, awarded a generator and turbine contract to a British firm, C. A. Parsons & Co., a first in postwar times and due to a lower price despite a heavy import duty<sup>160</sup>. On the regulatory front, in early 1960 the U.S. government indicted the domestic electrical machinery firms and their executives for violation of antitrust law and price-fixing. Confronted by these challenges, Allis, the third competitor, announced its exit from the business in December 1962<sup>161</sup>.

With the Allis withdrawal both GE and WH increased their shares, recovering their total share to approximately 95% of the level attained in the early 1950s. Following the second half of the 1960s, the share started to reduce as foreign firms began to continuously receive orders. This time was different, however, from the situation experienced in the second half of 1950s. While losing its share, WH only acquired 10% of orders in 1970 while GE increasingly recovered up to 62.7%, a position held previously.

GE and WH were the first movers in the U.S. conventional steam turbine business<sup>162</sup>, and their dominance was twice jeopardized between 1946 and 1970 but on different fronts. The first menace was the third competitor, Allison, that was depriving them of their full market share up until 1958, and the second is the entry of foreign firms that started increasing their turbine generator orders during the 1960s. When confronted by these two menaces the relative shares for GE and WH performed differently. The first menace in the 1950s reduced both their shares but more for GE, the second menace in the 1960s reduced WH's share while GE was recovering its share. GE maintained its competitiveness while WH experienced a general downturn over the course of a number of decades.

### 3. Corporate Performance and Business Competitiveness

During the postwar golden age period of economic expansion, both GE and WH experienced sound corporate growth. Looking at their corporate and business performance, however, their growths do not reflect identical processes. In the 1950s GE continued to grow well while WH was somewhat challenged in terms of performance. In the conventional steam turbine business, GE and WH started losing their shares toward the late 1950s due to the increasing competitiveness of the third competitor during a period of rapid expansion in electrical demand. In fact, GE lost more than its relative share. In the following decades, the gap in corporate performance was reduced but the gap in shares of the turbine business increased. On the one hand, WH improved its performance while GE grew stagnant, and the gap returned to the same levels as seen in the early 1950s. However, due primarily to increased costs, both their levels of profitability were approximately half of that experienced in the early 1950s. On the other hand, the divergence between the two became increasingly evident when foreign firms started entering the U.S. steam turbine market. While GE was improving its market share back to the same level seen in the early 1950s', the late 1960s saw WH with its worst performance in terms of market share.

Why did this occur? Does this imply that the performance of core business does not equate to overall corporate performance? The key to understanding this discordance is to



closely examine diversification and the link between corporate and business performance. During the golden age period, GE and WH implemented diversification in two tranches. The first was under a plan called the expansion program, which lasted until the late 1950s. This expansion greatly affected their steam turbine business.

## **II. Domestic Competition and Expansion Program**

### **1. Domestic Competition in U.S. Conventional Steam Turbines, 1946-1958**

The U.S. experienced an expansion in electricity usage through the period of postwar economic growth, which prompted an associated demand for turbine generators. Total growth in the consumption of electricity from 1946 to 1958 was 8.4%, with residential use, at 11.6%, the most expanded among the sectors, followed by commercial use at 10.1% and industrial use at 8.3%. The electric utility companies followed a cyclical type of behavior in plant expenditures in order to meet the growth<sup>163</sup>. There are three such cycles of orders for turbine generators, as shown in figure 2-7 and table 2-4: the first postwar cycle up until 1949, the second cycle from 1950 to 1954, and the third cycle between 1955 and 1958.

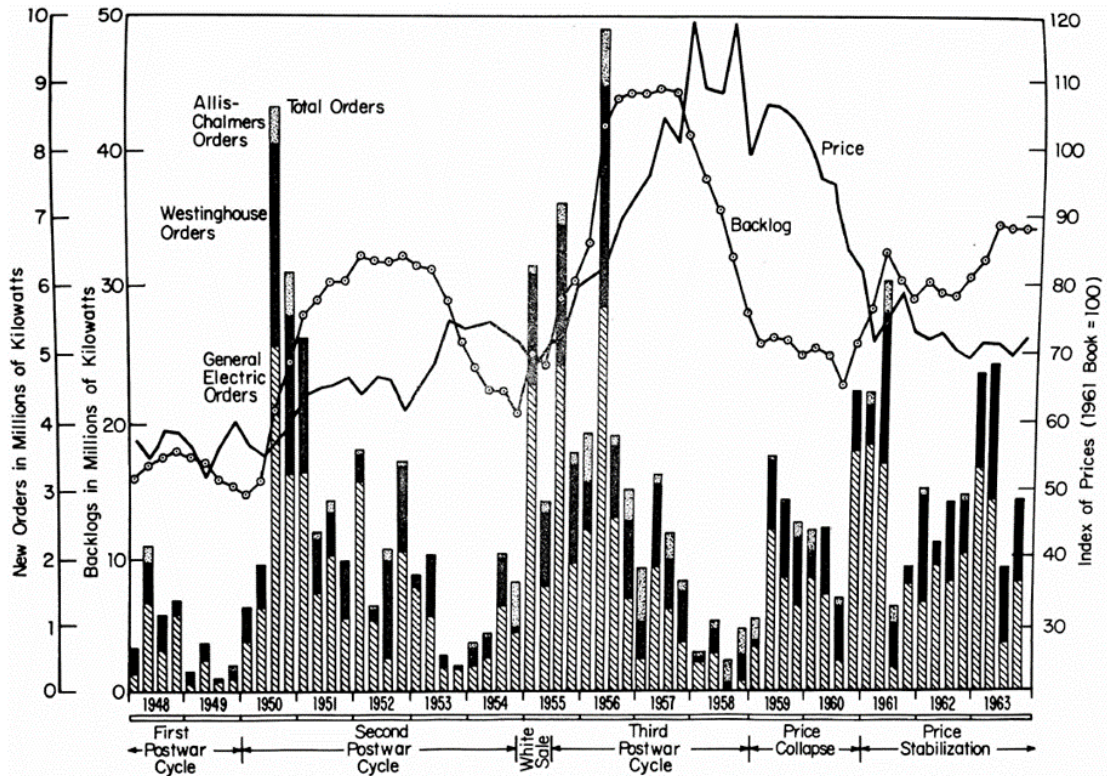


Figure 2-7. Turbine generator orders and backlogs, in kilowatts, and index of order price.

Original source: Exhibits material, *Ohio Valley Electric v. General Electric*, 62 Civ. 695 (S.D.N.Y. 1965).

Source: Ralph G. Sultan, *Pricing in the Electrical Oligopoly, Vol. 1* (Boston, MA: Division of Research, 1974): chart 2.7., p.55.

Table 2-4. Number of turbine generators ordered in the United States.

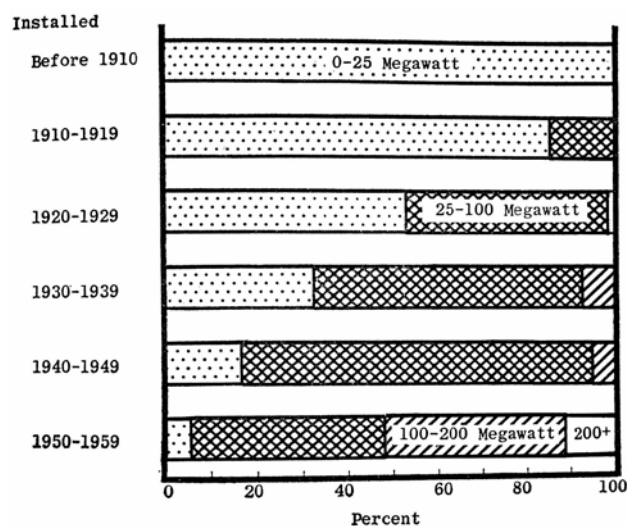
| Year  | number of orders |
|-------|------------------|
| 1950  | 234              |
| 1951  | 103              |
| 1952  | 69               |
| 1953  | 27               |
| 1954  | 102              |
| 1955  | 132              |
| 1956  | 104              |
| 1957  | 62               |
| 1958  | 25               |
| Total | 858              |

Original Source: the American Electric Power Company.

Source: Compilation of data from Richard F. Hirsh, *Technology and Transformation in the American Electric Utility Industry* (Cambridge: Cambridge University Press, 1989): figure 25., p.95.

Over these cycles, new demands were placed on the electrical manufacturing firms by the client electric utilities. The electric utilities saw larger scale steam turbine generators as one means of meeting the rapid growth in electricity usage<sup>164</sup>. Although 25-100 Megawatt units had been the standard for equipment installed up until the 1940s, 100-200 Megawatt units appeared in the 1950s and immediately accounted for almost the same percent of installation as the 25-100 Megawatt, as shown in figure 2-8. Electrical manufacturing firms had to respond to this drastic change in demand.

To meet the postwar demand, both GE and WH undertook capital investments to expand their manufacturing production for steam turbine generators. However, at this time there was already a gap forming between the number one and number two firms.



**Figure 2-8. Steam turbine generating equipment, percentage distribution of capacity installed in U.S., by size of equipment.**

Source: Jules Backman, *The Economics of the Electrical Machinery Industry* (New York: New York University Press, 1962): chart VI-3, p.155.

Since GE anticipated a continued trend for increased electricity consumption after the war, the firm took two actions to meet this expected significant demand<sup>165</sup>. First, they started working on a new product design for the steam turbine generator that would realize larger capacity, higher pressures and temperatures as a solution to the increasing electricity usage<sup>166</sup>.

The new product required custom-designed machines that were much more complex to engineer and to build<sup>167</sup>. Herman Hill, manager of manufacturing, Large Steam Turbine Generator Department of GE described at the time:

“In 1946 the operation was converting from wartime production to building land sets.

There were not many machines in production. Two things happened: volume and the size of the machines were both increasing. It became obvious that the new designs

would not be able to be produced in these [current] facilities. (Stenographer’s minutes,

Ohio Valley Electric v. General Electric et al., 62 Civ. 695, S.D.N.Y., 2031-2035)<sup>168</sup>”

Consequently, they undertook massive investments in existing plants, the principal manufacturing facility in Schenectady, New York and the facility for assembling medium-sized turbines located in Lynn, Massachusetts, this in order to expand manufacturing capacity<sup>169</sup>.

This strategy was successful and met the expectations of electric utilities, which began demanding larger custom-designed units in the early 1950s to operate optimally within their

specific systems<sup>170</sup>. These large custom-designed turbines then fast became the standard product. This trend led to significant increases in the average size of a turbine generator, from about 30,000 kilowatts after the war to almost 200,000 kilowatts in the early 1960s<sup>171</sup>. As a result of this change in the industry, GE increased its production capability from an estimated 3 gigawatts in 1946 to an annual 12.5 gigawatts capacity by 1963<sup>172</sup>.

While GE was offering new products as a response to aggressive forecasts for future demand and manufacturing capacities, WH was being far more conservative<sup>173</sup>. More precisely, WH did not anticipate the shift in demand to larger custom-designed turbines that was caused by GE<sup>174</sup>. This led WH to a different form of postwar expansion of manufacturing capacities.

In addition to its principal plants located in in the east, in South Philadelphia and Pittsburgh, WH acquired the lease on a plant for the manufacturing of turbines, located in Sunnyvale, California and operated by Joshua Hendy Iron Works<sup>175</sup>. This west coast plant sought to manufacture existing designs of turbines to respond to the rapid growth in demand for the west and was capable of producing the new product that had become the mainstream in the early 1950s<sup>176</sup>. This decision was made under an alternate assumption regarding the growth of electrical consumption. WH saw “standardization” as the solution, which simplified product design and aspects of the manufacturing process<sup>177</sup>. Product standardization led to increased

productivity within existing available facilities, thereby providing more volume of products to electric utilities. In fact, WH's production of standardized turbines accounted for approximately 54% of its manufacturing capacities in 1950<sup>178</sup>.

When new larger custom-designed products emerged as the business standard, however, WH managed to cope with the shift. D. W. R. Morgan, former general manager of the WH steam division, recalled the problems that WH faced in the change:

“The standard machine was an ordinary single-cylinder high-pressure and single-cylinder low-pressure turbine. When we get into the higher pressure, higher temperature machines, we have much more difficult problems. Even in 1946 I became concerned as to the percentage of that kind of business, realizing that it carried with it very substantial increases in cost, not only increases in cost of the article itself, but enlargement of our engineering and drafting work in the research departments that would be required.

Following the outbreak of the Korean War, the real desires of the power industry became more apparent. It placed a very substantial load on our engineering group. (Testimony of D. W. R. Morgan, general manager of Westinghouse steam division, 1948-1953, *Ohio Valley Electric v. General Electric*, 2224-2227)<sup>179</sup>,”

As the recent product designs offered by GE were gaining support from utilities, WH had no choice but to respond in order to meet the competitive pressures brought on by GE and customer demands<sup>180</sup>. One consequence was that WH's engineering capacity had to quickly grow seven to ten times<sup>181</sup>. At the beginning, "it became an exceedingly difficult time to procure enough engineers to do the job, particularly 1950, 1951, 1952<sup>182</sup>." WH had to hastily invest in the plant to expand and convert its manufacturing capabilities for a newly designed turbine. In 1952, WH leased a South Philadelphia Merchant Marine plant that WH had set-up and operated during the war, while also establishing a budget for a new development laboratory<sup>183</sup>.

In addition to catching up to the demand for larger turbines, WH was suffering significantly from labor issues, more than was the case for GE. Both firms were preoccupied with post-war union relations, as the unions succeeded in shutting down every North America GE and WH plant in 1946, the largest strike in the history of the industry<sup>184</sup>. This strained relationship between corporate management and unions continued into the 1950s, adversely affecting the production of steam turbines. While GE managed to avoid the strike, much due to Lemuel Boulware's labor relation policy, and continued to manufacture the product, WH had to delay product shipments due to the effects of a 156-day nationwide strike and a 299-day walkout in

South Philadelphia that took place from 1955 to 1956<sup>185</sup>. Although WH still managed to maintain the flow of new orders through its marketing efforts (see overhead expense of 1956 on table 2-5), the accumulated backlog of orders led to additional costs while it returned to a normal delivery situation after the strike<sup>186</sup>. Furthermore, in the 1950s WH was short of the necessary engineering capacity for the manufacture of new larger turbines. WH's stretched steam turbine division engineers were working on not only the new custom-designed turbine but also on other business lines, such as jet engines, nuclear power, and wind tunnels<sup>187</sup>.

The large capital expenditure for changing production methods and the human resource problems had consequences to WH, which succeeded in increasing its annual production capability from an estimated 1.5 gigawatts to 7 gigawatts over 1946 to 1963, but which also saw a rapid increase in product cost, particularly starting in 1953, as can be seen in table 2-5<sup>188</sup>



**Table 2-5. Cost and profits to sales.**

| Year    | Direct Cost <sup>a</sup> |       |        | Overhead Expense <sup>b</sup> |       |       | 100%(Sales) - (Direct Cost+ Overhead Expense) |        |        | Pre-Tax Profit |        |        | After-Tax Profit <sup>c</sup> |        |        |
|---------|--------------------------|-------|--------|-------------------------------|-------|-------|---|--------|--------|----------------|--------|--------|-------------------------------|--------|--------|
|         | GE                       | WH    | Allis  | GE                            | WH    | Allis | GE  | WH     | Allis  | GE             | WH     | Allis  | GE                            | WH     | Allis  |
| 1947    | 83.2%                    | 76.7% | 106.0% | 30.5%                         | 21.1% | 30.5% | -13.7%  | 2.2%   | -36.5% | -17.9%         | 2.3%   | -36.5% | -8.9%                         | 1.2%   | -18.2% |
| 1948    | 71.3%                    | 66.9% | 100.4% | 21.6%                         | 20.8% | 18.9% | 7.1%  | 12.3%  | -19.3% | 9.0%           | 12.4%  | -19.3% | 5.2%                          | 6.5%   | -10.0% |
| 1949    | 75.0%                    | 55.0% | 77.2%  | 19.9%                         | 17.1% | 18.1% | 5.1%  | 27.9%  | 4.7%   | 4.6%           | 27.9%  | 4.8%   | 1.8%                          | 10.6%  | 2.0%   |
| 1950    | 66.7%                    | 55.6% | 75.9%  | 13.3%                         | 15.7% | 16.9% | 20.0%   | 28.7%  | 7.2%   | 16.4%          | 28.7%  | 7.1%   | 10.0%                         | 12.3%  | 3.2%   |
| 1951    | 65.9%                    | 65.7% | 68.8%  | 12.1%                         | 17.2% | 25.4% | 22.0%   | 17.1%  | 5.8%   | 23.9%          | 17.1%  | 5.8%   | 8.4%                          | 6.0%   | 2.4%   |
| 1952    | 66.7%                    | 69.2% | 69.7%  | 12.2%                         | 18.2% | 23.1% | 21.1%   | 12.6%  | 7.2%   | 24.7%          | 12.6%  | 7.2%   | 7.7%                          | 3.9%   | 3.2%   |
| 1953    | 62.6%                    | 83.7% | 81.6%  | 14.5%                         | 25.1% | 28.2% | 22.9%   | -8.8%  | -9.8%  | 26.9%          | -8.9%  | -9.8%  | 8.2%                          | -3.0%  | -3.9%  |
| 1954    | 61.8%                    | 73.0% | 75.5%  | 16.3%                         | 17.3% | 31.1% | 21.9%   | 9.7%   | -6.6%  | 27.3%          | 9.8%   | -6.6%  | 11.5%                         | 4.4%   | -3.0%  |
| 1955    | 62.1%                    | 77.9% | 72.6%  | 11.9%                         | 18.8% | 35.2% | 26.0%   | 3.3%   | -7.8%  | 26.4%          | 3.2%   | -7.8%  | 11.7%                         | 1.6%   | -3.7%  |
| 1956    | 63.4%                    | 79.6% | 74.0%  | 14.1%                         | 59.0% | 45.0% | 22.5%   | -38.6% | -19.0% | 21.3%          | -38.6% | -19.0% | 9.2%                          | -18.5% | -9.1%  |
| 1957    | 67.5%                    | 80.5% | 79.6%  | 14.1%                         | 23.6% | 24.3% | 18.4%   | -4.1%  | -3.9%  | 18.6%          | -4.1%  | -3.9%  | 7.6%                          | 2.0%   | -1.9%  |
| 1958    | 64.4%                    | 75.0% | 82.1%  | 14.0%                         | 16.3% | 10.0% | 21.6%   | 8.7%   | 7.9%   | 21.8%          | 8.6%   | 12.2%  | 9.6%                          | 4.1%   | 6.1%   |
| Average | 67.6%                    | 71.6% | 80.3%  | 16.2%                         | 22.5% | 25.6% | -   | -      | -      | 16.9%          | 5.9%   | -5.5%  | 6.8%                          | 2.6%   | -2.7%  |

Original source: Exhibits submitted to the court, *Ohio Valley Electric v. General Electric*, 62 Civ. 695 (S.D.N.Y. 1965).

Source: Compilation of data from Ralph G. Sultan, *Pricing in the Electrical Oligopoly*, Vol. 1 (Boston, MA: Division of Research, 1974): table 6.3, table 6.4. and table 6.5., pp.197-199.

a Direct cost includes direct labor, materials, components, and indirect factory expense.

b Overhead expense includes engineering, marketing, administration, employee relations, finance expense.

c Tax includes federal tax and other assessed financial charges such as interest.

Table 2-5 demonstrates both the continued trends and the changes that arose between GE and WH through 1947 to 1958. GE maintained profit earnings during the period, with the exception of the transitional year of 1947 when GE was moving into its new and efficient manufacturing facility in Schenectady<sup>189</sup>. WH, on the other hand, started a decline in profitability in 1952, when they offered more new larger custom-designed turbines<sup>190</sup>. WH's direct costs increased considerably at that time. Comparing the two firms, there is a revealing shift in their respective profitability positions prior to and after the new larger turbines became the industry standard. WH's profitability was actually superior to that of GE up until it had to move away from the previous turbine design. GE was in a much better position than WH after the mainstreaming of large turbines because WH's transition costs had simply been all that much higher. Meanwhile, in order for the third firm to draw market share from the big two, Allis had to pay extra overhead charges for receiving orders by discounting its product and undercutting the prices of its competitors<sup>191</sup>.

The smoother transition for GE is a result of its product strategy. GE anticipated a postwar higher growth in the use of electricity and associated products, they chose technological change as a product strategy and, as the technological leader, GE was placed in an advantageous position to forecast and influence future product designs<sup>192</sup>. The strategy was founded on having access to the necessary resources, such as capital, technological and human resources. Responding to the product strategy, GE became the first to invest in the expansion of manufacturing capacities. The new product responded well to the increasing demands of electric utilities, who were primarily concerned with avoiding any electricity shortage arising from the rapid growth in electrical consumption. GE had successfully

gained first mover's competitive advantage and continued to be successful as an influential lead firm in the industry.

WH, on the contrary, was now a complete follower and this mainly due to a conservative forecast for the growth in electricity usage. The WH business model was to embark on a geographic market expansion for the existing product design, leaving them in a significantly disadvantaged position when the market shifted. To catch up to the required technological and production capacities WH hastily invested in turbine manufacturing plants, but it had already lost several years to GE<sup>193</sup>. To worsen matters, WH was also faced with problems in its human resource capacities. WH was about half the size of GE and the allocation of available resources to large, custom-designed turbine projects was far more challenging. In such a situation, the strike and engineering shortage seems to have left WH with no role other than that of follower. After all, even as a follower WH managed to maintain the second market share position, but only by absorbing higher costs during the three cycles of orders for turbine generators<sup>194</sup>.

## 2. Diversification and the Military

There is a reason why WH was unable to concentrate heavily in the turbine business, there were huge pressures to diversify businesses in the postwar period. WH top management pursued corporate growth through diversification, especially in the military market. It was not only WH playing this game, as GE and other domestic electrical and electronics manufacturing firms pursued defense-related business, and one driving force behind this movement was an urging from government to do so.

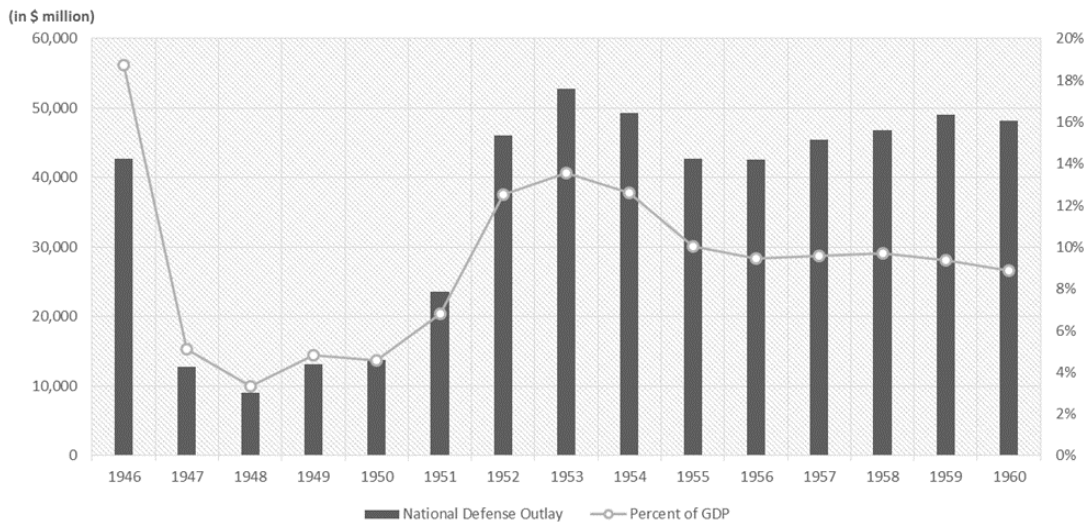
By the late 1940s the United States had transitioned from wartime to peace, and a major discussion gradually emerged over whether there was a need to maintain a large military force during peacetime<sup>195</sup>. In early 1950, President Truman ordered the secretaries of state and defense to reassess the existing defense and foreign policy<sup>196</sup>. A report was delivered a few months later, entitled “United States Objectives and Programs for National Security,” also known as National Security Council Memorandum (NSC) 68. The report called for a large expansion in military capabilities in order to constrain the Soviet Union and, as such, was an influential government document that was setting the course for the Cold War<sup>197</sup>. From the perspective of economics and business, it was significant that the report challenged the traditional view that military spending was harmful to the economy<sup>198</sup>, as follows:

“Progress in this direction [achievement of a GNP of \$300 billion per year] would permit, and might itself be aided by, a build-up of the economic and military strength of the United States and the free world; the necessary build-up could be accomplished without a decrease in the national standard of living because the required resources could be obtained by siphoning off a part of the annual increment in the gross national product.<sup>199</sup>”

Moreover, the analysis supported a view that the American economy and business enterprises were fully capable of offering both military and civilian products without issue:

“One of the most significant lessons of our World War II experience was that the American economy, when it operates at a level approaching full efficiency, can provide enormous resources for purposes other than civilian consumption while simultaneously providing a high standard of living.<sup>200</sup>”

Although Truman initially resisted approval of NSC 68 as the new national military policy, it eventually became the framework for military expansion when the Korean conflict suddenly occurred a few months later, in 1950<sup>201</sup>. Consequently, the national defense budget began increasing rapidly in the early 1950s, as shown in figure 2-9.



**Figure 2-9. National defense budget, 1946-1960.**

Source: Compilation of data from “Table 3.1. Outlays by Superfunction and Function: 1940–2020,” Office of Management and Budget and “Gross Domestic Product: Current-dollar and ‘Real’ GDP,” U.S. Department of Commerce, Bureau of Economic Analysis.

In the process of this expansion, the military budget supported the purchase of armaments such as aircraft, missiles, ships, electronics, and vehicles. While aircraft and missiles accounted for the majority of expenditures, ships and electronic-related goods gradually in-

creased to displace expenditures on vehicles and weapons, as per table 2-6. In terms of contracting, figure 2-10 indicates that aircraft-related firms dominated as prime contractors for the Department of Defense during the 1950s, but also shows that electronics-related firms escalated their share of contracts in the late 1950s. A military expansion focused on aircraft and electronic products inevitably involved GE and WH, as both were much involved in aircraft, missile, and electronics related products.

**Table 2-6. Department of Defense average monthly expenditures of durable goods industries, 1954 to 1959 (in millions of dollars, for years ending June 30).**

|   | 1954   |        | 1955  |        | 1956  |        | 1957   |        | 1958   |        | 1959   |        |
|---|--------|--------|-------|--------|-------|--------|--------|--------|--------|--------|--------|--------|
| Aircraft and guided missiles                        | 737    | 62.2%  | 730   | 74.6%  | 693   | 73.8%  | 839    | 79.9%  | 932    | 82.2%  | 929    | 80.1%  |
| Ships and harbor craft                              | 90.8   | 7.7%   | 84.1  | 8.6%   | 74.6  | 7.9%   | 74.8   | 7.1%   | 96.3   | 8.5%   | 128.1  | 11.0%  |
| Electronic and communications                       | 68.8   | 5.8%   | 53    | 5.4%   | 64.2  | 6.8%   | 73.4   | 7.0%   | 72.9   | 6.4%   | 76     | 6.6%   |
| Combat Vehicles, artillery, weapons, and ammunition | 287.8  | 24.3%  | 111.2 | 11.4%  | 107.6 | 11.5%  | 63.4   | 6.0%   | 32.6   | 2.9%   | 26.6   | 2.3%   |
| Total   | 1184.4 | 100.0% | 978.3 | 100.0% | 939.4 | 100.0% | 1050.6 | 100.0% | 1133.8 | 100.0% | 1159.7 | 100.0% |

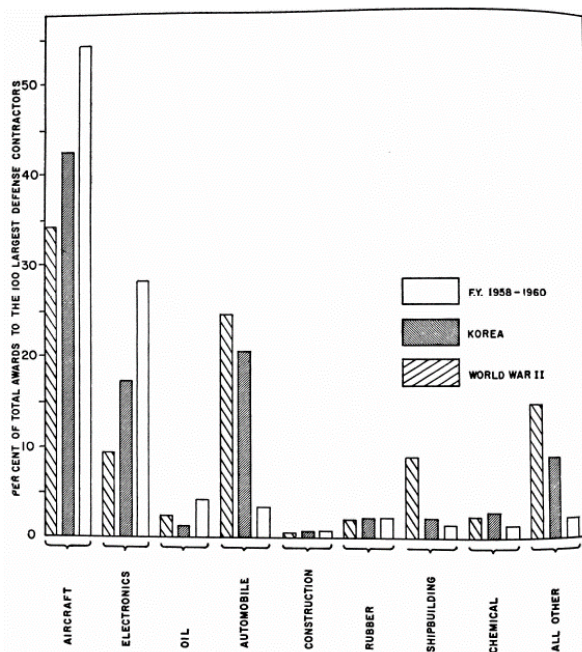
Source: Compilation of data from U.S. Department of Commerce, *Bureau of the Census, Statistical Abstract of the United States: 1960, 81th Annual Edition* (Washington, D.C.: U.S. Government Printing Office, 1960): No. 308. Defense Expenditure and Obligations, employment in Selected Industries, and New Orders and Sales of Durable Goods Industries: 1954 to 1959, p.241.

Note: Excludes military assistance program.

GE did not attempt to actively engage in military business after the war. In fact, GE president Charlie Wilson was criticized by one of its leading electronics engineers because of his rapid postwar transition of the electronics business from wartime to peacetime<sup>202</sup>. However, Ralph Cordiner, the successor to Wilson in 1950, began referring to the advantageous aspects of defense business. On Management Conference in 1954, he described:

“One factor that has been most helpful in eliminating the need for outside borrowing has been a contribution by those involved in defense activities. At present, 79% of our inventories and accounts receivable for defense production converted by progress collection that amounts to about \$400 million.<sup>203</sup>”

He “preferred commercial non-defense business because it is generally more open for Company-determined innovations and is more profitable.<sup>204</sup>” But he still regarded the defense business as a high return on investment since the investment requirements were low and compensated for narrow profit margins<sup>205</sup>. Since GE had “concentrated its defense efforts not on the mass production of items..., but on undertaking the difficult, unsolved research and production problems of military technology,” a half of GE’s defense work was research and development by the late 1950s<sup>206</sup>. And commercializing military technology, lavishly funded by the military, for non-defense business was the ultimate payoff for defense contracts, such as commercial jet engines, electronic computers and, most spectacular of all, atomic energy<sup>207</sup>.



**Figure 2-10. Distribution of major military prime contracts by industry for the 100 largest defense contractors: Three periods.**

Source: Merton J. Peck and Frederic M. Scherer, *The Weapons Acquisition Process: An Economic Analysis* (Boston, MA: Division of Research, 1962): figure 5.1., p.122.

Note: All 100 Firms = 100%

In addition to these advantages, Cordiner and his management team also looked to the defense business as a must in terms of social responsibility. Guy Suits, who was a vice president and director of research at GE, described in 1957:

“all industry continues to have a deeply important public responsibility to participate in the national defense program---even though commercial business offers a generally more profitable utilization of technical skills and facilities<sup>208</sup>”

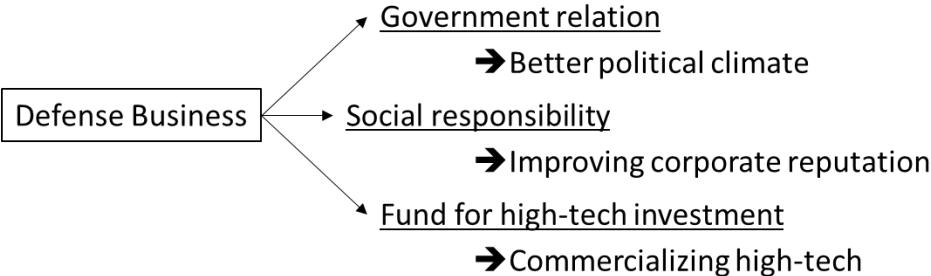
Thus GE top management deemed that business did not need defense, but defense needed business<sup>209</sup>. This allowed GE to not seek exclusive rights to all the business, but rather to cooperate with small firms on defense projects. For example, GE sought out, recruited, and trained 4,000 subcontractors to work on the jet engine program during the Korean War<sup>210</sup>. They also encouraged the closest possible teamwork between small and large businesses in order to cope with the substantial problems of defense work<sup>211</sup>.

Beyond these factors, it can be assumed that GE also considered the defense business as a way of gaining support from the government. When Robert Paxton, past-president of GE, made a 1958 address entitled “new responsibilities for managers”, he stressed the importance of government relations. This was based on the fact that the political climate had just as much an effect on a business’ bottom line as do the conditions of its market or its technology, mainly due to taxes, inflation, regulations, labor law and patent protection and such<sup>212</sup>. There was also a rise of labor union connections to positions of political power, allying with welfare-state politicians who were all about big government, big spending, big taxes, and increased government restrictions on business, in response managers needed to



seek out ways to gain political support, in order to build an effective counterforce to the unions<sup>213</sup>. Thus, GE had little choice but to contribute to defense business if they wanted to attain a better political climate for their business.

Although both GE and WH had already engaged in defense business during wartime, both continued to be partly obligated to participate in defence contracting in the 1950s and expand this business not only on the basis of economic incentives but also driven by social motivations (see figure 2-11).



**Figure 2-11. Incentives for contributing to defense business.**  
Source: Author.

As a result of this expansion in defense business, their rankings as military contract firms followed suit, as per table 2-7: GE was ranked 9th from June 1940 to September 1944 and then climbed to 3th during the FY 1951-1953 period, while WH went from 21st to 14th . However, by the end of the 1950s, the WH ranking for defense contracts dropped 5 spots to 19th while its commercial rank remained rather static, meanwhile GE maintained an equally high ranking for both military and commercial. A factor in WH’s decline in its military rank was its withdrawal from major defense business in 1960.

**Table 2-7. Military rank of GE and WH, 1944-1960**

|                 |    | 1939 | 1945              | 1954             | 1959             |
|-----------------|----|------|-------------------|------------------|------------------|
| Commercial Rank | GE | 10   | 4                 | 4                | 4                |
|                 | WH | 33   | 14                | 13               | 15               |
|                 |    | -    | 6/1940<br>-9/1944 | FY 1951<br>-1953 | FY 1958<br>-1960 |
| Military Rank   | GE | -    | 9                 | 3                | 4                |
|                 | WH | -    | 21                | 14               | 19               |

Source: Compilation of data from Merton J. Peck and Frederic M. Scherer, *The Weapons Acquisition Process: An Economic Analysis* (Boston, MA: Division of Research, 1962): table 5A.1., pp.604-611.

Early on, the major military products were divided into propulsion and electronics products. The main product of the former category was the jet engine. During the war the contract committee saw that the engineers who worked with steam turbines had experience with the aerodynamics of compressors and turbines, so GE and WH were chosen to develop the gas turbine aircraft engine (i.e. jet engine), and became pioneers in the industry for the U.S. during the war<sup>214</sup>. Both firms continued to provide aircraft engines after the war, mainly for military use. They also provided ship propulsion turbines and later came nuclear propulsion equipment for the Navy's submarine fleet, which eventually led to nuclear power plants. The second category, electronics related products, covered a wide range of products including airborne radar, rocket and missile firing system, radio and communication equipment, and computer later. Digital computers, in particular, became a major postwar electronics product. GE and WH had been working on early computing technology during the prewar period, to simulate power network systems<sup>215</sup>. But the wartime development of analog computers, such as gunfire systems, led their employees to the digital computer<sup>216</sup>. Among the products, jet engine, nuclear power, and computer businesses were particularly notable as postwar spin-off business arising from military technology. While

both firms engaged in these three business lines, they also diversified into commercial businesses.

Among the spin-off businesses, it was in the computer business that they took different paths. While GE established the computer department for commercial use in 1956, once it started developing some digital computers after receiving military (e.g. OAR: later called OARAC in 1947) and commercial (i.e. ERMA in 1956) orders. WH mainly developed an analog computer, called Anacom, which continued to work in the electrical power field until 1990<sup>217</sup>. Although WH also developed a digital computer for weapons systems (i.e. SOLOMON), they decided to withdraw from the business since they did not have the funding available to go into renting computers<sup>218</sup>.

Aside from the computer business, at the beginning of the postwar both GE and WH took fairly similar diversification strategies for their commercial and military businesses. By the end of the 1950s, however, WH's business structure had gradually shifted away from that of GE. As demonstrated on table 2-8, WH provided 120 categories of products to market in 1950. These products broadly consisted of heavy equipment for electric power system, propulsion equipment including jet engines, electrical equipment for consumer and industrial use, and other related products including defense products, financial services, radio stations, and medical products. In 1950 the consumer product category accounted for 31.5% of total sales, industrial products were 60.6%, defense products and others were 7.3%, and radio stations were 0.6%<sup>219</sup>. Up until 1960, WH had entered into nuclear power generation, significantly expanded its defense products, and was into heating, ventilating

and air conditioning businesses. As reflected in its diversification in the military market, WH defense products and nuclear power generation, the latter derived from military technology, were remarkably enlarged. As a result of this expansion and disposal of businesses, WH's sales by segment changed as consumer products dropped to 25%, apparatus and general products constituted 55%, and atomic and defense products took a 20% share in 1960<sup>220</sup>. Although the WH business profile of 1960 is not fully compatible with that of 1950, it does indicate that defense related business remained an important segment of WH business. Consequently, WH was embedded into the U.S. military-industrial complex. However, unlike GE, WH withdrew from jet engines as a major aircraft product, and from locomotives as well as x-ray tubes in the medical category. The expansion of atomic and defense, and disposal of jet engines and other products, was largely implemented under "Mr. Expansion", WH President Gwilym A. Price.<sup>221</sup> His expansion strategy also influenced WH steam turbine business.

Gwilym Alexander Price was elected WH president in January 1946, after he changed careers from banking to join the firm as a vice president in 1943 and serve as executive vice president from 1945<sup>222</sup>. After Price took the helm, WH executed two large capital investments under its expansion program. The first expansion, under a \$132 million budget, started in 1946 and was to convert its plants to peacetime production and to expand its facilities for electrical products<sup>223</sup>. This was fulfilled in 1948 when its productive capacity was increased by 50%<sup>224</sup>. The second expansion involved government financing, to expand its manufacturing capacity for defense products, and was carried out between 1951

and 1955<sup>225</sup>. The program budget, which at \$296 million dollars was almost double the size of the first one, led to another 50% increase in production capacity<sup>226</sup>.

**Table 2-8. Diversification of products in Westinghouse Electric Corporation, 1950-1960.**

| Product Category                              | 1950       | 1951-1960  |
|---|------------|------------|
| Power Generation (non nuclear)                | 7          | 8          |
| Nuclear Power Generation                      | 0          | 8          |
| Transmission and Distribution                 | 14         | 16         |
| Power Modulation Equipment                    | 6          | 9          |
| Transportation (land)                         |            |            |
| Elevator related                              | 2          | 2          |
| Locomotive related                            | 3          | 0          |
| Other   | 1          | 1          |
| Transportation (non land)                     |            |            |
| Marine  | 5          | 5          |
| Air   | 2          | 1          |
| Space   | 0          | 3          |
| Heating, Ventilating and Air Conditioning     | 7          | 14         |
| Refrigeration                                 | 4          | 5          |
| Industrial Process Equipment                  | 16         | 18         |
| Lighting and Lamps                            | 19         | 21         |
| Home Appliances                               | 5          | 8          |
| Defense Product                               | 7          | 15         |
| Materials and Material Related Products       | 11         | 16         |
| Medical                                       | 2          | 1          |
| Entertainment and Leisure activities          | 4          | 6          |
| Maintenance, Service, Financial Services      | 1          | 2          |
| Miscellaneous Components and Special Products | 4          | 6          |
| <b>Total</b>                                  | <b>120</b> | <b>165</b> |

Source: Compilation of data from "Principle Products Analysis 1952-1982," 1982, box16, folder 8, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

During these expansions, WH placed a different focus on major defense product businesses. For example, Price made atomic energy the number one priority with the goal to build the nuclear power plant<sup>227</sup>. WH had seen itself as the pioneer in the field of atomic products ever since it built the first industrial atom smasher in 1937. Price's priority led to

the establishment of the atomic power division in 1948, and saw WH invest some two million dollars in 1954 for the first privately-financed plant for the manufacture of atomic power equipment<sup>228</sup>. As a consequence, WH provided a number of “firsts” in nuclear related products, such as the first practical atomic engine for submarines in 1953 and the first full-scale nuclear power plant in 1957<sup>229</sup>.

Although WH also developed the first American-designed and American-built jet engine in 1941, not enough was invested in jet engines for WH to maintain its competitive advantage<sup>230</sup>. In the 1955 congressional investigation of WH’s J-40 engine program, which focused on delays in WH’s jet engine product development, the WH gas turbine aviation division officially admitted failures, such as underestimating the magnitude of the task, failing in the rapid expansion of their engineering staff, placing inadequate emphasis on research, and scattering their bases of operation<sup>231</sup>. As the subcommittee’s investigation team testified, the WH jet engine division had not been sufficiently invested by the company<sup>232</sup>. In order to redeem its honor, WH tried to develop a new engine, the J-54, at its own expense. However, the government did not accept the engine for production<sup>233</sup>, mainly because they had already considered that “[t]he Air Force (and Department of Defense) is already sorely pressed to find sufficient funds to keep four major engine contractors productive. One more contractor would further disperse our resources.<sup>234</sup>” As a result WH left the jet engine business in 1960. Reinout Kroon, a former chief engineer of the division, described:

“The J40 story is sort of sad. We were able to make the required thrust, as I recall, well. But the airplane which was to use the engine became much heavier than anticipated, and that required more thrust. This we saw no way of providing. We were criticized for not anticipating engine growth in our design.

This may indeed have been one of the reasons why Westinghouse got out of the business. But I think the more basic reason was that after the war, finances began to dry up. The Services decided that, in the long run, they could only afford two suppliers of jet engines, Pratt & Whitney and GE. It was probably a wise decision. Westinghouse management had much difficulty adapting to the style of aircraft engine manufacturing, which was so different from the turbine activity they had been used to<sup>235</sup>.”

Thus, the disposal of the jet engine line arose from a double bind, one where WH top management was unable to fully understand and support the business and the government reducing its budget in the middle of 1950s (see figure 2-9). Since the jet engine division could not obtain enough facility space, even in the 1950s its research and development facility remained at South Philadelphia, where the steam turbine division was also located<sup>236</sup>.

Nuclear power and jet engines are the extreme cases of support, or lack of, from WH top management. There is also a sort of middle case from the wind tunnel project. WH was awarded a contract to build a propulsion wind tunnel for the U.S. Navy, the largest built to date<sup>237</sup>. Regarding this defense project, D. W. R. Morgan, a general manager for the Westinghouse steam division, described:

“That [the wind tunnel] was a huge undertaking requiring a great deal of engineering and development. As a matter of fact, that compressor on that wind tunnel required a motor of 216000 horsepower and the blades in the compressor were placed on a drum that was 18 foot [sic] in diameter, the blades were six foot [sic] long and about two foot [sic] wide. Incidentally all the engineering was done within the Steam Division. (Testimony of D. W. R. Morgan, general manager of Westinghouse steam division, 1948-1953, Ohio Valley Electric v. General Electric, 2228-2229)<sup>238</sup>”

This enormous wind tunnel project was technically challenging but was apparently limited by a development approach that was applicable more to commercial products<sup>239</sup>. Furthermore, the technological challenge, as Morgan testified, was not completed through a new organization but through its existing steam turbine division.

WH top management were greatly engaged in both the diversification of business and the expansion of production capacity that went on up until the middle of the 1950s. The nuclear power business saw significant investments but the technology was related to its steam turbine line, and this required the reassignment and use of existing division staff. In addition, jet engine technology was also related to steam turbines, and also did not obtain sufficient investment so this became an additional draw on steam turbine resources. Moreover, the huge and challenging wind tunnel building project was fully undertaken by the steam turbine business. Thus, the expansion had not effectively followed diversification for some business lines, especially those that lacked sufficient human resources.



In fact, GE was also faced with similar problems. To sustain business growth, they called back retired engineers and salesmen to help GE solve both the technological challenges arising from government requirements and the increasing demands for electrical products and electrical energy<sup>240</sup>. As shown in table 2-9, GE's increase in the number of employee was comparatively greater when compared to WH. Both top management teams were faced with similar problems and went on to execute their respective expansions and diversifications, but differences emerged on how they managed the sizable growth in national demands that had been placed on them.

**Table 2-9. The Number of employees of GE and WH, 1946-1958.**

|                            | Year | GE     | year-to-year | WH     | year-to-year | WH/GE |
|----------------------------|------|--------|--------------|--------|--------------|-------|
| First<br>Postwar<br>Cycle  | 1946 | 160968 | -            | 93049  | -            | 57.8% |
|                            | 1947 | 197324 | 36356        | 102065 | 9016         | 51.7% |
|                            | 1948 | 196798 | -526         | 105812 | 3747         | 53.8% |
|                            | 1949 | 179300 | -17498       | 94729  | -11083       | 52.8% |
| Second<br>Postwar<br>Cycle | 1950 | 183800 | 4500         | 98279  | 3550         | 53.5% |
|                            | 1951 | 210200 | 26400        | 108654 | 10375        | 51.7% |
|                            | 1952 | 216800 | 6600         | 112582 | 3928         | 51.9% |
|                            | 1953 | 222070 | 5270         | 122729 | 10147        | 55.3% |
| Third<br>Postwar<br>Cycle  | 1954 | 210151 | -11919       | 117143 | -5586        | 55.7% |
|                            | 1955 | 214794 | 4643         | 115857 | -1286        | 53.9% |
|                            | 1956 | 280497 | 65703        | 125050 | 9193         | 44.6% |
|                            | 1957 | 282029 | 1532         | 128572 | 3522         | 45.6% |
|                            | 1958 | 249718 | -32311       | 114652 | -13920       | 45.9% |

Source: Compilation of data from GE, *Annual Reports*, various years and WH, *Annual Reports*, various years.

Note: GE's definition of employee changed in 1948, 1954 and 1956. 1948 data includes the number of employees on Nucleonics projects operated for the U.S. Government; 1954 excludes 10,805 employees at atomic projects operated for the U.S. Government; 1956 includes 11,496 employees at the governmental atomic projects.

### 3. Competition in Technologies and Diversification in the Military-Industrial Complex

While advancing their diversification in defense related businesses, GE and WH were also competing in the conventional steam turbine industry where the product and production technology had changed to larger-scale custom-designed turbines. The new turbines required more engineers while some of the defense business also required attention from steam turbine engineers. Diversification in the military-industrial complex was executed not only on economies of scale and scope but also more on responsibilities of scale and scope. This left GE and WH, as large firms, partially obligated to work on defense business and their status of being technologically advanced electric and electronics firms also required a wide range of defense products.

The “size” of the firm had a strong bearing on the ability to respond to both corporate growth and social obligations. GE had the advantage over WH, and WH was disadvantaged vis-a-vis GE. GE, for example, was successful in leading in the development and building of the new turbine because it had access to more human resources. The size of the firm became a major competitive advantage. Also, GE responded to government requirements by significantly increasing its workforce. WH, half the size of GE, not only had diversify into defense products but also had follow GE in its core business. The diversification into defense products had a much more serious impact for WH on its steam turbine business because they simply did not have a sufficient supply of engineers, even to undertake the design of the new product. As a consequence WH run into more severe problems. However,

WH was still able to maintain market share in the 1950s for its steam turbine through its customer preference strategy.

#### **IV. International Competition and New Ventures, 1959-1970**

##### **1. Foreign Competitors and Emerging New Demand, 1959-1970**

The U.S. steam turbine business encountered a huge change in the 1960s. The early trigger was the prosecution for antitrust violations, known as the Great Price Conspiracy, and later came the 1965 Northeast power blackout. During the decade, GE and WH were both rewarded by another growth in electricity demand but, again, somewhat differently.

###### **(1) Collapse of Price Conspiracy**

The electrical machinery industry became the stage for corporate scandals in the early 1960s, at the time becoming the biggest criminal case in the history of the Sherman Act<sup>241</sup>. In 1960, 29 electrical manufacturing firms and 45 of their executives were indicted on charges of price fixing, rigging, and market splitting on 20 product lines (including steam turbines)<sup>242</sup>. GE and WH were judged to be leading the conspiracy. As a result of the judgement, conspiring firms and individual officers received fines totaling \$1,924,500, 7 executives went off to prison, and another 23 were given suspended jail sentences and placed on probation for five years<sup>243</sup>.

The beginnings of this antitrust case arose from changes in the marketplace for U.S. steam turbines. In 1959, the Tennessee Valley Authority (TVA), a government-owned electric utility company, purchased turbine generators from Brown Boveri Corporation of Switzerland and the C.A. Parsons Co of England because the prices offered by American firms were nearly 37% higher than Brown Boveri and 50 percent higher than Parsons<sup>244</sup>. As a result, Brown Boveri and Parsons had collectively won 13.3% of domestic orders in 1959 (see figure 2-6)<sup>245</sup>. Robert A. Monroe, a former chief design engineer at TVA, recalled: “the foreign manufactures bids came in so far under those of the American companies that we felt constrained to give the business to them.”<sup>246</sup> In fact, the price of electrical machinery equipment, in particularly steam turbines, had been rapidly increasing during the 1950s, as shown in table 2-10. For this reason, TVA decided to invite bids from qualified foreign firms<sup>247</sup>.

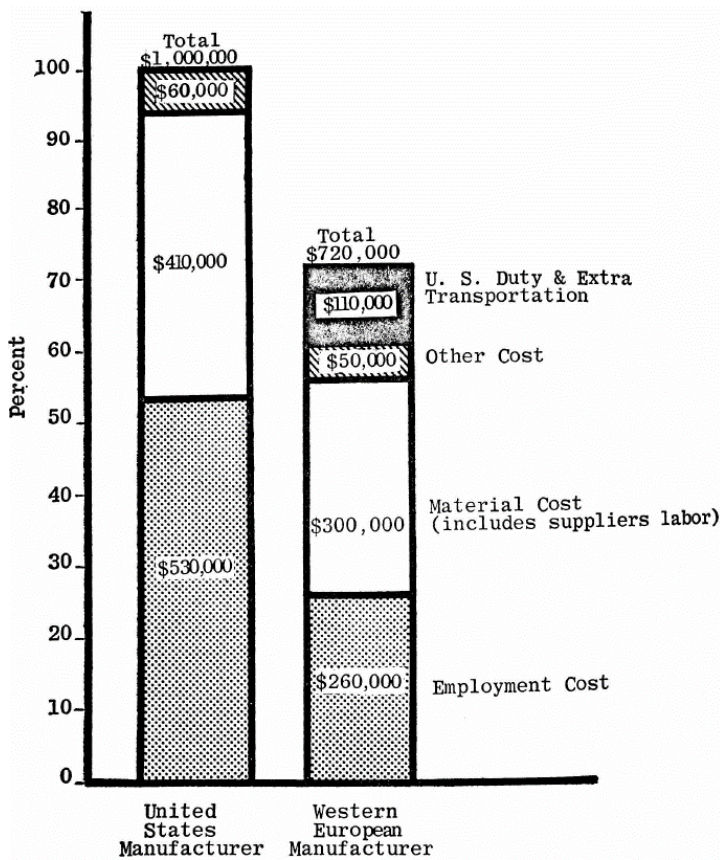
**Table 2-10. Wholesale price index (1947-49=100).**

| Year | All Commodities | Machinery and Motive Products | Electrical Machinery Equipment | Steam Turbine-Generators |
|------|-----------------|-------------------------------|--------------------------------|--------------------------|
| 1950 | 103.1           | 108.6                         | 106.4                          | 104.7                    |
| 1952 | 111.6           | 121.5                         | 120.3                          | 118.6                    |
| 1955 | 110.7           | 128.4                         | 128.2                          | 134.5                    |
| 1956 | 114.3           | 137.8                         | 138.4                          | 160.8                    |
| 1957 | 117.6           | 146.1                         | 149.0                          | 191.9                    |
| 1958 | 119.2           | 149.8                         | 155.2                          | 201.2                    |

Original Source: U.S. Department of Labor, Bureau of Labor Statistics.

Source: Clarence C. Walton and Frederick W. Cleveland, Jr., *Corporations on Trial: The Electric Cases* (Belmont: Wadsworth, 1964): table 2-1, p.30.

This posed a great threat to GE and WH, since TVA was a major customer that represented 8.8% of the market and was the largest single customer for turbine generators in 1960<sup>248</sup>. Both firms announced they would protest the awards as detrimental to national security<sup>249</sup>. In addition, they stated that the gap in price came primarily from differences in labor costs between the U.S. and Europe which resulted in the higher bid (refer to figure 2-12)<sup>250</sup>.



**Figure 2-12. Total cost comparison: Heavy electrical apparatus, United States vs Western Europe, 1959.**

Original Source: Westinghouse Electric Corporation.

Source: Jules Backman, *The Economics of the Electrical Machinery Industry* (New York: New York University Press, 1962): chart XI-3, p.298.

While the Office of Civil and Defense Mobilization started investigate the national security and import of foreign turbine, TVA reported further that some U.S. manufacturers were submitting identical bids on equipment and materials<sup>251</sup>. The Senate Subcommittee on Antitrust and Monopoly announced to investigate the identical bids<sup>252</sup>. Following a result of the investigation that such imports did not threaten the national security, three major turbine manufacturing firms (i.e. GE, WH and Allis) began cutting prices on large steam turbine<sup>253</sup>. As another identical bids among the domestic firms were reported later, eventually the government investigated the whole 20 cases in electric machinery industry<sup>254</sup>. It led to reveal the price conspiracy.

The course and consequence of this antitrust case brought some changes to the steam turbine business. First, foreign firms were officially permitted to enter the major U.S. market.<sup>255</sup> Second, the price of turbines fell as a result of the collapse of the conspiracy.<sup>256</sup> Imported turbines and the collapse of the conspiracy met the next cycle of lower demand for turbines, and combined to make the industry more competitive by the middle of the 1960s<sup>257</sup>.

## (2) Aftermath of the 1965 Northeast Blackout

An unexpected development, however, this rescued the industry from its severe predicament. The power outage hit New York particularly hard as the Niagara power grid dropped out during rush hour on November 9, 1965, quickly becoming a chain reaction that cut power to more than 25 million people in eight states and two provinces in the U.S. and Canada, later called the Great Northeast Blackout of 1965.<sup>258</sup> The event spurred electric

utilities to re-evaluate and consider installing new capacity to ensure reliability.<sup>259</sup> This led to two responses for the requirement for new capacity.

One was for emergency power. A relatively common deficiency uncovered by the blackout was a lack of emergency power, so electric utilities began installing gas turbines in their plants, which required the least time for manufacture and installation.<sup>260</sup> As shown in table 2-11, internal combustion plants increased significantly after 1965. Moreover, the larger the size of the plant, the more likely they would be installed. Although Gas turbines were used in a variety of other applications, its use for electric utilities rapidly increased after 1965 (see figure 2-13).

**Table 2-11. Privately owned electric utility generating plants, by type of plant and plant size, 1959-70.**

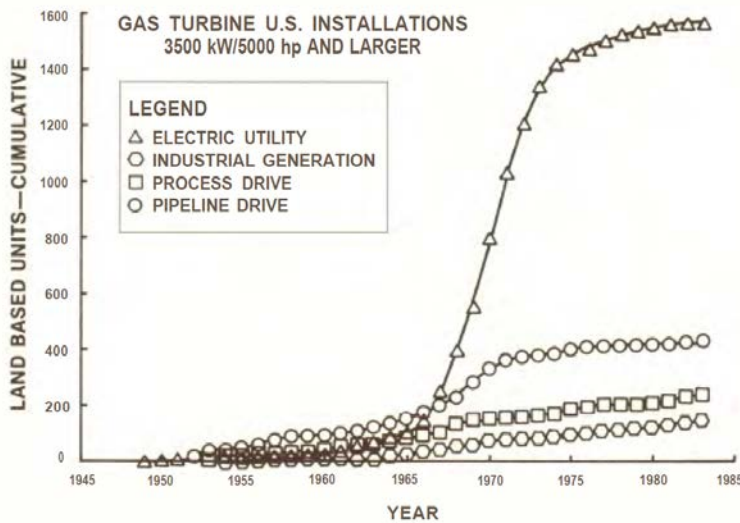
|      | Steam plants |             | Nuclear plants | Hydro plants | Internal combustion |           |                    | Total |
|------|--------------|-------------|----------------|--------------|---------------------|-----------|--------------------|-------|
|      | Under 500000 | Over 500001 | All            | All          | Under 5000          | Over 5000 | Gas turbine plants |       |
| 1959 | 655          | 39          | 3              | 888          | 295                 | 25        | -                  | 1905  |
| 1960 | 660          | 47          | 4              | 866          | 291                 | 28        | -                  | 1896  |
| 1961 | 637          | 59          | 5              | 839          | 282                 | 36        | -                  | 1858  |
| 1962 | 619          | 67          | 7              | 821          | 262                 | 42        | -                  | 1818  |
| 1963 | 602          | 72          | 7              | 812          | 251                 | 54        | -                  | 1798  |
| 1964 | 581          | 83          | 7              | 786          | 237                 | 61        | -                  | 1755  |
| 1965 | 564          | 89          | 7              | 754          | 234                 | 36        | 40                 | 1724  |
| 1966 | 556          | 95          | 8              | 749          | 226                 | 41        | 51                 | 1726  |
| 1967 | 545          | 112         | 8              | 439          | 231                 | 58        | 101                | 1494  |
| 1968 | 530          | 127         | 8              | 734          | 229                 | 68        | 147                | 1843  |
| 1969 | 516          | 140         | 10             | 719          | 229                 | 80        | 199                | 1893  |
| 1970 | 506          | 155         | 13             | 702          | 223                 | 89        | 235                | 1923  |

Source: Compilation of data from the United States Bureau of the Census, *The Statistical History of the United States: from Colonial Times to the Present* (New York: Basic Books, 1976): S 58-73, p.822.

Note: Plant size interval in kilowatts

GE and WH had both been providing gas turbines ever since GE delivered the first gas turbine for electric use in 1949<sup>261</sup>. Even after WH withdrew its aircraft engine business in 1960, WH maintained its gas turbine division within its steam turbine division<sup>262</sup>. On the

other hand, GE's continued interest in the aviation business allowed it the agility to transfer knowledge between its aircraft engine and power generation turbine businesses<sup>263</sup>.



**Figure 2-13. Gas turbine U.S. installations.**

Source: Euan F. C. Somerscales and Robert L. Hendrickson, "America's First Power Generating Gas Turbine," Brochure of Landmark Designations, the History and Heritage Program of ASME: figure 2., p.4.

The second response by electric utilities for increased capacity was the installation of larger scale turbines. Since the blackout led to the creation of nine regional power pool arrangements, it enabled utilities to install larger size turbines under the rule that each regional group purchased 7 to 10% of the entire regional group capacity<sup>264</sup>. Through this rule, small utilities, which were unable to purchase large turbines before, could now cooperate with other utilities in the same region to build large, even nuclear, power plants<sup>265</sup>. Following this change in demand there was a gradual increase in the late 1960s in the production of larger scale steam turbine and nuclear power plants, as seen in table 2-11. In terms of



production of capacity, after the blackout the demand for nuclear power plants rose to become equivalent to that of fossil-fired plants, as shown in figure 2-14. The nuclear power plant market expanded rapidly and appeared to be competitive with conventional fuels.

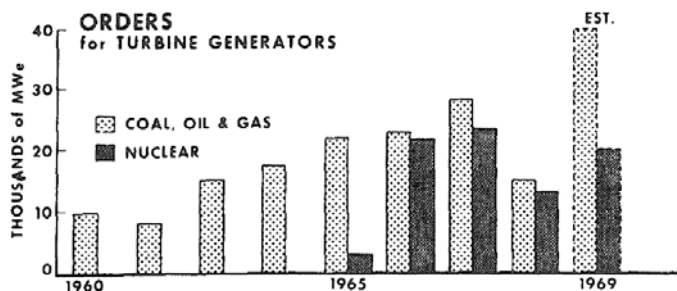


Figure 2-14. Orders for turbine generators, 1960-1968.

Source: U.S. Atomic Energy Commission, *The Nuclear Industry, 1969*: Chart G., p.13.

GE and WH offered nuclear power plants as well as gas turbines. In the nuclear power market, competition emerged differently from what was the case for conventional steam turbines and gas turbines. As shown in table 2-12, WH obtained a similar share of nuclear power contracts to that of GE. This was the first time WH was on the cusp of being the market share leader in the turbine business. Prior investments in the nuclear power business, led by WH president Price led, was bearing fruit in the 1960s.

Table 2-12. Number of contracts of nuclear plants in the U.S. central station.

|           | WH                  |                | GE                  |                | Other               |                | Total               |                |
|-----------|---------------------|----------------|---------------------|----------------|---------------------|----------------|---------------------|----------------|
|           | Number of Contracts | Size (Mwe-Net) | Number of Contracts | Size (Mwe-Net) | Number of Contracts | Size (Mwe-Net) | Number of Contracts | Size (Mwe-Net) |
| 1953-59   | 2                   | 265            | 3                   | 338            | 3                   | 366            | 8                   | 969            |
| 1960-65   | 5                   | 2950           | 5                   | 3145           | 3                   | 1170           | 13                  | 7265           |
| 1966      | 6                   | 4867           | 9                   | 7744           | 5                   | 3694           | 20                  | 16305          |
| 1967      | 13                  | 10657          | 8                   | 7076           | 10                  | 8209           | 31                  | 25942          |
| 1968      | 4                   | 4438           | 9                   | 8171           | 3                   | 2182           | 16                  | 14791          |
| 1969      | 3                   | 3129           | 3                   | 2986           | 1                   | 1140           | 7                   | 7255           |
| 1970      | 4                   | 3688           | 4                   | 3752           | 6                   | 6722           | 14                  | 14162          |
| Total     | 37                  | 29994          | 41                  | 33212          | 31                  | 23483          | 109                 | 86689          |
| Share (%) | 33.9%               | 34.6%          | 37.6%               | 38.3%          | 28.4%               | 27.1%          | -                   | -              |

Source: Compilation of data from U.S. Atomic Energy Commission, *The Nuclear Industry, 1970*: table IV-5 and 6., pp.154-156.

Note: The data is considered from the year 1953 to September 30, 1970

### (3) Conventional Steam Turbines in a New Business Setting

A wave of change descended on the turbine business during the 1960s, including foreign competitors, collapse of the price conspiracy and a growth in demand for new products. Although GE and WH managed to respond, a divergence in their respective business competitiveness became apparent by the late 1960s.

The collapse of the price conspiracy coupled with new competition from foreign firms led to a more competitive industry, as U.S. firms granted price concessions in order to fill their excess manufacturing capacity with orders<sup>266</sup>. The market prices were discounted 30% to 35% in 1961<sup>267</sup>. Allis-Chalmers, the third domestic firm, then announced its intention to leave the business in late 1962<sup>268</sup>. The exit of Allis left only two domestic firms and, boosted by increasing demand, price leadership soon replaced price competition<sup>269</sup>. The following year GE changed its pricing policy to adhere strictly to the levels published in a new price book, and WH subsequently followed this lead<sup>270</sup>. It allowed them to submit virtually identical prices for electrical machinery during the 1960s<sup>271</sup>. They formed a tacit collusion through a non-cooperative process, different from the approach taken in the 1950s<sup>272</sup>. However, foreign firms, particularly Brown Boveri, had weakened this collusion and were immediately the major source of competition during the period. For instance, GE's relationship with American Electric Power went from bad to worse when the latter chose Brown Boveri's products in the middle of 1960s, since the price offered underbid that offered by GE and WH<sup>273</sup>. As a result, price and cost competitiveness were much more factors in obtaining market than in the previous decade.

Following the blackout, the rapid growth in demand largely went to steam turbines over gas turbines and nuclear power. As with the other products, these required larger scale turbine generators to expand capacity. As shown in figure 2-14, the number of orders and total capacity for steam turbines expanded suddenly, starting in 1965. GE and WH took on a new product strategy to exploit this opportunity, by offering gas turbine “packages” for power generation<sup>274</sup>. This product strategy met the needs of utilities and allowed the firms to reduce the total cost of gas turbine manufacturing.<sup>275</sup>

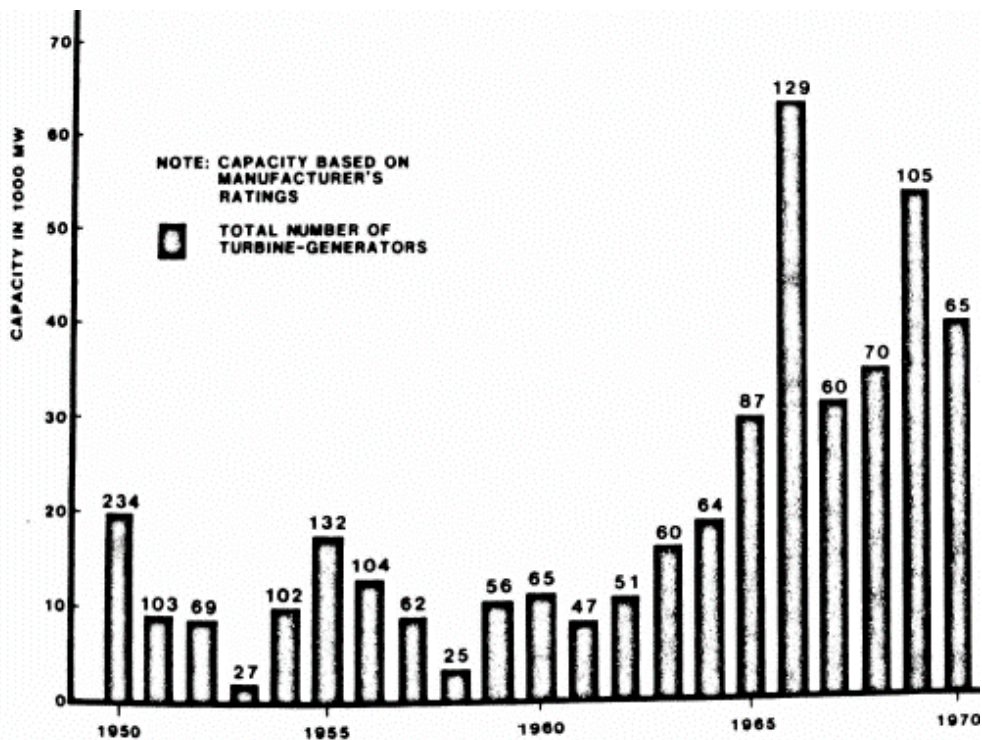


Figure 2-15. Capacity and number of turbine generators ordered in the U.S.

Original source: American Electric Power Company.

Source: Richard F. Hirsh, *Technology and Transformation in the American Electric Utility Industry* (Cambridge: Cambridge University Press, 1989): figure 25., p.95.

However, the sudden boost in demand for large turbines posed a huge problem. The rapid change in the size of units and the excess of orders led to the large turbines experiencing problems in operation (e.g. turbine blades) and there was a decline in reliability from about the late 1960s<sup>276</sup>. WH's problems, however, were more serious<sup>277</sup>. When compared to the much more reliable and less labor-intensive General Electric unit, for example, the WH unit had become, as some plant managers commented, 'supertroublesome.'<sup>278</sup>. The reason behind WH's serious problems was that it received too many orders to handle<sup>279</sup>. In addition, there was also a possibility that the problems were due to an unbalanced research and development investment in the 1960s<sup>280</sup>. Therefore WH decreased its technological capability in conventional steam turbines by focusing on nuclear power technology, while GE was able to more adequately invest in both conventional steam turbine and other technologies.

In the conventional steam turbine industry, price competitiveness and technological capabilities in the late 1960s drove the contrast in market share between GE and WH (see figure 2-6). GE maintained price leadership and better cost competitiveness, and also had sufficient size to continuously invest in steam turbines. On the other hand, WH was faced with a higher cost structure when building its steam turbines. In fact WH, starting in 1959, tried to decrease its product cost through a "block building" approach, which was focused on standardizing or modularizing components of the product<sup>281</sup>. This worked but only temporarily. Direct costs of WH decreased from 72.9% in 1959, to 65.0% in 1960, and then to 58.6% in 1961<sup>282</sup>. However, this strategy became less useful when the size of turbine gen-

erators were rapidly increasing as it was difficult to sustain in such a fast-changing technological environment<sup>283</sup>. As a consequence, WH was unable to reduce its costs. As a result of this difference, price competition from foreign firms had a more negative effect on WH.

Furthermore, since GE was twice the size of WH, GE could not only afford investments in new technologies, such as nuclear power, but also in gas turbine and steam turbine technologies, while WH had to remain more focused on nuclear power. This allowed GE to maintain the reliability of its product even when faced with a rapid increase in the size. WH, on the contrary, experienced a decline in reliability and reputation. As a result, WH lost an even greater share of its market in conventional steam turbines. Hence the divergence in market share seen in the late 1960s resulted from the fact that WH was unable to also adequately concentrate on its traditional business, as in the 1950s.

## 2. Diversification and Social Change

The reason WH was unable to concentrate on turbine business during the 1960s, however, was not the same as for the 1950s, it was more an extension of their traditional logic. GE and WH undertook their prewar diversification following a logic of “the benign circle of electric power.” Ralph J. Cordine, GE president during the 1950s described:

“A turbine generator installed in a power station makes possible the sale of more lamps, appliances, motors, and other users of power. And as more people buy lamps, appliances and so on, they create the need for another turbine generator and more transmission equipment. Thus, each new use of electricity accelerates the turn of the circle---creating a bigger potential market for General Electric products, not only in

end use equipment, but in equipment to produce, transmit, and distribute electric power.<sup>284</sup>

In short, they believed that the more that society accelerated its electrification, the more their core business, turbine generator products, would be in demand, and electrical machinery firms would thereby increase profits. Since electric utilities had helped push the message that greater electricity consumption increases sales<sup>285</sup>, utilities and manufacturing firms had a shared interest in electrifying society. When utilities promoted the “Medallion Home” program in 1957, which was an extension of the “Live Better Electrically” program in 1956, GE and WH both followed suit<sup>286</sup>.

The Medallion Home program was an attempt to encourage sales of all-electric homes by placing a “visible but not conspicuous” medallion on the new house<sup>287</sup>. Utilities offered lower, promotional rates to the owner of those houses<sup>288</sup>. Since industrial consumption initially led to the growth of electric usage in the 1940s and 1950s<sup>289</sup>, a reasonable way of sustaining growth was through an expansion of residential usage.

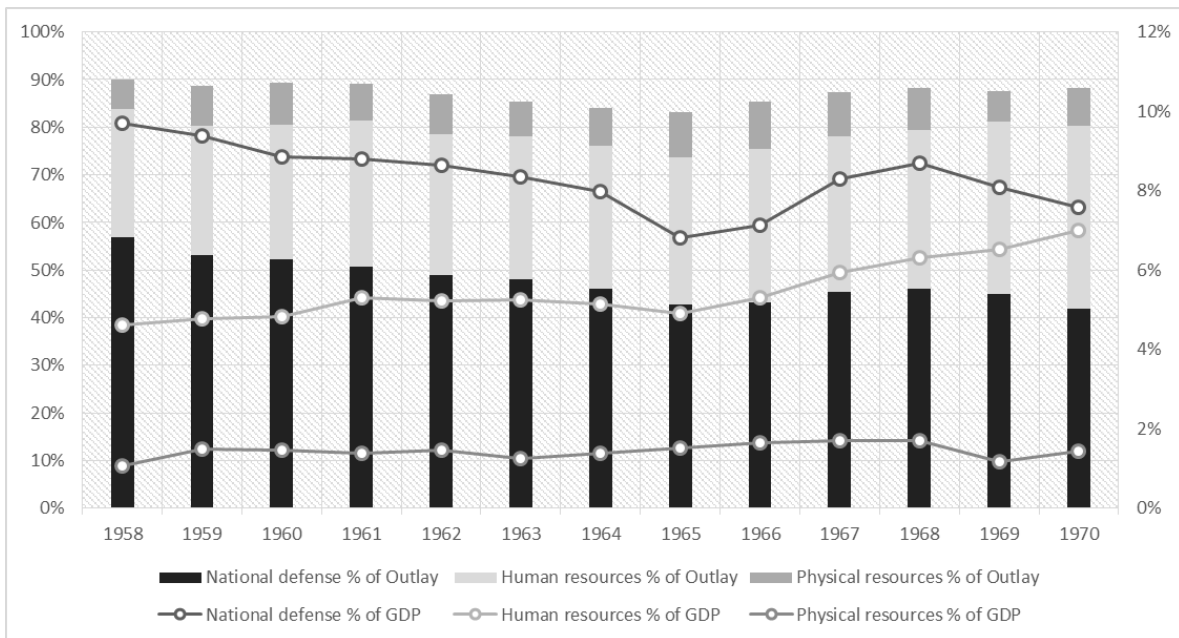
For electrical manufacturing firms, the all-electric home concept served as a potential market for their products. As they forecasted orders, even with an aggressive forecast by GE, they expected a decline in orders for turbines in the late 1950s cycle<sup>290</sup>. Thus the program compensated for the drop in orders of turbines. WH began proposing the “Total Electric Home” concept in 1959, and GE referred to “total electric living” and “Gold Medallion Homes” as its product market in 1959<sup>291</sup>. According to a GE estimate, the average new

home in the U.S. contained \$575 (at factory selling prices) in electrical equipment and related materials, and Gold Medallion homes could utilize as much as \$3,020 worth of GE appliances and equipment<sup>292</sup>. This highlighted the potential market gains by expanding residential use of electricity and electrical products<sup>293</sup>. To exploit market opportunities, both firms launched a series of specialized task teams, such as GE's Residential Market Development Operation in 1959 and WH's Residential Marketing Department in 1960<sup>294</sup>. Through these teams, the firms offered home building contractors integrated proposals for a set of preinstalled products for the home.

This emphasis on the consumer market was driven by social changes that were occurring in American society. Ralph Cordiner, as Chairman of the Board of GE, foresaw in 1958 that the “[r]ising level of income and education, along with the sharp increase in household formation in the 1960s, will mean a bigger, higher-quality market for residential uses of electricity”<sup>295</sup>. In 1962 WH described the emergence of a large consumer market as follows: “[d]espite an unprecedented expansion of new construction in the United States, population growth continues to create new and greater needs for homes, schools, shopping centers, hotels, motels, office buildings, government buildings and apartment buildings.”<sup>296</sup> Around 1960, both top managements had confidence that the trends in the consumer market would continue throughout the 1960s, and this could be exploited for additional corporate growth.

Also in the 1960s, actions by the U.S. government presented another potential market under the Democratic administrations of John F. Kennedy (1961-1963) and Lyndon B.

Johnson (1963-1969). The government embraced macroeconomic planning as an integral aspect of modern policy, and expanded its involvement into social security areas, from education to welfare, while still maintaining the national defense budget.<sup>297</sup> Figure 2-16 presents the major categories of expenditure for the U.S. government from 1958 to 1970.



**Figure 2-16. National defense, human resources, physical resources budget, 1958-1970.**

Source: Compilation of data from “Table 3.1. Outlays by Superfunction and Function: 1940–2020,” Office of Management and Budget, and “Gross Domestic Product: Current-dollar and ‘Real’ GDP,” U.S. Department of Commerce, Bureau of Economic Analysis.

Note 1: human resources consists of education, training, employment, and social services, health, medicare, income security, social security, and veterans benefits and services.

Note 2: Physical resources includes energy, natural resources and environment, commerce and housing credit, transportation, community and regional development.

Note 3: Each budget does not reach 100%, because net interest and other functions such as international affairs agriculture etc. are excluded on data.

While the outlay for national defense continued to account for approximately 40% to 50% of the total federal budget, the outlay for human resources gradually increased in amount.

Its percentage of GDP particularly increased from 1966 onwards, from approximately 5%



to 7%. Although defense, highway building, and the space programs were particularly important areas of government spending that shaped the expansion of entire sectors of the economy<sup>298</sup>, the budget for human resources was also attractive to GE and WH, as described later. Table 2-13 presents expenditures for selected subcategories of the space program. The physical resources expenditures, such as transportation and community development, were provided a fix amount during the 1960s. On the other hand, while outlays for general science, space and technology research peaked in 1966, all subcategories for human resources gradually increased and continued to account for a high percentage in the late 1960s.

**Table 2-13. Selected subcategories budget, 1962-1970.**

|  | 1962          | 1963          | 1964          | 1965          | 1966          | 1967          | 1968          | 1969          | 1970          |
|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Total General Science, Space, and Technology               | 1,723 (0.4%)  | 3,051 (0.6%)  | 4,897 (0.9%)  | 5,823 (1.0%)  | 6,717 (1.1%)  | 6,233 (1.0%)  | 5,524 (0.8%)  | 5,020 (0.7%)  | 4,511 (0.6%)  |
| Total Natural Resources and Environment                    | 2,044 (0.4%)  | 2,251 (0.4%)  | 2,364 (0.4%)  | 2,531 (0.4%)  | 2,719 (0.4%)  | 2,869 (0.4%)  | 2,988 (0.4%)  | 2,900 (0.4%)  | 3,065 (0.4%)  |
| Total Transportation                                       | 4,290 (0.9%)  | 4,596 (0.9%)  | 5,242 (1.0%)  | 5,768 (1.0%)  | 5,730 (0.9%)  | 5,936 (0.9%)  | 6,316 (0.9%)  | 6,526 (0.9%)  | 7,008 (0.9%)  |
| Total Community and Regional Development                   | 469 (0.1%)    | 574 (0.1%)    | 933 (0.2%)    | 1,114 (0.2%)  | 1,105 (0.2%)  | 1,108 (0.2%)  | 1,382 (0.2%)  | 1,552 (0.2%)  | 2,392 (0.3%)  |
| Elementary, secondary, and vocational education            | 482 (0.1%)    | 553 (0.1%)    | 579 (0.1%)    | 719 (0.1%)    | 1,627 (0.3%)  | 2,310 (0.4%)  | 2,516 (0.4%)  | 2,470 (0.3%)  | 2,893 (0.4%)  |
| Higher education   | 328 (0.1%)    | 426 (0.1%)    | 382 (0.1%)    | 413 (0.1%)    | 706 (0.1%)    | 1,161 (0.2%)  | 1,394 (0.2%)  | 1,234 (0.2%)  | 1,387 (0.2%)  |
| Other education, training, employment, and social services | 431 (0.1%)    | 479 (0.1%)    | 594 (0.1%)    | 1,008 (0.2%)  | 2,029 (0.3%)  | 2,982 (0.5%)  | 3,125 (0.5%)  | 3,844 (0.5%)  | 4,355 (0.5%)  |
| Total Education, Training, Employment, and Social Services | 1,241 (0.3%)  | 1,458 (0.3%)  | 1,555 (0.3%)  | 2,140 (0.4%)  | 4,363 (0.7%)  | 6,453 (1.0%)  | 7,634 (1.1%)  | 7,548 (1.0%)  | 8,634 (1.1%)  |
| Total Health   | 1,198 (0.2%)  | 1,451 (0.3%)  | 1,788 (0.3%)  | 1,791 (0.3%)  | 2,543 (0.4%)  | 3,351 (0.5%)  | 4,390 (0.6%)  | 5,162 (0.7%)  | 5,907 (0.7%)  |
| Total Medicare   | -             | -             | -             | -             | 64 (0.0%)     | 2,748 (0.4%)  | 4,649 (0.7%)  | 5,695 (0.8%)  | 6,213 (0.8%)  |
| Housing assistance   | 165 (0.0%)    | 179 (0.0%)    | 150 (0.0%)    | 231 (0.0%)    | 238 (0.0%)    | 271 (0.0%)    | 312 (0.0%)    | 383 (0.1%)    | 499 (0.1%)    |
| Other income security                                      | 9,042 (1.9%)  | 9,133 (1.7%)  | 9,507 (1.7%)  | 9,237 (1.6%)  | 9,439 (1.6%)  | 9,990 (1.6%)  | 11,504 (1.7%) | 12,693 (1.7%) | 15,156 (1.9%) |
| Total Income Security                                      | 9,207 (1.9%)  | 9,311 (1.8%)  | 9,657 (1.8%)  | 9,469 (1.7%)  | 9,678 (1.6%)  | 10,261 (1.6%) | 11,816 (1.7%) | 13,076 (1.8%) | 15,655 (1.9%) |
| Social security  | 14,365 (3.0%) | 15,788 (3.0%) | 16,620 (3.1%) | 17,460 (3.1%) | 20,694 (3.4%) | 21,725 (3.4%) | 23,854 (3.5%) | 27,298 (3.7%) | 30,270 (3.7%) |

Source: Compilation of data from "Table 3.2. Outlays by Function and Superfunction: 1962-2020," Office of Management and Budget, and

"Gross Domestic Product: Current-dollar and Real GDP," U.S. Department of Commerce, Bureau of Economic Analysis.

Note 1: million dollars.

Note 2: a number of parentheses is percent of GDP.

In addition to the huge potential consumer market that was emerging from population growth, GE and WH also saw these large government expenditures as a potential market for growth. Gerald L. Phillippe, president of GE, stated “just as we found with consumer and industrial expenditures, governments have a wide latitude of discretion in what programs to push....Here again the opportunity for the electrical industry is big.<sup>299</sup>” He made reference to selling electrical solutions to the problems faced in the governmental market<sup>300</sup>. As examples, it raised the provision of adequate street lighting to prevent violent crimes, educational facilities for educational television, and electrified rapid transit to address the traffic congestion crisis<sup>301</sup>. And they saw transportation systems, education, public safety, urban renewal, street lighting, water and sewage treatment as potential government related markets<sup>302</sup>. While emphasizing the expanding population and the growing needs of humans, WH president Donald C. Burnham considered city transport, purified water, undersea exploration, waste and refuse disposal as social problems that posed as potential markets<sup>303</sup>.

GE and WH understood the new governmental policy to be part of the social change. They also saw the growth in population and urbanization as fundamental factors of this change. In the coming of the “Age of Cities”, they positioned themselves as solution providers through

the electrification of city problems, problems called “urban sprawl,” “urban scatteration,” and “slurb”<sup>304</sup>. These emerging societal problems were growth opportunities for the two firms.

To seize the opportunities, two concepts were pursued, the customer-oriented and the systems approach. Regarding the former, Mark W. Cresap, Jr., WH president, in 1962 describes it as follows “defines and identifies a market from the point of view of the customer’s needs and concentrates Company skills, facilities and resources and serving this market”<sup>305</sup>.

Also, General L. Phillippe, GE president in 1963, referred as “our still-important *technological* mastery is geared up to serve known *market objectives*”<sup>306</sup>. Thus, they emphasized the importance of a market strategy for this new emerging market. As a result, in 1963 GE reorganized the Residential Market Development Operation to create the Construction Market Development Operation and then, in 1965, again restructured to form the Community Systems Development Division, meanwhile WH established the Marketing Communications Department in 1964 to undertake all marketing operations<sup>307</sup>.

The new focus on urban markets to meet the needs of a growing number of consumers, combined with electrical manufacturing capacities, led to the foundation of the systems approach as the optimal approach to obtaining profits from a growing market. Marketing was

now not so much geared on the actual products and would focus on systems. The system selling approach first appeared in military and industrial markets in the late 1950s, and then expanded to other businesses<sup>308</sup>. The concept of total electric living serves as a prime example.

The idea was applied not only to residential, but also to non-residential markets, such as commercial and institutional<sup>309</sup>. As examples, systems were offered in the industrial market through automation and computerization systems, in the government market through mass transportation systems, and in the military market through missile guidance systems<sup>310</sup>. It is assumed that they believed their role in society was more than just that of an electrical machinery firm but also as a provider of social systems, the electrified society led to a growth in demand for electrified systems as solutions.

Although this new systems-based approach can be seen as expanding the logic applicable to “the benign circle of electric power,” the traditional logic for business operations, it was a strong enough driver that allowed for expansion and diversification of their businesses to promote corporate growth in the 1960s. In response to the \$12 billion tax cut approved by Congress in 1964, spurring an impressive increase in private investment<sup>311</sup>, GE and WH accelerated their respective businesses expansions under a new logic, namely mergers and acquisitions.

Starting 1963, under President Fred J. Borch, GE looked for market opportunities that were both growing at a faster rate than the GNP and also suited to GE capabilities<sup>312</sup>. They identified nine business lines: nuclear energy, computers, commercial jet engines, polymer chemicals, entertainment, community development and housing, personal financial services, medicine, and education<sup>313</sup>. GE hoped to achieve \$1 billion in sales through the expansion<sup>314</sup>. Among the business lines, nuclear power, computers, and commercial jet engines were seen as businesses for the future<sup>315</sup>. At the same time, GE started to internationalize its business. Although GE performed well in international markets through exports, there was concern over the increasing penetration into U.S. markets by foreign competitors in the early 1960s<sup>316</sup>. They regarded the reduction of world trade barriers as healthy but it also introduced a shock of change that could not be ignored<sup>317</sup>.

GE's subsequent expansion took two tracks during the 1960s. Since most of the "business of the future" had already been established within the firm, GE focused on mergers and acquisition for internationalization, as shown in table 2-14. They mainly purchased European firms that were operating in the same businesses, such as electrical machinery. Among the "futures" businesses, the computer business was the only one that was rapidly expanded through M&A. Other businesses for the future, such as education and media, were also established

through M&A and joint ventures but these were smaller businesses at the time. Community development and housing, however, was the ultimate goal for the total electric living idea that GE itself established for communities and homes of the future, and GE announced in 1968 that it would build such a city in Columbia, Maryland<sup>318</sup>.

**Table 2-14. A list of new business for GE, 1960-1970.**

| Year | Name                                       | Business             | Nationality | note (1)             | note (2)                             |
|------|--|----------------------|-------------|----------------------|--------------------------------------|
| 1960 | Compagnia Generale di Elettricità          | electronics etc      | Italia      | controlling interest | disposed in 1968                     |
| 1964 | Compagnie Bull General Electric            | computer             | France      | half interest        | disposed in 1970                     |
|      | Société Industrielle Bull-General Electric | computer             | France      | half interest        | disposed in 1970                     |
|      | Prometheus                                 | housewares           | West Germa  | controlling interest | disposed in 1971                     |
|      | ESGE group                                 | housewares           | Swissland   |                      | disposed in 1971                     |
|      | James N Kirby                              | appliance            | Australia   | majority interest    |                                      |
| 1965 | Landers, Frary & Clark                     | housewares           | US          |                      |                                      |
|      | N.C.Joseph                                 | housewares           | UK          |                      |                                      |
|      | Olivetti-GE                                | computer             | Italia      | majority interest    | disposed in 1970                     |
|      | (JV) Simplex-GE Manufacturing              | control device       | UK          | half interest        | joint venture with Simplex Electric  |
|      | (JV) Simplex-GE                            | control device       | UK          | half interest        | joint venture with Simplex Electric  |
|      | (JV) General Learning                      | education            | US          |                      | joint venture with Time              |
|      | (EB) GE Overseas Capital                   | financing            | US          |                      |                                      |
|      | (EB) GE Cablevision                        | media                | US          |                      |                                      |
| 1966 | Kuba-Imperial group                        | consumer electronics | West Germa  |                      | disposed in 1970                     |
|      | Computron                                  | material             | West Germa  | half interest        | disposed in 1968                     |
|      | GE-Enka Fibers                             | material             | -           | controlling interest | disposed in 1970                     |
|      | APAG Apparatebau                           | consumer products    | Swissland   |                      | disposed in 1969                     |
|      | Electromat                                 | lamps                | Chili       | controlling interest |                                      |
|      | Fabricantes de Material Eléctrico          | lamps                | Chili       | controlling interest |                                      |
|      | General Medical Balteau                    | X-ray                | Belgium     |                      | renamed GE Medical                   |
|      | four cable television systems              | media                | US          |                      |                                      |
|      | (EB) ECCO                                  | electronics          | Ireland     |                      |                                      |
|      | (EB) Ventas de General Electric Controls   | push button controls | Puerto Rico |                      |                                      |
|      | (EB) GE Pilot Service                      | general controls     | Puerto Rico |                      |                                      |
|      | (EB) Carbolov                              | lamps                | Italia      | controlling interest |                                      |
| 1967 | GE Espanola                                | electrical products  | Spain       | controlling interest |                                      |
|      | (EB) Electronic Industry                   | electronics          | Hong Kong   |                      |                                      |
| 1968 | Metropolitan Television                    | media                | US          |                      | renamed GE Broadcasting Co. of Colo. |
|      | Caribe GE                                  | -                    | Puerto Rico | merged               | formed GE Power Products             |
|      | (EB) Business Development Services         | financing            | US          |                      |                                      |
| 1969 | Benerson                                   | -                    | US          |                      |                                      |
|      | (EB) GE Devices                            | -                    | -           |                      |                                      |
|      | (EB) Stentor                               | -                    | -           |                      |                                      |
|      | (EB) Berwyn Power Equipment                | -                    | -           |                      |                                      |

Source: Compilation of data from *Moody's Industrial Manual*, various years and *GE, Annual Reports*, various years.

Note: (JV) indicates Joint venture, (EB) indicates establishment of new company.

Through this expansion, however, GE did not achieve what they had aimed for by the end of the decade. Although GE's sales grew rapidly, profitability did not follow this growth in sales (see figure 2-1 and figure 2-3). By the late 1960s GE had achieved "growth without

profit<sup>319</sup>”. The major contributors were three “future” businesses. As shown in table 2-15, nuclear power, commercial jet engines, and computers were all racking up losses. Reginald H. Jones, vice president of finance, surmised: Computers, in particular, had no positive prospects for GE top management.

“our debt to capital ratio had been climbing. And we just said [ ] there is a breaking point where we will lose our triple A rating as a corporation if we continue to pile on debt and if we try to do all of these things that we have got on our plate right now. (Testimony of Reginald H. Jones, U.S. v. IBM, Trial Transcript, 8831-32.)<sup>320</sup>”

Consequently, GE left the computer business in 1970. This is mainly because GE already held more than a 20% market share in the nuclear power and jet engine markets, and could operate these in a competitive posture that was more suited to the firm but, above all, it would be difficult to abruptly leave these businesses due to contractual relationships<sup>321</sup>. Around that time, GE decided to divest European foreign businesses that did not contribute to GE profits and where GE managers were not inclined to work<sup>322</sup>.

Since GE failed to successfully expand and diversify its businesses during the decade, its corporate profitability declined in the late 1960s. However, they were capable of covering the losses due to the strong financial position that had been built over its history. In other words,



GE had invested surplus fund in new businesses while maintaining its investments in traditional businesses.

**Table 2-15. Estimated profit contribution for major product categories of GE, 1968-69.**

| Product category   | 1968       | 1969       |
|--|------------|------------|
| Nuclear turnkey  | -150       | -150       |
| Other nuclear  | -30        | -25        |
| Turbine generators   | 114        | 82         |
| Transmission and distribution                                      | 70         | 62         |
| Total utility business   | 4          | -31        |
| Commercial jet engines division                                    | -30        | -50        |
| Other heavy capital goods  | 85         | 65         |
| Total heavy capital goods  | 55         | 15         |
| Computer division  | -30        | -1         |
| Other light industrials  | 225        | 161        |
| Total light industrials  | 195        | 160        |
| Consumer products  | 255        | 215        |
| Aerospace and defense  | 65         | 50         |
| Non-operating earnings<br>(Primarily GE Credit Corp.)              | 71         | 84         |
| <b>Total</b>   | <b>645</b> | <b>493</b> |
| Pretax profit from nuclear,<br>computer, and jet engine businesses | -240       | -226       |
| Pretax profit from other operations                                | 885        | 719        |
| <b>Total pretax profit</b>   | <b>645</b> | <b>493</b> |

Original Source: U.S. v. IBM, Plaintiff Exhibit 362, p. 11; and Wall Street Institutional reports.

Source: Modified from William E. Fruhan, Jr., *Financial Strategy: Studies in the Creation, Transfer, and Destruction of Shareholder Value* (Homewood: Richard D. Irwin, 1979): table 6-5, p.158.

WH's approach, on the other hand, differs from that of GE. For example, they went further than GE in advancing the total electric living idea. As seen in table 2-16, unlike GE, WH mainly purchased domestic firms in a variety of businesses, including furniture, softdrinks, education, construction, residential development, auto rental, etc. These M&As were conducted under the concept derived by WH senior management, which Donald C. Burnham, WH president described:

“We are seeking growth in two directions. One is serving customers better with improved products and services in our existing businesses. The other is new businesses evolving from the Company’s capabilities and resources and from new environmental needs of people throughout the world...Among them are the further promise of atomic power, underseas exploration, transportation, urban development, water desalting, education and an expanding electronics technology.<sup>323</sup>”

After seeing GE’s forward action to build a city, WH increasingly purchased a variety of businesses. Similar to GE, WH had worked towards the ultimate goal of the total electric living idea. In 1966 WH purchased the Coral Ridge Properties in Florida and decided to build a new city, Coral Springs, for the following purpose:

“to broaden Company experience in urban planning and stimulate development of products and services for the city of the future. Designed for 60000 residents, the community is being built to the highest architectural, construction and landscaping standards, and will combine the advantages of city and suburban living.....Coral Springs will be an excellent vehicle for developing and testing new products and systems which will augment the Company’s capabilities to serve the rapidly growing urban development and building construction market<sup>324</sup>.”

To be able to build a city, WH began to go out and purchase any business that was related to the building of a city. For example, this would explain why WH acquired a furniture business. To provide a full housing system, kitchen cabinets and other basic furniture could be incorporated into the system, along with the electrical system. One can further assume that the reason WH acquired an auto rental business in Florida could be due to the anticipated demand in the city where WH began building. WH extended its involvement in businesses linked to the total electric living concept much deeper than GE.

With regards to community development, WH committed to a market of population growth exceeding that premised by GE. WH identified water-supply as a potential business in 1962, with the following reference “An expanding population, greater individual consumption and increased industrial use of water as a raw material are draining our supplies at an unprecedented rate and have raised the threat of future water shortages.<sup>325</sup>” In fact, water related machinery had been one of WH’s small business lines since 1948, when Kuwait approached them for large-volume seawater purification<sup>326</sup>. Although not a major business within the firm, WH held onto the water business as did GE for its plastic business. However, WH saw these small existing businesses as having the potential to grow in the new society.

**Table 2-16. A list of new business for WH, 1960-1970.**

| Year | Name   | Business                  | Nationality | note (1)          |
|------|--|---------------------------|-------------|-------------------|
| 1961 | Thermo King  | refrigeration products    | US          |                   |
| 1962 | Radio station WINS                                     | media                     | US          |                   |
| 1963 | Controls business of Hagan Chemical & Controls         | industrial products       | US          |                   |
|      | Ateliers Jaspas-Westinghouse                           | industrial products       | Switzerland | majority interest |
| 1965 | Dick X-Ray   | X-ray                     | US          |                   |
|      | Chase Electric   | -                         | US          |                   |
|      | Electric Marketeer Manufacturing                       | industrial veicles, carts | US          |                   |
|      | I-XL Furniture   | furniture                 | US          |                   |
|      | Goshen Realty Corporation                              | furniture                 | US          |                   |
|      | Philacor   | appliance                 | Philippine  | minority interest |
| 1966 | Coral Ridge Properties                                 | residential development   | US          |                   |
|      | DECO Electronics                                       | electronics products      | US          |                   |
|      | Seven-Up Bottlers of Fairfield Country                 | softdrink                 | US          |                   |
|      | Seven-Up Bottling Co.                                  | softdrink                 | Puerto Rico |                   |
|      | Radio station KFVB                                     | media                     | US          |                   |
|      | Lighting Inc.  | -                         | Puerto Rico |                   |
|      | Lincoln Warm Air Heating Equipment                     | air heating system        | UK          |                   |
| 1967 | Sanford Brothers                                       | industrial services       | US          |                   |
|      | Florida Antennavision                                  | media                     | US          |                   |
|      | CATV service in New York                               | media                     | US          |                   |
|      | Compagnie des Dispositifs Semiconducteurs Westinghouse | semiconductor             | France      | majority interest |
| 1968 | K.W. Battery   | industrial products       | US          |                   |
|      | Measurement Research Center                            | education                 | US          |                   |
|      | MCA, Inc   | media                     | US          |                   |
| 1969 | Hub Electric   | lighting                  | US          |                   |
|      | Seven Up Bottling Co of Los Angeles                    | softdrink                 | US          |                   |
|      | Seven Up Bottling Co of San Bernardio                  | softdrink                 | US          |                   |
|      | Seven Up Bottling Co of Bakersfield                    | softdrink                 | US          |                   |
|      | Intercounty Construction                               | water&waste treatment     | US          |                   |
|      | C.W. Blakeslee & Sons                                  | construction              | US          |                   |
| 1970 | C & C Construction                                     | water&waste treatment     | US          |                   |
|      | Econo-Car  | auto rental               | US          |                   |
|      | Longines-Wittnauer Watch                               | timepieces&mail-order     | US          |                   |
|      | Ateliers de Constructions Electriques de Charleroi     | electrical product        | Belgium     |                   |
|      | Southern Prestressed Concrete                          | construction services     | US          |                   |
|      | Ideal School Supply Company                            | education                 | US          |                   |
|      | Americar   | auto rental               | US          |                   |
|      | Seven Up Bottling Co of Southern Indiana               | softdrink                 | US          |                   |
|      | Seven Up Bottling Co of Indiana                        | softdrink                 | US          |                   |

Source: Compilation of data from *Moody's Industrial Manual*, various years and WH, *Annual Reports*, various years.

Consequently, WH advanced its diversification in a manner different from that of GE.

As per table 2-17, in the 1960s WH increased its number of products from 165 to 231. While

WH disposed of a few products, other new product categories were expanded in response to the

building a city initiative and new government policies, such as health, social service, and education. Thus WH, more than GE, pursued potential demands arising from social changes. For GE, on the contrary, its diversification actually led to better financial performance in the late 1960s.

**Table 2-17. Diversification of products in Westinghouse Electric Corporation, 1960-1970.**

| Product Category                                    | 1960 | 1961-1970 |
|---|------|-----------|
| Power Generation (non Nuclear)                      | 8    | 9         |
| Nuclear Power Generation                            | 8    | 12        |
| Transmission and Distribution                       | 16   | 20        |
| Power Modulation Equipment                          | 9    | 12        |
| Transportation (land)                               |      |           |
| Elevator related                                    | 2    | 4         |
| Other   | 1    | 4         |
| Transportation (non land)                           |      |           |
| Marine  | 5    | 3         |
| Air   | 1    | 1         |
| Space   | 3    | 4         |
| Heating, Ventilating and Air Conditioning           | 14   | 13        |
| Refrigeration                                       | 5    | 6         |
| Environmental Equipment and Services                | 0    | 6         |
| Industrial Process Equipment                        | 18   | 19        |
| Lighting and Lamps                                  | 21   | 23        |
| Home Appliances                                     | 8    | 7         |
| Defense Product                                     | 15   | 28        |
| Materials and Material Related Products             | 16   | 15        |
| Medical   | 1    | 0         |
| Health, Social Services, Education                  | 0    | 7         |
| Home Building, Real Estate Development, Building Tr | 0    | 8         |
| Entertainment and Leisure activities                | 6    | 12        |
| Maintenance, Service, Financial Services            | 2    | 7         |
| Miscellaneous Components and Special Products       | 6    | 11        |
| Total   | 165  | 231       |

Source: Compilation of data from Principle Products Analysis 1952-1982, 1982, box16, folder 8, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

### 3. Competition in a New Setting and Diversification in the Socio-Industrial Complex

Throughout the 1960s GE and WH continued to compete in the conventional steam turbine business, but the business environment had changed significantly. Instead of simply gaining from the third competitor's exit, foreign firms began gaining market share and emerged as new competitors after the collapse of price conspiracy, and this demanded more price competitiveness. In addition, there was the new demand in turbine products that emerged after the massive blackout in 1965. Both firms suddenly received a number of orders for large conventional turbines while also receiving orders for gas turbine and nuclear power plants. While GE managed the orders, WH was overwhelmed. As a consequence, WH's share market was reduced towards the late 1960s, much owing to its decline in reputation.

On the other hand, the top managements of both firms tried to identify new businesses for corporate growth. They had seen the growth in population, urbanization, and new governmental policies as potential markets. To profit on the situation, they took similar approaches, customer-oriented and system. Although both firms diversified into a number of similar businesses, their diversification efforts were quite different as a whole. In responding to the government's new social security policy, they became part of the socio-industrial complex, as opposed

to the military-industrial complex, by entering into the community development and housing, medicine, and education sectors<sup>327</sup>.

WH evidenced a much deeper commitment to these new businesses than did GE, while WH followed the logic of an expansion to the benign cycle. Although the benign cycle was validated by economies of scale and scope, based on a cost advantage to the supply side, WH diversification was based on factors of demand and market. Customers desired the system, and firms could sell products, even those unrelated to their business, as long as they provided them as the part of the system. Thus expansion that occurred had actually moved WH away from the original benign cycle, as the new business was largely different from its electrical machinery the past logic no longer applied. The new strategy, however, improved the performance of WH.

GE, besides entering into new businesses, also chose to internationalize its business.

Among the new businesses, the performance of the computer business was far below expectations, despite undertaking major international M&As. In addition, other international businesses also contributed less to GE less than forecasted. Consequently, GE grew in sales but with a lesser increase in profit. The premise of GE's internationalization was based on economies of scale and scope on a global scale. Although GE followed its virtuous logic, it was una-

ble to gain the reward in profits. One reason, it is assumed, is that they failed to build a corresponding organization. This could be because GE managers resisted working in foreign countries and GE imposed its American way onto locals<sup>328</sup>.

GE, due to its size, could cover both the massive orders for turbines and the losses it incurred in its corporate expansion and diversification. On the other hand, WH succeeded in improving its profitability through diversification, but was unable to adequately invest in its conventional steam turbines in order to maintain its technological quality. These differences led to, on the one hand, similar corporate performance and, on the other, divergent business competitiveness between GE and WH during the course of the 1960s.

## **V. Same Logic, Different Size**

This chapter explores the development of a wider gap between GE and WH in terms of corporate performance and business competitiveness in the postwar domestic conventional steam turbine business.

First, it is revealed that both firms improved corporate performance and maintained business competitiveness in steam turbines under the oligopolistic conditions that existed between



domestic firms in the late 1950s. Corporate performance was significantly challenged by a human resource shortage that was brought on by diversification into the military-industrial complex. Because both firms were implicitly obligated to cooperate on national defense, they needed to expand their defense business. Meanwhile, GE was leading technological change in the steam turbine industry, and WH had to follow the GE product strategy. The increase in demand for larger custom-build turbines required more human resources. Consequently, both firms faced human resource shortages in the steam turbine business. In the end, it was the larger firm that had an advantage in responding to both diversification and the evolving steam turbine business. Since GE was twice size of WH, GE was able to maintain its corporate performance and business competitiveness. WH, on the other hand, was in a more severely challenged situation and even had to leave some businesses, including jet engines. Although both firms maintained a similar strategic logic for corporate diversification and product competition, the size of the firm was the deciding factor in terms of their divergent corporate performances.

Over the following decade, it is confirmed that they diverged in their business competitiveness in the steam turbine business while, towards 1970, closing the gap in corporate performance. Human resource shortages and competition with foreign firms were the fundamental factors that allowed WH to lose market share. An abrupt increase in demand for much larger

turbines occurred after the blackout of 1965, and both had to manage a large number of more complex turbine orders. While GE succeeded in delivering on orders, WH received orders more than they could handle. As a consequence, due to declining WH product reliability and reputation, foreign firms increased their market shares at the expense of WH. Over this period both top managements were looking for businesses that had potential for corporate growth, and diversification was part of this strategy. They saw new markets emerging from social/demographic changes, such as population growth, urbanization, and new government policies.

Through customer-oriented and system approaches, they diversified their businesses into the socio-industrial complex. The respective degrees of diversification, however, ultimately led to different corporate performances. WH was committed to expanding domestic business and selling “systems”, while diversifying into new businesses that supported the overall strategic logic. Although GE also sold “systems” like WH, GE invested more in international acquisitions and the computer business while remaining less diversified in new businesses such as health and education. By 1970, this resulted in WH recovering its profitability, through increased sales and profits, while GE declining in its profitability because of failures in its international and computer businesses, closing the gap in corporate performance between the two firms.

An examination of the two firms from 1946 to 1970 requires a number of assumptions. First, that both shared the same corporate logic in terms of the need to pursue diversification, public responsibility and the benign cycle. Under this new corporate logic, diversification was directed to new growth related to their business, but not only just for financial reasons. Government policies also had a large influence on diversification. As a result, both firms were more embedded into relations with the government and society.

Second, the amount of available human resources largely affects business competitiveness in the steam turbine business. GE determined its human resources capacity to be its key competitive advantage when it led the mainstreaming of custom-built turbines. In an industry that has high barriers to entry, the level of resources of the firm is vital to business competitiveness, and this as long as all follow a similar business strategy. Lastly, a corporate strategy for expansion impacts on business competitiveness when a firm does not have enough business resources available to also maintain the required level of support for existing business.

Although the corporate logic and strategies of two firms might be similar, a difference in size and the level of resources would be a determining factor for business competitiveness. GE and WH applied similar corporate logic to their diversifications, but while GE was able to use

its size to overcome its failure in the 1960s, WH was unable to recover from the failure it encountered in the 1950s.

By the end of the golden age, although their financial standings seemed similar, GE and WH had very much diverged their business competitiveness in conventional steam turbines.

## Chapter 3

### Managing Crises in the Midst of the “Great U-Turn” of 1971 to 1979

"Silently waiting for something, and when the time comes, it flies straight toward."

Haruki Murakami, *Colorless Tsukuru Tazaki and His Years of Pilgrimage*

#### I. American Enterprises as Contributors to the Decline of the U.S. Economy

This chapter reveals the differences in managerial perceptions for both GE and WH, and how they responded to the first oil crisis and the associated period of economic inflation that occurred in the 1970s.

After “the Golden Age”, a growth period when large American enterprises created competitive advantages and glorified their successes, signals gradually emerged in the late 1960’s that revealed a rise in new global competition and that the American economic system had limits. The U.S. was confronted with a multiplicity of challenges, including high debt financing costs, inflation, an oil crisis, and a general economic decline. These challenges fostered more

intense competition from foreign enterprises during the 1970s, and prompted American enterprises to explore other means to attain corporate growth while coping with these other challenges.

The factors that contributed to America's economic decline in the 1970s have been explored extensively in the fields of economics and management study. Economists have demonstrated the impact that significant events can have, such as the impact of the Vietnam War, the oil crisis or even from government policies that were introduced while the American economy was in decline<sup>329</sup>. For example, in one of the eminent research studies on this subject, Eckstein Otto concluded that, amongst the other events that occurred, the oil crisis was the most critical factor for decline<sup>330</sup>. Meanwhile, from a management scholars' perspective, Robert H. Hayes and William J. Abernathy suggested that American management was the chief contributor to the American economic decline in that period, after having been admired for a strikingly effective post-World War II performance through the 1950s to the 1960s<sup>331</sup>.

Business historians acknowledge that American enterprises had to deal with terrible external factors, including new directions (if not misdirections) in government policy<sup>332</sup>, but also they also conclude that American enterprises and industries lost their competitive edge in the

1970s as a result of management strategies undertaken in the previous decade. The top managements of large American industrial enterprises had already embarked on an active program of M&A, extending the logic for diversification to sectors unrelated to core business in terms of technology or traditional markets<sup>333</sup>. In doing so, enterprises that had led the previous period of phenomenal growth simply ignored the prevailing logic that an enterprise gains a competitive edge on the basis of economies of scale and scope in related industries, by constructing organizational capabilities under three-pronged investments<sup>334</sup>. As of yet, no consensus has emerged amongst scholars on the decisive factor for America's economic decline in the 1970s but studies do suggest that the top management in American enterprises had to address rather disastrous conditions, brought on by changes in the external environment and compounded by the highly diversified businesses that resulted from their management actions in the previous decades. In terms of management response, this was the starting point for divergence amongst some American enterprises, a process that continued toward the 1990s<sup>335</sup>.

GE and WH were no exception. They both found themselves caught in a difficult predicament in terms of their core manufacturing businesses, a condition brought on by foreign enterprises (i.e. West European and Japanese) while other political and social environmental changes served as added sources of pressure. After the disastrous 1970s, GE and WH followed

their own paths on rather distinct corporate transformations that continued until the 1990s. As raised in the previous chapter, it was becoming clear that, although both enterprises similar “outsides”, their “insides” had already started to differ. Commonly faced with such profound external challenges in the 1970s, how did the perceptions and responses of the top management teams result in divergence toward the 1980s?

The 1970s is the period during which GE and WH changed their respective management systems. From the late 1960s to the early 1970s, both enterprises had started realigning their organizational structures and introduced strategic management systems. GE undertook its second major post-war change in organizational structure, establishing the Office of the President and doubled the number of operating groups from five to ten<sup>336</sup>. GE then started incorporating a set of strategic management tools into its management system, such as Strategic Business Units (SBUs) and Product Portfolio Matrix (PPM). Around the same time WH was creating three vice-chairman positions for the new top management team<sup>337</sup> and reorganized from a group structure to a structure that more resembled four companies<sup>338</sup>. WH also introduced an alternate strategic management tool called Vabstram (the Value Based Strategic Management System). Although WH was falling slightly behind GE in performance, on the surface the two were superficially similar as large 1970s electric and electronics conglomerate enterprises.



However, studies indicate that enterprises had been growing differently in terms of management practices, financial aspects, and corporate growth. In analyzing the transformation of U.S. industrial enterprises listed as Fortune 100 companies in 1974, Nohria, Dyer and Dalzell describe the divergence that emerged between GE and WH as very symbolic in light of the US move from an industrial to a post-industrial economy. More specifically, they contend that GE was more than a step ahead of WH in terms of organizational control and its introduction of strategic management processes over the period<sup>339</sup>. More detailed descriptions of GE can be found in studies of Sakamoto and Rothschild<sup>340</sup>. To extricate itself from the profitless growth it experienced in the late 1960s, GE endeavored to institutionalize advanced strategic management and planning<sup>341</sup>. For example, each of the SBU strategies within GE was subject to a personal review and evaluation undertaken by the CEO himself<sup>342</sup>. GE recognized its own strategic management system to be distinct when compared to other companies<sup>343</sup>. In this regard, GE and WH were diverging in terms of their practices for organizational systems and strategic management.

With regard to financial aspects, O'Sullivan's analysis provides us some indication. Using both companies as examples to explore the relationship between financial systems and corporate growth, she reveals that the financial behavior of the two companies strikingly diverged,

beginning in the mid-1970s<sup>344</sup>. One of her findings is that GE, toward the end of twentieth century, was more successful than WH at achieving efficiencies in the use of working capital while WH continued to maintain a higher financial dependence on working capital<sup>345</sup>. GE's relative dependence on financing declined, even in periods of economic decline, which suggests that GE was more adept than WH at managing financial aspects.

GE clearly outperformed WH in the 1970s. Regarding the sustainability of corporate growth, Fleck's quantitative and descriptive examinations of GE and WH, from their foundation to the end of the 1990s, demonstrates that the gap in growth that already existed prior to the 1970s gradually expanded during the 1970s<sup>346</sup>. She cites coordination by top management as a key factor, not to mention their very distinct approaches to expansion and dissimilar approaches to managing risk<sup>347</sup>.

However, these previous researches were not specifically focused on the relationship between the two top managements and the divergence that took place in 1970s. As an introductory story on the transformation of American enterprises that took place after 1974, Nohria, Dyer and Dalzell's study provides the historical aspects and vital events of the decade but the scope is limited to analyzing how top management responded to environmental changes. Although O'Sullivan conducted an in-depth analytical study of GE and WH, her main focus was

on the relation between the U.S. financial system and corporate finance over a period that covered almost 100 years. Her study does not consider the specific dynamic of top management influence. On the other hand, Fleck does demonstrate the most comprehensive understanding of the managerial capabilities of GE and WH, but her study lacks analytical detail on the process by which top management perceived, anticipated, and behaved in the 1970s. To examine which of the top management responses contributed to the divergent positions that resulted, it is necessary to gain an understanding of underlying factors in the contrasting transformation processes of both the enterprises in the late twentieth century.

One reason this has not been sufficiently explored is due to a limitation in historical sources of information. This chapter overcomes this constraint through the use of a set of historical documents, as follows. For top management perceptions of GE in the 1970s, this is examined through Executive Speeches and Reports to Shareowners, drawing from the speech manuscript collection of GE executives. For WH, an examination of the collection of speeches is also pursued, found in the Records of the Westinghouse Electric Corporation that consists of speeches given mostly by senior management. Both speech collections cover from 1970 to 1980. Even though the speech manuscripts are public, and do not provide an exact reflection of each executive's perceptions and conceptions, these can be considered as the consensus of

GE's and WH's top management thinking at the time and allow for an analysis of the changes in a company's perceptions and conceptions. In addition, the methodology also uses strategic and R&D planning documents and financial data to examine how the perceptions and conceptions of top management are reflected in corporate behavior. As for GE's materials, Corporate Annual Reports, the Downs Collection and the R&D Planning Series are accessed, whereas Corporate Annual Reports, Series XIII Research and Development/Science and Technology Center 1919-1998, and the Records of the Westinghouse Electric Corporation are used for WH. Planning documents, in particular, can be seen as indicators that are reflective of top management thinking. Although other documents and data provide insight to top management thought, one reason to use planning documents is that these tend to reflect what top management is anticipating for the future on the basis of perceptions of the environment.

Some documents used in this chapter are late drafts and are not the final planning documents. However, they still provide sufficient information to adequately satisfy the object of the research. Most of historical documents were collected by the author at the miSci Archives, Schenectady, NY, and the Library and Archives of the Heinz History Center, Pittsburgh, PA<sup>348</sup>.

This chapter investigates how the top managements of both GE and WH perceived the changes in the external environment, developed blueprints for the short-term, and took actions

under a defined approach. The next section explores why the performances of GE and WH diverged during the 1970s under declining economic conditions. The subsequent section then takes a close look at the responses of top management to changes in the business environment, focusing on the periods before and after the first oil crisis. It analyzes how GE's and WH's managerial perceptions changed, and the underlying logic behind the perceptions. It concludes by comparing perceptions from both managerial perspectives, while revealing that decisions from top management in response to these environmental changes ultimately extended the degree of divergence of the two firms.

## **II. Divergence in Financial Standings**

### **1. Financial Standings in the 1970s**

Large U.S. industrial enterprises had expanded their business much as a by-product of wars in the 1950s, and then entered new industries and markets for the continued growth of their enterprises during the 1960s. After the third merger movement of the 1960s, referred to as the conglomerate merger<sup>349</sup>, many U.S. enterprises entered new businesses to try to achieve growth.

The two large lead enterprises in the electric manufacturing industry, GE and WH, were part of

this community. Despite differences between them in corporate strategy and M&A (see chapter 2), they both had more or less similar financial standings in the early 1970s. In fact WH had surpassed GE in areas of financial strength, profitability and growth, as shown on table 3-1<sup>350</sup>. The changes in the economic environment, instigated by the Nixon Shock in 1971 and the 1973 oil crisis, and the recession from November 1973 to March 1975 strained the financial performances of both firms. Although both profitability and growth indicators had become increasingly worse, WH's decline was much more pronounced (see table 3-1). The second half of the 1970s saw the gap between them increase even further. Although both firms went onto recover their financial standings, as shown in figure 3-1 and table 3-1, WH was unable to fully recover its profitability and growth, and worsened in efficiency, while GE even improved in performance.

This gap stems chiefly from decisions taken by WH top management and to a significant problem that was unique to WH. During the first half of the 1970s, both firms appear to respond similarly to the changes, by disposing of unprofitable businesses. Being comparatively less active, GE sold its mainframe business to Honeywell as well as a number of other businesses acquired in the 1960s<sup>351</sup>. WH, meanwhile, went onto to sell its portable home appliances business in 1972, its domestic major appliances, car rental and leasing businesses in 1975, while also acquiring

resort hotel, education and manufacturing-related service businesses. Although the gap remained at about the same level, WH had fallen into a worse financial standing.

**Table 3- 1. Financial standings of GE and WH, 1971-1980.**

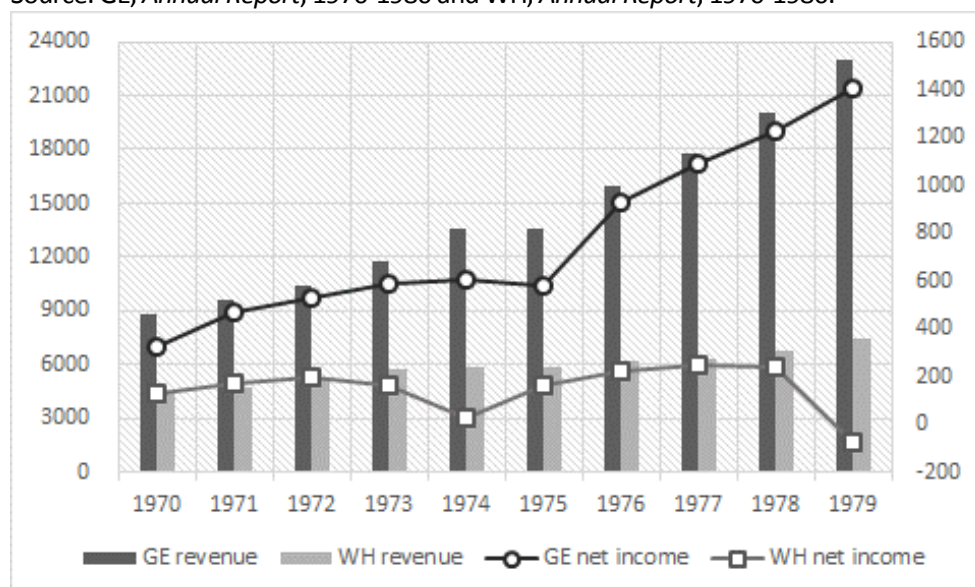
| Indicator          | Financial Measurement               | 1971      | 1972   | 1973   | 1974   | 1975   |         |
|--------------------|-------------------------------------|-----------|--------|--------|--------|--------|---------|
| Financial Strength | Current ratio                       | GE 128.1% | 138.7% | 128.4% | 134.6% | 140.4% |         |
|                    | WH                                  | 210.9%    | 198.3% | 173.6% | 176.8% | 140.4% |         |
|                    | Equity Ratio                        | GE 40.7%  | 41.7%  | 40.5%  | 39.5%  | 43.4%  |         |
|                    | WH                                  | 50.2%     | 50.2%  | 45.3%  | 44.7%  | 41.1%  |         |
| Profitability      | ROA <sup>a</sup>                    | GE 11.5%  | 12.1%  | 12.2%  | 10.7%  | 9.7%   |         |
|                    | WH                                  | 11.5%     | 9.1%   | 6.6%   | 4.8%   | 5.6%   |         |
|                    | ROS <sup>b</sup>                    | GE 8.4%   | 8.8%   | 8.7%   | 7.5%   | 7.1%   |         |
|                    | WH                                  | 8.8%      | 6.9%   | 5.1%   | 3.6%   | 4.7%   |         |
| Efficiency         | Total Asset Turnover                | GE 1.4    | 1.4    | 1.5    | 1.5    | 1.4    |         |
|                    | WH                                  | 1.3       | 1.4    | 1.4    | 1.3    | 1.3    |         |
| Growth             | Sales Growth                        | GE 8.0%   | 8.6%   | 13.0%  | 15.9%  | -0.1%  |         |
|                    | WH                                  | 7.4%      | 9.8%   | 12.1%  | 1.7%   | 1.1%   |         |
|                    | Ordinary Income Growth <sup>c</sup> | GE 42.9%  | 13.3%  | 12.8%  | -1.1%  | -5.1%  |         |
|                    | WH                                  | 74.1%     | -14.3% | -16.2% | -29.5% | 33.3%  |         |
| Indicator          | Financial Measurement               | 1976      | 1977   | 1978   | 1979   | 1980   | Average |
| Financial Strength | Current ratio                       | GE 145.2% | 145.2% | 141.8% | 136.6% | 130.2% | 136.9%  |
|                    | WH                                  | 132.9%    | 130.2% | 124.0% | 129.1% | 126.2% | 154.2%  |
|                    | Equity Ratio                        | GE 43.6%  | 43.4%  | 43.8%  | 44.2%  | 44.3%  | 42.5%   |
|                    | WH                                  | 40.2%     | 41.5%  | 38.6%  | 33.0%  | 37.1%  | 42.2%   |
| Profitability      | ROA <sup>a</sup>                    | GE 13.5%  | 13.8%  | 14.3%  | 14.4%  | 13.5%  | 12.6%   |
|                    | WH                                  | 6.8%      | 7.7%   | 7.4%   | 6.7%   | 8.2%   | 7.5%    |
|                    | ROS <sup>b</sup>                    | GE 10.4%  | 10.8%  | 11.0%  | 10.6%  | 10.0%  | 9.3%    |
|                    | WH                                  | 5.9%      | 7.0%   | 7.0%   | 6.3%   | 6.5%   | 6.2%    |
| Efficiency         | Total Asset Turnover                | GE 1.4    | 1.4    | 1.4    | 1.4    | 1.4    | 1.4     |
|                    | WH                                  | 1.2       | 1.1    | 1.1    | 1.1    | 1.2    | 1.3     |
| Growth             | Sales Growth                        | GE 17.2%  | 11.6%  | 12.2%  | 14.3%  | 11.1%  | 11.2%   |
|                    | WH                                  | 4.8%      | -0.1%  | 8.6%   | 10.0%  | 16.1%  | 7.2%    |
|                    | Ordinary Income Growth <sup>c</sup> | GE 71.4%  | 16.1%  | 14.0%  | 11.1%  | 4.3%   | 17.9%   |
|                    | WH                                  | 31.4%     | 18.2%  | 9.8%   | -2.0%  | 21.2%  | 12.6%   |

a) Earnings before income taxes and minority interest.

b) Earnings before income taxes and minority interest.

c) Earnings before income taxes and minority interest.

Source: GE, *Annual Report, 1970-1980* and WH, *Annual Report, 1970-1980*.



**Figure 3- 1. Revenue and net income of GE and WH, 1970-1979.**

Source: GE, *Annual Report, 1970-1979* and WH, *Annual Report, 1970-1979*.

The turning point in their divergence occurred in the second half of the 1970s. Starting in 1972, under Reginald Jones and his team, GE introduced the strategic management system on a full scale<sup>352</sup>. Although the new strategic planning system and new organizational systems, such as SBU (Strategic Business Unit), and Sector organization structures are fundamental aspects of Jones' management approach, in terms of impact in financial standing, it is the 1976 acquisition of Utah International (hereafter Utah), a natural resources business, that provides the symbolic outcome in terms of management. Jones decided to acquire Utah as a stable and predictable earnings and cash-flow generator, to take advantage of its consistently high ROI and positive cash flows<sup>353</sup>. William Rothschild, a senior executive in Corporate Planning at the time, describes how he was shocked when Jones made the acquisition, mainly because the cash-generation expectation for Utah seemed unduly optimistic and the potential for conflict arising due to the dissimilarity in business and differences in the corporate cultures of GE and Utah<sup>354</sup>. However, in terms of financial data, GE's financial standing started improving after the acquisition, and Utah's natural resource business generated almost 14% of operating profits up until 1980 (see table 3-2). This supports that Utah accomplished, at least superficially, Jones' goal even though one should also consider the performance of existing businesses under the economic recovery<sup>355</sup>.



WH, on the other hand, had to face its own specific problem. When Robert Kirby and his team took the helm of WH in 1975, they had to deal with 17 lawsuits launched by 27 public utility customers, alleging a breach in uranium supply contracts<sup>356</sup>. WH had guaranteed uranium fuel deliveries to the 27 utilities at an average price of \$9.50 per pound, which reflected the uranium price at the time, in order to help to promote the nuclear-power market<sup>357</sup>. Since sales of uranium was regarded as an adjunct to the sale of reactors, and was almost always done at the request of the reactor customer<sup>358</sup>, GE also made similar contracts. Although GE, like WH, guaranteed a fixed-price delivery of uranium, it hedged its risk by also contracting to purchase supplies at fixed prices<sup>359</sup>. Since WH, unlike GE, did not enter into similar contracts with suppliers, WH was forced to decline deliveries when uranium prices soared to almost \$40 per pound in 1976<sup>360</sup>. As a result, only WH was sued by public utility customers.

The rapid rise in uranium prices had been conspired through a cartel of 29 uranium producers, such as Gulf Oil Corporation<sup>361</sup>. After being sued by utility customers for two billion dollars in damages, WH filed a damage recovery suit against uranium producers, citing a violation of the Sherman Anti-Trust Act<sup>362</sup>. In the course of the trial WH lost \$20.5 million in 1977, \$67.9 million in 1978, and \$405 million in 1979<sup>363</sup>. In the end, WH, which was the middleman in the conflict, reached a settlement with both the 27 public utilities and the 29

uranium producers and, even after obtaining reparation from the uranium producers, WH still expended an aggregate total of \$435.1 million by December 31, 1980<sup>364</sup>.

Near the end of the trial, in March 1979, the Three Mile Island accident became the most serious accident in the U.S. commercial nuclear power plant operating history<sup>365</sup>. It had a more serious affect on WH, which had regarded nuclear power systems as its key business line for future growth and, in response, had undertaken intensive investment in the field<sup>366</sup>. At the time, the WH system was present in 28 operational nuclear power plants and in 39 backlog orders in the domestic market, and in 16 plants and 23 backlog orders internationally<sup>367</sup>. Due to the accident, the market had a slowdown, several orders were cancelled, and regulatory requirements and governmental indecisiveness had increased<sup>368</sup>. As a result, plant constructions were delayed and costs increased due to the immense time it took to process the licensing of nuclear plants<sup>369</sup>. Even though the business remained profitable, the excess in cost reached \$259 million in 1979 and \$254 million in 1980, and the excess in progress billings rose to \$1,380 million in 1979 and \$1,274 million in 1980<sup>370</sup>. These nuclear power business issues hampered WH's financial standing during the second half of the 1970s and was a considerable draw on the time of top management.

## 2. Corporate Growth and Business Structures, between 1971 and 1980

In terms of relative financial standing, by 1980 GE had strengthened its entire financial position and WH, while its position had improved, had not yet fully recovered, particularly in terms of profitability. Comparing performance and business structures for the two between 1971 and 1980 provides additional consideration.

First, one looks at the achievement of growth during the 1970s. In 1971, the total sales for GE were \$9,425.3 million and net earnings were \$471.8 million, and this increased to \$24,959 million in total revenues and \$1,514 million in net earnings in 1980, these amounts do not exactly match those reflected in table 3-2 due to the exclusion of corporate items and eliminations<sup>371</sup>. The net earnings more than tripled while revenues more than doubled. On the other hand, WH's total revenues amounted to \$8,514.3 million in 1980, up from sales of \$4,630 million in 1971, and net earnings went to \$402.9 million from \$175 million, both almost doubled during the 1970s<sup>372</sup>. Their gaps, however, widened from 2.3 to 3 times in terms of sales and revenues and from 2.9 to 3.8 times in terms of net earnings (see figure 3-1). This demonstrates that GE managed to financially outperform WH.

Another factor that could result in a difference in growth is the business structure. The power system business, the traditional core business for both GE and WH, was rapidly positioned differently within their respective structures. Although each power system group did not contain

exactly the same business units, it continued to be a vital cash-generating business for WH during the 1970s, much more the case than for GE, as shown in table 3-2. In addition, as cash-generators, they had rather different businesses in 1980, namely natural resources for GE and broadcasting for WH. Aside from the natural resources and broadcasting distinction, the historical backgrounds also differed. For example, WH had been developing its competitiveness in the U.S. broadcasting industry while GE introduced the natural resource business line through acquisition, under a strategic management decision taken in the 1970s. Regardless of these backgrounds, as cash-generators the two business lines accounted for almost 14% and 10% of GE and WH profits, and contributed 5.2% and 3% respectively to their revenues.

A lesser, but still important, element of their business structures was the growth in financial service subsidiaries, namely General Electric Credit Corporation (hereafter GECC) and Westinghouse Credit Corporation (hereafter WCC). Contributions coming from both the financial service arms declined by 1980, down to 4.0% for GE and 3.3% for WH from the 1971 levels of 6.0% at GE and 8.6% at WH<sup>373</sup>. The difference in the growth of these businesses, however, was rather significant. By 1980, GECC increased its net income 3.7 times from that of 1971, whereas the increase for WCC over the same period was only 1.5 time (see table 3-2).

Particularly after 1977, GE experienced an accelerated growth in GECC net income, from \$67 million in 1977 to \$77 million in 1978, to \$90 million in 1979 and then to \$115 million in 1980<sup>374</sup>.

**Table 3- 2. GE and WH: Business segment performance for 1971 and 1980 (in millions of dollars).**

| 1971                                   |          |       |                          |       |
|--|----------|-------|--------------------------|-------|
| GE                                     | Sales    |       | Net earnings             |       |
| Industrial Components and Systems      | 2865     | 27.1% | 141                      | 27.4% |
| Consumer                               | 2383     | 22.5% | 106                      | 20.6% |
| Industrial Power Equipment             | 2131     | 20.1% | 114                      | 22.1% |
| (Power Systems: estimated)             | 1321     | 12.5% | 26                       | 5.0%  |
| Aerospace                              | 1623     | 15.3% | 37                       | 7.2%  |
| International                          | 1584     | 15.0% | 86                       | 16.7% |
| GECC                                   | -        | -     | 31                       | 6.0%  |
| Total                                  | 10586    |       | 515                      |       |
| 1980                                   |          |       |                          |       |
| GE                                     | Revenues |       | Operating profit         |       |
| Industrial Products and Components     | 5157     | 19.4% | 568                      | 19.6% |
| Consumer Products and Services         | 5599     | 21.1% | 558                      | 19.3% |
| Power Systems                          | 4023     | 15.2% | 194                      | 6.7%  |
| Technical Systems and Materials        | 7128     | 26.9% | 774                      | 26.7% |
| International                          | 3234     | 12.2% | 285                      | 9.8%  |
| GECC                                   | -        | -     | 115                      | 4.0%  |
| Natural Resources                      | 1374     | 5.2%  | 404                      | 13.9% |
| Total                                  | 26515    |       | 2898 (1514) <sup>a</sup> |       |
| 1971                                   |          |       |                          |       |
| WH                                     | Sales    |       | Net income               |       |
| Power Systems                          | 1504     | 32.5% | 76                       | 43.4% |
| Industry and Defense                   | 2019     | 43.6% | 61                       | 34.9% |
| Consumer Products                      | 759      | 16.4% | -8                       | -4.6% |
| Broadcasting, Learning and Leisure Tir | 304      | 6.6%  | 26                       | 14.9% |
| (Broadcasting estimated)               | 109      | 2.4%  | 18                       | 10.3% |
| Other                                  | 44       | 0.9%  | 5                        | 2.8%  |
| WCC                                    | -        | -     | 15                       | 8.6%  |
| Total                                  | 4630     |       | 175                      |       |
| 1980                                   |          |       |                          |       |
| WH                                     | Revenues |       | Operating Profit         |       |
| Power Systems                          | 2998     | 33.9% | 272                      | 40.7% |
| Industry Products                      | 3227     | 36.4% | 219                      | 32.8% |
| Public Systems                         | 2245     | 25.4% | 115                      | 17.2% |
| Broadcasting                           | 267      | 3.0%  | 64                       | 9.6%  |
| Other                                  | 115      | 1.3%  | -24                      | -3.6% |
| WCC                                    | -        | -     | 22                       | 3.3%  |
| Total                                  | 8852     |       | 668 (403) <sup>b</sup>   |       |

a) Net earnings.

b) Net earnings.

Note: The data exclude corporate items and eliminations.

Source: GE, *Annual Report*, 1971, 1980, and WH, *Annual Report*, 1971, 1980.

### 3. Key Businesses and Divergence

The fundamental factors contributing to the divergence in financial standings between GE and WH include the large acquisition by GE and WH's struggle in the courts. In terms of actual business, the nuclear power and natural resource businesses took on a key role in extending the gap. GE top management chose natural resource as a way to counter a stagnant economy. WH top management was greatly consumed in managing the uranium problem, which had strong ties to nuclear power. Although both GE and WH shared a common trait as energy firms, their responses in the energy sector led the electrical manufacturing firms to have different corporate standings by the 1980s.

## **III. Managerial Perceptions: First Oil Crisis**

### 1. GE Perceptions and Conceptions

The energy crisis influenced GE and WH. Especially they both had changed their perception of business environment before and after the first oil crisis in 1973. But their emphasis of impact of the crisis was different.

GE's top management quickly perceived that "Inflation is now a worldwide problem. . . The energy crisis is real,<sup>375</sup>" and tried to analyze the situation in order to consider an effective counterplan. As for the first oil crisis, they understood:

"the reality is that the energy crisis was not caused by Arab sheiks, by environmental activists, by the international oil companies, by federal energy planners, or even by profligate advocates of unrestrained growth. . . . the principal cause of the energy crisis was the lack of institutional mechanisms capable of foreseeing and dealing with all of the complex interrelated elements of the world energy situation.<sup>376</sup>"

While considering the oil crisis as a problem of institution, they gained a good understanding of inflation, having the insight to separate the contributors to inflation post-1975 from that which occurred prior, as follows:

"The current double-digit inflation can trace many of its roots to the excess demand of the late 1960s and early 1970s. . . . These rapid rising government outlays put the nation's existing capacity to produce under substantial strain. . . . [but] As we approach 1975, inflation no longer reflects excess demand. . . . Now we have cost-push inflation. And it is almost certain to continue as the force suppressed by the wage-price controls of the past four years spread through the system, and the recent explosion of oil process and materials costs.<sup>377</sup>"

Regarding tactics employed against the effects of inflation, GE merged with Utah International in 1976, proclaiming the move as "a valuable hedge against worldwide inflation."<sup>378</sup> In addition, while taking into account economic data (see Appendix 1 and 2), the top management of GE concluded that the serious problem of inflation was the fundamental factor contributing to an investment capital shortage, capital that was essential for corporate and economic growth:

“We’ve all been worried – rightly – about the energy shortage. I think there’s another shortage that ought to worry us even more – the shortage of capital needed to energize economic growth and employment. Fuel we can get, though the price may be high by any past standards. But capital we cannot get unless we have sharp reversal in the anti-profit, anti-business attitudes and policies that have been rotting out the very foundations of our economy.<sup>379</sup>”

Although there is a fundamental difference of focus between the oil crisis and inflation, GE urged the U.S. government to cope with these problems through strong and pointed criticism, to change the government policy lens from one that was consumer-oriented<sup>380</sup> to one that would be on “production side.<sup>381</sup>” The recommendations include tax reform, dealing with government spending, and deregulation of nuclear plants and other businesses.

While contending with changing government economic policy, GE, as a power system company, also had to deal with the energy problem. After the oil crisis, GE embarked on multiple responses to cope with the energy situation. GE did not focus on a particular technology, such as nuclear energy, but instead pursued multiple equipment and infrastructures as energy options. Due to the prevailing obstacles facing nuclear plants, such as regulation, technological development, uncertainty over the supply of enriched uranium, plutonium treatment, etc., the utility industry decided to move away from nuclear plants and turned to gas turbines<sup>382</sup>. This led to the situation whereby “General Electric’s backlog of gas turbine orders is now the largest in our history.<sup>383</sup>” Another part of the reason is that GE had been less competitive in the nuclear energy field<sup>384</sup>.



GE's top management then took a slightly more positive attitude to nuclear power, beginning in 1977. Nuclear resurfaced as one of the other options for further growth of energy when they stated:

“Over the long term, into the next century, nuclear fission will not be the end-all, be-all energy source. But until such new sources as solar and fusion can be developed, coal and nuclear fission – together with what additional oil and gas may be available – are the only options that can provide the time and the bridge we need to manage the next transition in U.S. energy supply.<sup>385</sup>”

In 1978, while contending that whether it is coal or nuclear that would be the main option for increasing US energy supply would largely depend on government policy, they started to regard nuclear as not the option of last resort but one of the first options<sup>386</sup>.

GE's top management perceived that the vital concern was the treatment of inflation, understood to be of more concern than the oil crisis because it undermined the capital investment that was needed for growth through improved productivity. On the other hand, they accepted the uncertainty of what would emerge as the next new energy source, and therefore took a position that could respond to any possible situation, although nuclear power was clearly regarded as the most viable resource in the end.

## 2. WH Perceptions and Conceptions

While GE's top management was in the process of perceiving the problems of inflation and the oil crisis, WH's top management were also perceived these situations in a manner that was both somewhat similar and somewhat different. Regarding the concerns of an energy shortage generated by the oil crisis, WH perceived that the “energy shortage is clearly not of a

temporary nature,<sup>387</sup> and coal and uranium were the possible candidates for substitutes to oil because other energy sources such as geothermal, solar, wind and tides were likely to be of minor importance<sup>388</sup>. However, they then adopted nuclear energy as the main long-term solution to the energy problem and in the expansion of the uses of electricity, while shifting to an electric economy<sup>389</sup>. Much can be attributed to overcoming historical difficulties in the introduction of electric power in the early 20th century, as a parallel to the situation of nuclear energy<sup>390</sup>, and WH's had gained confidence as having "pioneered the development of nuclear power."<sup>391</sup> On the other hand, inflation was regarded as the main factor of wage and cost of living increases<sup>392</sup>. The situation under the oil crisis and inflation was understood to be negatively influencing the electrical equipment industry, as they stated:

"It [electrical equipment industry] grew in a `Benign Circle.'<sup>393</sup> . . . This circle began to disintegrate in about 1972. . . . Somewhat later, specifically, with the Arab oil embargo of 1973, there came a sharp rise in the cost of energy. Suddenly, for the first time, electric utilities began to see the real constraints on their growth. . . . As if that were not enough, other problems developed. An upward spiral of construction costs, a sharp increase in interest rates on borrowed money. The construction time for major capital projects, notable nuclear power plants, stretched out."<sup>394</sup>

Behind such an understanding of the situation, they emphasized energy as a basis for increasing economic prosperity. There was a necessity for an expansion of nuclear plants, based on the assumption that the likely scenario was a medium growth in nuclear power coupled with a maximum use of coal, as well as deregulation and a new government policy for support<sup>395</sup>. This understanding and their actions reinforced the underlying perception that "the `essence` of Westinghouse is the vital role we are playing in the energy field."<sup>396</sup>

Hence, based on the understanding that the outlook of growth was electricity, they replaced many of their unprofitable, non-electric businesses with a commitment of returning to their core business line, namely electricity, in other words “Westinghouse is transforming itself back into a profitable electrical company.<sup>397</sup>” In particular it focused on the generation, transmission, distribution and efficient utilization of energy<sup>398</sup>. This is quite opposed to the prevailing 1973 perception that “WH is moving into the services industries, which certainly will be the high-profit area of the future<sup>399</sup>”.

WH’s top management perceived that the oil crisis was a great opportunity for WH as a leading company in the building of nuclear plants, and that it had bright outlook for corporate growth as an electrical equipment company. To address inflation, they divested unprofitable business and introduced a program to improve productivity, but this assumed that they would achieve a reduction of the price of electricity through nuclear energy as one of the ways to combat against inflation. That is, the nuclear power business was perceived as the solution for both the oil crisis and inflation.

### 3. Differences in Actions during the Stagnation

Although both GE’s and WH’s top management faced the same situation, there is a certain difference in their perceptions. GE was concerned more about finding solutions to inflation while WH emphasized more the opportunity that the energy crisis posed for corporate growth. These top management perceptions were reflected on their corporate behaviors. Taking up their respective R&D planning, one can examine verify how these plans are reflective of their behaviors<sup>400</sup>.

In the early 1970s, WH invested more in R&D than GE<sup>401</sup> and was considered to have a strong technological capability. For instance, GE understood WH to be characterized as: a

strong broad program in motors, controls, drives, automation equipment; as excellent work in transformers, switchgear, wire and cable, and ballast; as ineffective in home appliances, housewares, lighting, distribution equipment, commercial equipment, medical systems; as strong in steam turbines in turbine products; major push in drives and controls in locomotives, transit systems, off-highway vehicles<sup>402</sup>. On the other hand, GE planned to increase corporate R&D expenditures in the 1970s after cutting off the budget in the late 1960s<sup>403</sup>. Corporate R&D of GE was concentrated in a broad range of technology, from signal electronics and energy generation to communications and quality of life technologies<sup>404</sup>.

Subsequent to the first oil crisis and the economic recessions in 1974 and 1975, both firms took account of these experiences and reflected them in their respective R&D plans. WH's top management perceived that there was an opportunity in the power energy field. This is indicated through the founding of the Advanced Power Systems Division in 1976, which was the former Astronuclear Laboratory, but was also clearly influential in the R&D program in 1976 as shown figure 3-2. It reflects "a heavy emphasis on programs of importance to the Power Systems Company. . . , it is easy to estimate that 50 to 60 percent of the entire Laboratories' effort might be classified as 'for Power Systems'."<sup>405</sup>

Besides the power system, advanced technology (e.g. biological sciences, materials, design techniques) was also the target for the corporate R&D effort. However, some of the power system programs were affected by the decreased funding in R&D of 1978 on table 3-3. This is attributed to issues in completing program goals or other existing problems, and the program related to power systems remained essentially constant in the level of effort<sup>406</sup>.

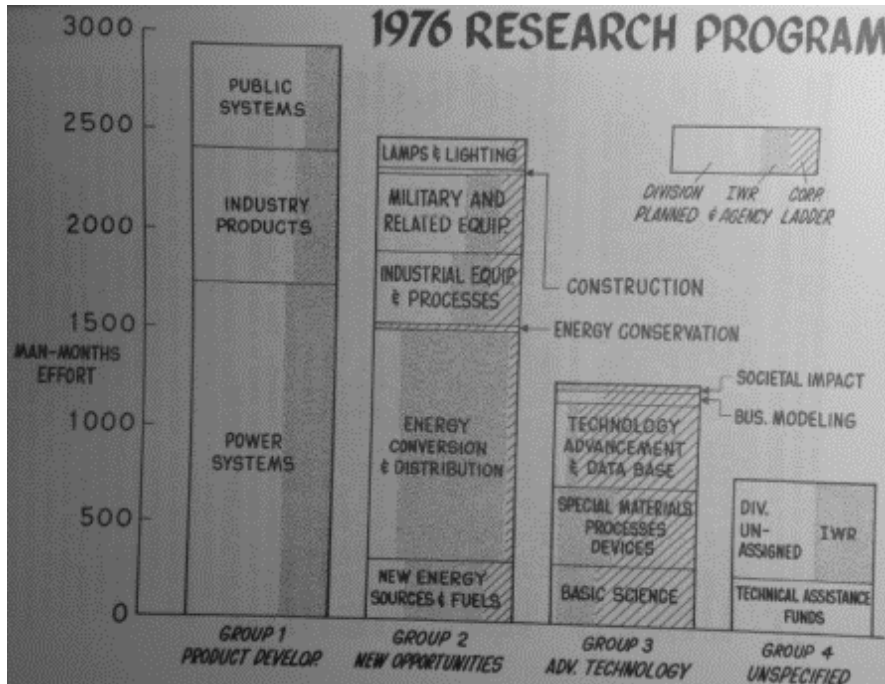


Figure 3- 2. Research program of WH in 1976.

Source: "Strategic Plan, 1976-1980," box168, folder 13, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

Table 3- 3. WH prioritized candidates for increased / decreased funding in 1978.

| WH  |   |
|---|---|
| Increasing Program Fund                       | Decreasing Program Fund                     |
| Computer Based Automation, Design and Control | Batteries                                   |
| Design Services                               | Coal Gasification and Fossil Fuel Treatment |
| Generator(Electric)                           | Heating, Refrigeration and Air Conditioning |
| Laser Chemistry and Optical Synthesis         | Homopolar Machinery                         |
|   | Gas Turbine                                 |
|   | Laser, Gas                                  |
|   | Liquid Metals                               |
|   | Nuclear Reactors                            |
|   | Power Conditioning                          |
|   | Uranium, Exploration and Production         |

Source: "Strategic Plan, 1978-1982," box169, folder 1, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center

On the other hand, when looking at the perception of GE's top management, which does not actively emphasize a particular business line such as a power system, it is reflected in GE's R&D investment to some degree. On figure 3-3 and table 3-4, it reveals that, although power generation related R&D funds tends to increase with growing external funds, it remains a stable amount of funds.

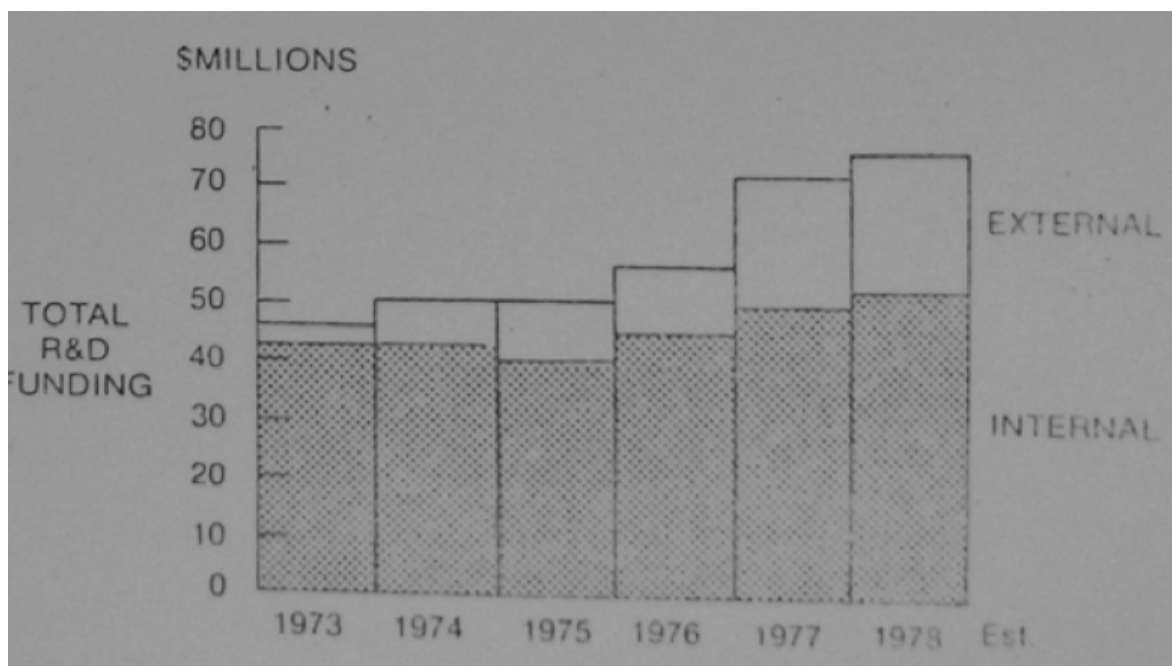


Figure 3- 3. Investment of R&D in the power generation and delivery business of GE.

Source: CRD Back up Data of Activities 1978, C.

Table 3- 4. Growth trends for company funded RD&E of GE from 1977 to 1979.

|             | Company Funded RD&E \$M |       |       |              |
|-------------|-------------------------|-------|-------|--------------|
|             | 77A                     | 78E   | 79B   | AAGR 77-79 % |
| Total Co.   | 405.2                   | 492.4 | 560.2 | 17.6         |
| Tech. Sys.  | 176.0                   | 126.2 | 281.5 | 26.5         |
| Pow. Sys.   | 85.7                    | 81.9  | 88.0  | 1.3          |
| Con. Prods  | 55.2                    | 69.9  | 76.6  | 17.8         |
| Ind. Prods. | 26.5                    | 32.4  | 33.4  | 12.3         |
| CRD         | 52.9                    | 59.2  | 66.7  | 12.3         |

Source: CRD Back up Data of Activities 1978, D.

Notably, it plans to invest in the technological systems and materials sector, which is given responsibility for a wide range of the company's high-technology and materials businesses, including aircraft engines, diverse types of aerospace products, a variety of man-made materials, medical systems, mobile radio, data communication products, and information services. This is reflected in the research program candidates for incremental funding as shown on table 3-5.

Moreover one can presume that investment in high-technology reflects a business of significant capital investment, and serves as a proxy of the prevailing management perception.

**Table 3- 5. GE prioritized candidates for increased / decreased funding in 1978.**

| GE   |   |
|--|---|
| Increasing Program Fund                        | Decreasing Program Fund                   |
| Software Engineering                           | Thermomigration                           |
| High Resolution Electronic Processes           | Chemical Reaction Systems                 |
| Polymer Process Engineering                    | Laser Fusion                              |
| Acceleration of DEC 2060 Computer Installation | Power Semiconductor Packing               |
| GE Mail  | Signal Processing for Radar & Sonar       |
| CT - Medical NMR                               | Arcing Contacts                           |
| Electrical Health Hazards                      | Entry/Display                             |
| Exploratory Organic & Inorganic Chemistry      | Non Diestruct, Test and Measur            |
| Electromagnetic Analysis                       | Magnetic Material for Electric Equipment  |
| Fundamentals of Stress Corrosion               | Cancer & Medical Diagnosis                |
| Failure & Deformation of HT Materials          | Sensor Technology                         |
| Isothermal Compressor                          | Digital Control System Technology         |
| Amorphous Metals                               | Signal Processing for Communications      |
| New Processes for Metals                       | Process Automation                        |
| Fluidized Beds                                 | Microprocessor Control for Power          |
| Fossil Plant Corrosion                         | Microprocessor Applied to Electric        |
| Silicon/SiC Composites                         | Chemical Process Resolution & Engineering |

Source: CRD Back up Data of Activities 1978, D.

These investments in high-technology is actually reflected on GE managerial perception, which more emphasized on the inflation. In addition to a merger with Utah, new management-education program was developed as the major managerial action as a solution of inflation for GE. “Effectively Coping with Inflation,” or COIN was the program which helps managers understand chronic high inflation, realized how it distorts financial data, and learn how to minimize its impact<sup>407</sup>. This program was the product of study on inflation “to learn to live with it<sup>408</sup>” in GE. Through the program, it indicated the expansion of service and high-technology was the strategic response to inflation<sup>409</sup>. Thus the reason of increasing R&D investment in high-tech was the response to inflation.

#### **IV. Same Situation, Different Perceptions**

This chapter examines how the top managements of GE and WH perceived the changes in external environment, conceived blueprints for the future, and behaved with a defined approach during the 1970s. In the stagnate economy, GE and WH began financially diverging after the first oil crisis. The fundamental factors of the divergence were a big merger with Utah by GE in 1976 and WH own problems with uranium contract from 1975. The former greatly improved GE financial standing and the latter aggravated WH financial standing.

The turning point of both firms was the first oil crisis in 1973. After the crisis, uranium price rapidly increased and inflation was drastically accelerated. Each top management responded to the oil crisis differently. Emphasized more the opportunity that the energy crisis posed for corporate growth, WH saw nuclear power business as the solution against inflation and lower corporate growth behind its superior competitiveness in the business and lagging competitiveness in conventional steam and gas turbines. Subsequently R&D investment went to power system business. GE was concerned more about finding solutions to inflation. Following the study of the strategy for inflation, GE acquired the natural resource business as a valuable hedge against worldwide inflation, educated their manager to formulate adequate strategy under inflation, and endorsed the expansion of service and high-technology business as



a way of the solution for corporate growth. The emphasis of high-technology was reflected on its R&D investment while power business was not regarded as the key strategy unlike WH.

This set of different action of the 1970s between them led GE to achieve further growth even in stagnate economy and WH to become sluggish. As a major result, their financial standings were diverged by the end of the 1970s.

## Chapter 4

### Managing Restructuring in the Emergence of “Mega-Competition,” from 1980 to 1999

"the law of selection trumps the dominant gene."

Haruki Murakami, *Colorless Tsukuru Tazaki and His Years of Pilgrimage*

This chapter explores historical factors that drove the divergent corporate transformations of GE and WH in the 1990s.

The last two decades of the twentieth century served as an important turning point, not just for the U.S. economy and industrial enterprises but also on a global scale. New technologies and political agendas led to an accelerated globalization of the economy and heightened competition, resulting in a regrowth of the U.S. economy in the so-called “new economy” of the 1990s. New information, electronics, and transport technologies enabled a reduction in the costs of international communications and shipping<sup>410</sup>. International capital mobility increased through the introduction of new technologies and the spread of financial deregulation around the world, while institutional investors became major providers of financial capital<sup>411</sup>. Although U.S. business enterprises were faced with a changing composition of the workforce and increased labor costs,

technological changes permitted companies to export jobs to countries with lower labor costs even though migrant flows were still tightly restricted at the time<sup>412</sup>. In addition, since numerous countries were following a worldwide trend to reduce tariffs, this increased access to foreign markets during a period when international trade was growing<sup>413</sup>. Moreover, the end of the Cold War saw former Communist countries in Eastern Europe and China begin a shift toward becoming market economies. The end result saw the world economy go into full-scale globalization, an environment of “mega-competition”<sup>414</sup>. U.S. industrial enterprises were challenged by global competition more than ever before.

In order to stand up to this new level of global competition, large U.S. industrial enterprises were obligated to refocus on core business lines, their core competencies, through a restructuring of their businesses and organizations<sup>415</sup>. As Constantinos Markides<sup>416</sup> examines, during the 1980s in the U.S. there were two movements at play, one where overdiversified enterprises were found to be refocusing and another where underdiversified firms were increasing their level of diversification, however both these movements had the same common objective of sharpening the overall focus on core and related businesses. During the same period, changes in public policy had impacts on large U.S. enterprises, though deregulation, anti-inflation measures, and relaxation of antitrust policy<sup>417</sup>. This trend in U.S. enterprises went hand in hand with the great merger

movement that accompanied restructuring and asset redeployment<sup>418</sup>. This, the fourth merger movement in U.S. history, was accelerated by innovations in financial services, such as the introduction of leveraged buy-outs (LBO), managerial buy-outs (MBO) and junk bonds<sup>419</sup>.

However, according to Bronwyn Hall's analysis, the level and degree of merger movement varied between U.S. industries. LBO and other private acquisitions of publicly traded manufacturing firms overwhelmingly took place in low-tech and in parts of stable-tech industries, such as food and textiles, in sectors where R&D investment and innovation was deemed to be of less importance<sup>420</sup>. With her data and findings, Alfred Chandler then went on to suggest that the high-tech industries and the other parts of stable-tech industries were less prone to financial restructuring when long-term investments, such as in R&D, were present because these enterprises were successful in making the required long-term investments and, as a result, remained powerful competitors in the midst of global competition<sup>421</sup>. Thus, as Takashi Hikino summarizes, capital markets were instrumental in the reorganization of mature, low-tech industries, whereas the growing high-tech field was often supported by internal growth of the enterprise<sup>422</sup>.

GE and WH were also members of the movement to restructure business. In fact, from 1981 to 1984 GE divested 152 businesses while acquiring another 232, meanwhile WH, between

1980 and 1984, sold off 15 and acquired 39<sup>423</sup>. However, in the course of this restructuring movement the firms further extended the gap in performance and underwent different corporate transformations by the end of the century. While GE maintained its lead position in the steam turbine business, and concurrently built competitiveness in new businesses such as financial services, WH was not only divesting its traditional business but also all other manufacturing businesses as it transformed itself into a media company, renamed as CBS Corporation. How did this restructuring movement relate to the divergent transformations that followed?

The early 1990s was the critical turning point, a period when WH was saddled with huge debt built up by its financial services subsidiary. After the recession of the early 1990s, GE was achieving growth with a much more accelerated M&A strategy while WH commenced its drastic restructuring to become a broadcasting business. Although poor management of the financial subsidiary is the direct reason, another factor should be considered. Before its debt crisis, WH was unable to accomplish sufficient growth to both cover the losses generated by financial services and avoid selling off high-tech businesses. On the other hand, GE managed to deal with the problems of its financial services subsidiary through high growth and by generating enough earnings from the steam turbine business in spite of the emergence of global competition. Thus, in order to gain a deeper understanding of the divergent transformations between the firms in the

1990s, it is necessary to explore how GE and WH conducted their respective restructurings in the 1980s.

Although this restructuring in the 1980s is a vital aspect for explaining the transformation that ensued, there exists little in the way of comparative studies that provide detail on their restructuring, at least beyond just the large M&A cases, particularly in the case of WH.

Denise Fleck provides the most comprehensive examination of GE and WH. Her examination covers over a hundred years, analyzing various sorts of secondary data to reveal two distinct traits regarding the continued growth of the firms, and it is these traits that led to the significant divergence in GE and WH performance<sup>424</sup>. One of the traits is organization-related. GE was managing and organizing its business resources through integration efforts and a systematic approach, with strong top coordination coming from the well-developed managerial hierarchy, while WH resources were managed by a fragmented and piecemeal approach characterized by weak top-level coordination and oversight, which came from a poorly developed managerial hierarchy<sup>425</sup>. The other trait is business-related, in terms of the characteristics of the way the businesses were managed. GE pursued ambitious and forceful goals, aimed at building a financially sound business while instilling motivation to pursue technological improvements, innovation and to handle changes in the environment. WH's less ambitious goals were aimed at building

a financially satisfactory business with a tendency to manage change without a similar motivation to innovation and technology<sup>426</sup>. In the process of building these organizational and business traits, GE had a stronger presence in high-tech and developed a good capacity for risk management, while WH was less inclined to high-tech and disregarded risk<sup>427</sup>. The historical traits reveal that GE fostered a self-perpetuating destiny while WH pursued a self-destructing destiny, allowing GE to manage the troubles of its financial subsidiary and effectively manage both old and new businesses whereas WH took significant financial hits that led to its decay and its exit from the financial services business<sup>428</sup>.

Spanning over a century in time, Fleck's analysis provides a rich historical context and comprehensive perspective to the divergence of GE and WH, including raising organization structures as contributing factors to this divergence. Outside of her research purpose, her study does not fully examine the restructurings that occurred in the 1980s nor the reason why WH divested its traditional core business. There is no doubt, of course, that GE in the end succeeded in being superior to WH, but further investigation of the restructurings is required to develop a deeper understanding of the corporate transformations that occurred.

Taking GE and WH as representative cases, Nohria, Dyer and Dalzell's study focuses on the 1974-2000 period but also brings in a comparison to other corporate transformations undertaken by a number of U.S. industrial enterprises listed on the *Fortune* 100. Within this broader examination of U.S. industrial corporate transformations, the study draws comparisons from the process of transformation undertaken by GE and WH over the period of study. According to their findings, GE's top management created more opportunity and choice for growth by acknowledging the need to change earlier than WH, while the top management of WH shifted its priorities from the pursuit of growth to the pursuit of shareholder value while being reluctant to other changes<sup>429</sup>. The contrasted transformations that resulted came from dramatic changes taking place within the enterprises, such as in corporate strategy, structure, management systems, and governance, all in response to a America's shift from an industrial economy that was based on physical assets and production, to a post industrial economy that, due to the impact of new information technology and social and demographic changes, was based on intangible assets and services<sup>430</sup>. In the case of WH, the study raises that institutional investors (e.g. Calpers) were particularly influential up to the turning point<sup>431</sup>. The study somewhat positively assesses the transformation of WH, rather raising it as a failure, due to the focus taken from a shareowner's perspective<sup>432</sup>.



O'Sullivan's analysis complements this point. Exploring the role of the U.S. financial system in providing funding to GE and WH, she raises that investments in working capital determined the patterns for financial dependence and autonomy<sup>433</sup>. GE, until the 1990s, relatively declined its financial dependence by more successfully achieving efficiencies in its use of working capital, while WH continued to rely on external funding to invest in working capital rather than pursuing efficiency in its operations<sup>434</sup>. Her argument implies that WH, more than GE, was left with relatively less autonomy and needed to be concerned with its investor value. The findings contend that investors both directly and indirectly influenced WH's restructuring and transformation over the last two decades of the century.

Nohria, Dyer and Dalzell's study provides a detailed context of the transformation as well as insight into the relationship between business environmental changes and responses by the top management of GE and WH. Their findings on the two transformations cover not only internal factors of the firms but also external factors, which are partially supported by the O'Sullivan study. The main purpose of study was to provide a broad perspective of the changing paradigm for large industrial enterprises in the new economy, however, it provides less clarification on how the restructuring actually progressed, how it affected traditional business lines, and how it was

influenced by historical drivers other than mention of management impacts from previous decades.

In addition to these studies, there are numerous other studies of GE which cover the 1980s and 1990s, less so for WH. For instance, Francis Aguilar, in providing restructuring information and a variety of corporate data, contends that corporate strategy was the key to success for GE. Meanwhile, Alfred Chandler points out that GE's strategic control, through tight controlled budgets and clearly defined strategic targets, was a factor of success<sup>435</sup>. While Kazuichi Sakamoto provides an overview of the restructuring and organizational change, and Keiji Natsume demonstrates the influence corporate strategy has on corporate performance and American society, Noel Tichy and Stanford Sherman and William Rothschild describe in detail the restructuring and reorganization of GE under CEO Jack Welch<sup>436</sup>. Comparing GE to Toshiba Corporation, Akitake Taniguchi and Shin Hasegawa propose that GE created its new enterprise system through restructuring and organizational innovations, which differs from the Chandler's model, while Yasuyuki Kamigusa points out the main characteristic of GE's restructuring was an efficiency in capital investment<sup>437</sup>. According to these studies, it can be said that corporate strategy and restructuring are the fundamental elements of corporate transformation, and a vital factor in GE's new enterprise system was the strategic control exercised by its headquarters. William

Ocasio and John Joseph further examine this aspect through close analysis to define the structure behind this new strategic control at GE<sup>438</sup>. In the last two decades of the century, GE combined both new and old businesses by improving its annual planning cycle, through the GE Operating System, which saw a shift in the role of top management from one of coordinating planning with budgeting, to one centered on coordinating strategy formulation with implementation through corporate initiatives<sup>439</sup>.

Although these studies verify many aspects of GE's restructuring and the changes behind transformation, it is left relatively unclear how GE's restructuring differs from that of WH, mainly because focus is placed exclusively on GE, seeks to compare large U.S. enterprises in different industries, or compares similar business enterprises in different countries. In addition, there is not much attention paid to the interaction between corporate strategy and traditional business lines, such as steam turbine. Thus it is necessary to investigate another aspect of GE's restructuring, with a comparison to WH, to fully understand the divergent transformations that took place. This is because the refocusing was not simply limited to where they had competitiveness, such as their core business lines or high-tech business. The diversification also went to service businesses and included some divesting from high-tech and core businesses.

The reason this has not been explored sufficiently is mainly due to a limitation in the availability of research materials. This chapter combines a variety of secondary source and historical documents to overcome this limitation, as follows. The tendencies in M&A approaches of both firms examined through data provided in the Thomson One Banker's Mergers and Acquisitions database. Although the data does not cover all M&A cases, particularly for the 1980s, it still provides an understanding of differences between the two. For the restructuring, research information and data is lacking on WH because it was not a popular topic of examination during the period, while GE was often selected as a research subject. To address this gap, an examination of WH's historical documents in the Records of the Westinghouse Electric Corporation is pursued, including some business restructuring and M&A data from the time. In addition, the annual reports of GE and WH serve as the basis for determining the turning points in corporate transformations and top management perceptions. Regarding competition in core business lines, the steam turbine industry is examined by using data from secondary sources, found in Anna Bergek, Fredrik Tell, Christian Berggren and Jim Watson, "Technological Capabilities and Late Shakeouts: Industrial Dynamics in the Advanced Gas Turbine Industry, 1987-2002," *Industrial and Corporate Change* 17, no. 2 (2008): 225-392, and Mike Curtis, "United States: Advanced

Turbine System,” in *Innovation in Energy Technology: Comparing National Innovation Systems at the Sectoral Level* (Paris, France: OECD Publishing, 2006) 295-317.

Using these materials, this chapter examines why past actions led to different corporate transformations and business competitiveness in the traditional business of GE and WH.

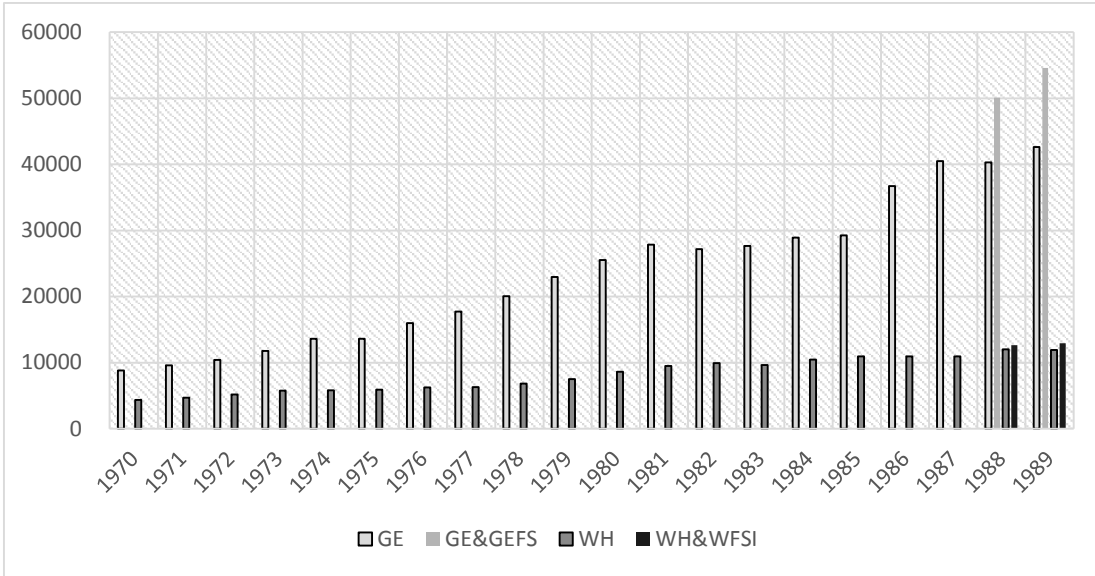
The next section quantitatively verifies the final point of divergence between GE and WH, particularly in terms of corporate investment and performance. The early 1990s is shown as the point of divergence. The subsequent section shows the degree to which GE and WH maintained their global competitiveness against foreign competitor in the steam turbine industry. It is argued that the previous corporate strategies affected their relative competitiveness when the combined cycle gas turbine (CCGT) arrived as the new main product in the steam turbine industry. The following section clarifies how historical factors influenced their business restructurings during the period. Thus it is shown that the destiny of both firms was largely dependent on actions by their top managements taken in the 1980s. In the end, it is revealed that it is an accumulation of past managerial actions taken by GE and WH that largely influenced their relative competitiveness in the steam turbine industry as well as the divergent transformations in the 1990s. The two had similar conceptions when faced with a changing business environment,

but past diversifications and the resulting financial standings did not offer the same options for managerial responses.

## **II. Divergence in Corporate Transformation<sup>440</sup>**

### **1. A Crucial Period of Transformation**

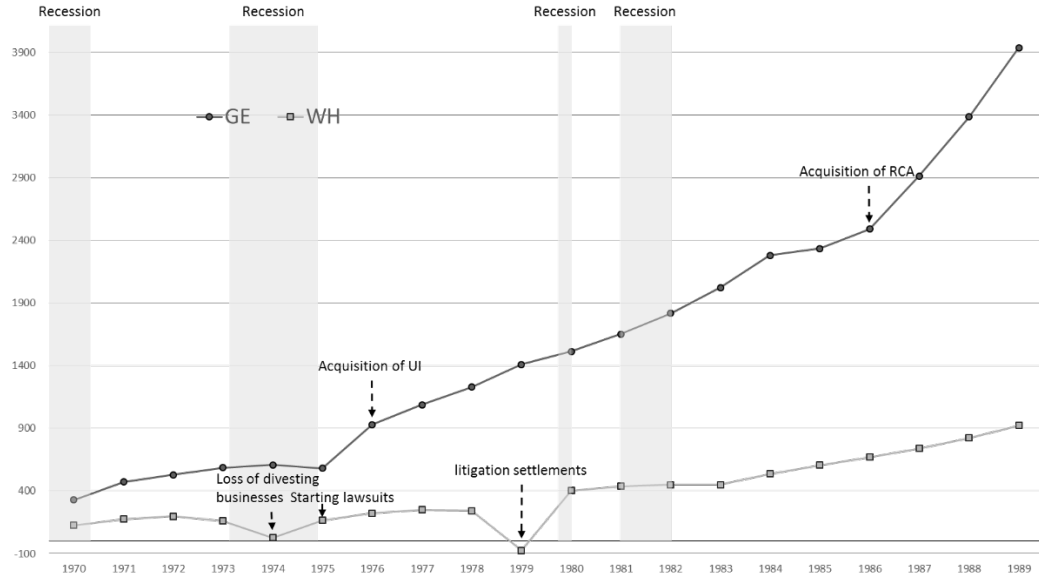
Although both firms were experiencing low growth and profitability in the 1970s, WH, without doubt, was facing a much tougher financial situation in the late 1970s, as shown in figures 4-1 and 4-2. WH was faced with uranium price contract problems with customers and had to defend against 17 lawsuits launched by 27 public utility customers, a process that lasted from 1975 until the contract litigation settlements in 1979<sup>441</sup>. As a consequence, the settlements from these legal actions caused \$493 million in losses to WH. Meanwhile, in 1976 GE was in the process of merging with the natural resources company, Utah International, in order to increase its profitability. It was also further strengthening its financial base by introducing strategic management tools (e.g. SBU, PPM), and new organizational models, such as the Sector organizational structure<sup>442</sup>.



**Figure 4- 1. Revenues of GE and WH, 1970-1989 (\$ millions).**

Source: GE, *Annual Report*, various years and WH, *Annual Report*, various years.

Note: Revenues consist of sales and other income including financial business net earnings. The consolidation with financial business revenue started from 1988.



**Figure 4- 2. Net earnings of GE and WH, 1970-1989 (\$ millions).**

Source: GE, *Annual Report*, various years and WH, *Annual Report*, various years.

Since the gap of their respective business sizes extended through the 1970s, GE was already three times the business size of WH by 1980. GE's consolidated revenue, when the financial services division is factored out, grew 10 to 8 times larger by the late 1990s. Up to the

time WH's financial services business problem became visible in 1990<sup>443</sup>, both firms had succeeded in gradually increasing net income through the 1980s, as shown on figure 4-2. The divergence in financial standings had influence on the amount of investments undertaken during the two decades, as reflected in figure 4-3, a period which sees WH's investment increasing at a relatively lower rate than that of GE.

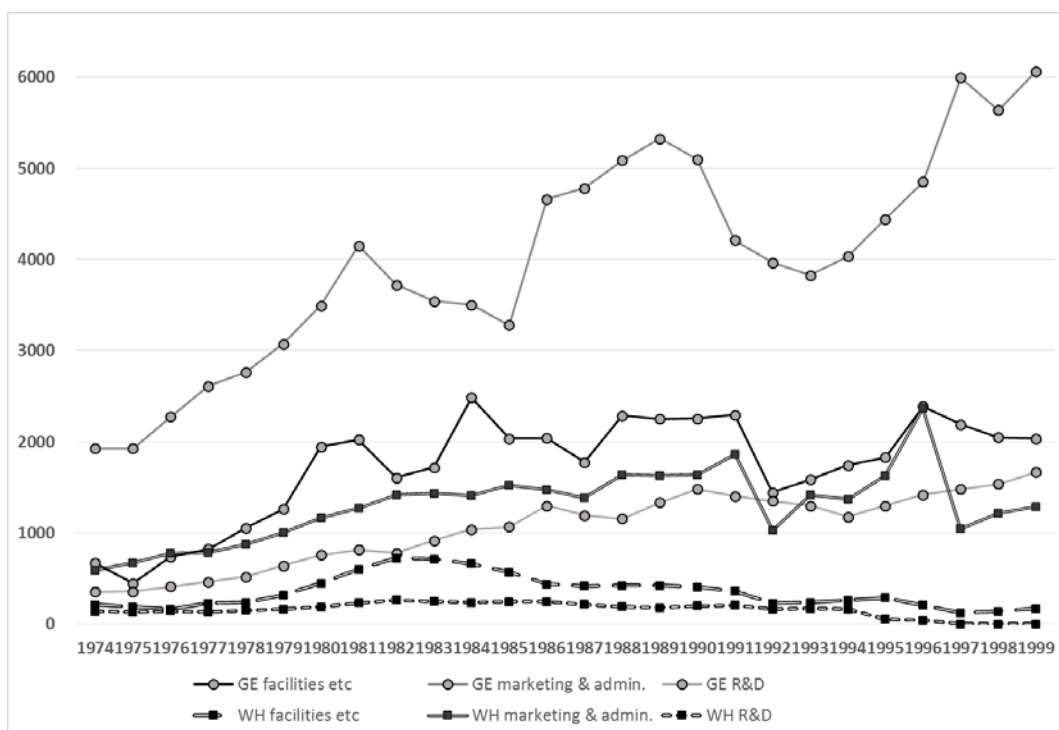


Figure 4- 3. Investments of GE and WH, 1974-1999 (\$ millions).

Source: GE, *Annual Report*, various years, WH, *Annual Report*, various years, CBS Corporation, *Annual Report*, various years, CBS Corporation, *Form 10-K*, various years.

Their investment approaches were reflected in the process of corporate transformation.

Entering the 1980s, GE and WH commenced the process of restructuring their business portfolios. During the Reaganomics period, starting in 1981, GE took a “No.1 or No.2” strategy under new CEO Jack Welch and executed a series of large scale mergers and acquisitions (M&A)



to restructure itself. GE divested 152 businesses, including Utah International, and obtained 232 businesses through acquisitions, joint ventures, formations of new companies, and other equity investments from 1981 to 1984<sup>444</sup>. Meanwhile, WH was also acquiring and divesting businesses under an alternate management tool, Vabastram (the Value Based Strategic Management System), though with far less volume of M&A when compared to GE. Although both entered the Factory Automation business through M&A and sold off electrical appliances, WH made acquisitions in nuclear service, beverage bottling, broadcasting, and divested some of its broadcasting and businesses in the educational division. Meanwhile, GE obtained software services, insurance companies and disposed of its natural resources businesses. Although revenues were stable, both GE and WH increased net income 1.5 times from 1980 until 1985 (see figures 4-1 and 4-2). As reflected in figure 4-3, the increase in investments in the first half of the 1980s for both companies was more than that of the entire 1970s.

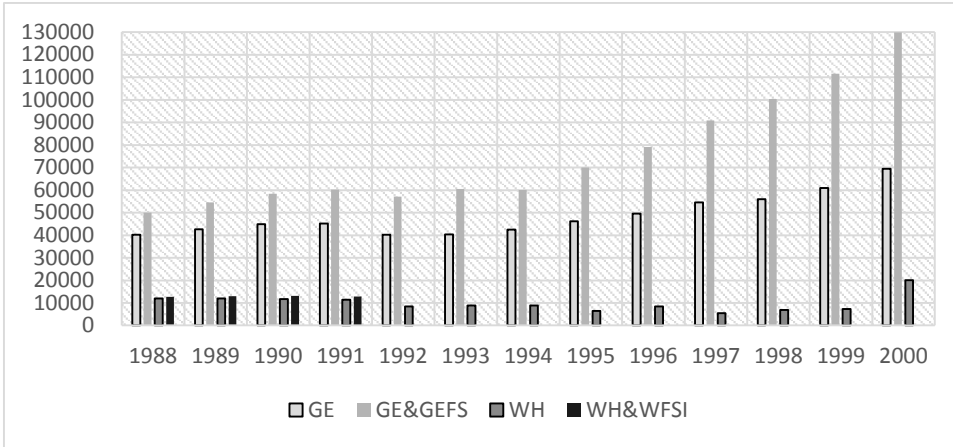
The last half of the 1980s was a business growth period for both GE and WH, centered on M&A and boosted by an international relaxation of monetary restrictions that resulted in the development and expansion of the global financial market. Both companies rode this wave. GE expanded their financial service subsidiaries through M&A, acquiring financial businesses such as Kidder Peabody Group, Navistar Financial Corporation, D&K Financial Corporation and

Montgomery Ward Credit Corporation. In addition to financial businesses, GE merged Radio Corporation of America (RCA) and other businesses in order to strengthen its holdings in lines such as medical equipment, plastics and locomotives, while parting with a set of RCA business, with the exception of NBC, and business related to factory automation and TV manufacturing. WH mergers, on the other hand, focused mainly on broadcasting, furniture, nuclear service, real estate, and business related to residential construction, while it divested elevator, transmission and distribution equipment businesses. Starting in 1986 the increases in volumes of investment began to differ between GE and WH, as seen in Figure 4-3. Whereas WH had a relatively low level of investment, with a downward trend, GE maintained a high level that was generally on an increased slope. Going back to figure 4-1 and 4-2, one can see that GE grew its business size and net income while WH was relatively stable on both up until the end of the 1980s.

All things considered, in the 1980s GE and WH pursued different paths in their respective business portfolios even though they were both competing in the similar business fields of power systems, industrial appliances and defense electronics. GE strengthened its high-tech industry holdings and financial services while WH placed more weight on services and relatively low-tech industries. There is at least one point in common in their M&A decisions in the 1980s.

Their corporate management decisions on business portfolios were largely affected by path-dependence, in that they would generally select a business that was within the business lines they possessed prior to 1980, although there are a few exceptions, rather than enter into entirely new ones,<sup>445</sup>. These decisions were later reflected in the business growth that resulted in the late 1980s.

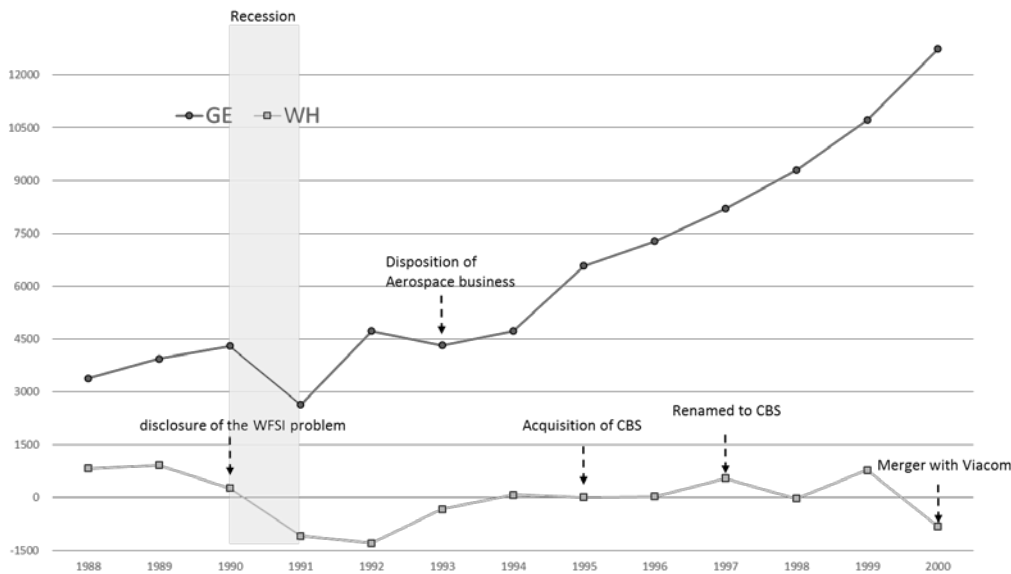
The last decade in the 20th century also serves as the last decade of the story between GE and WH. In 1992, both firms' revenues declined to certain degrees. Timed to high income attained in 1993, GE divested the aerospace business to Martin Marietta, in order to strategically pull out of the munitions industry, which saw firms scrambling to downsize once demand had ebbed after the cold war. Meanwhile, WH disposed of its financial business, Westinghouse Financial Services, which had losses that inflated like a balloon until it burst in 1991<sup>446</sup>. Subsequently, as on figure 4-4 and 4-5, GE's revenue and investment amounts were on the increase while WH never recovered to pre-1992 levels, even after it transformed itself into a media corporation as CBS. GE remained as an industrial corporation with new profitable business lines and WH was transformed to a media service company by the close of the decade.



**Figure 4- 4. Revenues of GE and WH, 1988-2000 (\$ millions).**

Source: GE, *Annual Report*, various years, WH, *Annual Report*, various years, CBS Corporation, *Annual Report*, various years, CBS Corporation, *Form 10-K*, various years, and Viacom, *Form 10-K*, various years.

Note: Revenues consist of sales and other income including financial business net earnings. The consolidation with financial business revenue started from 1988.

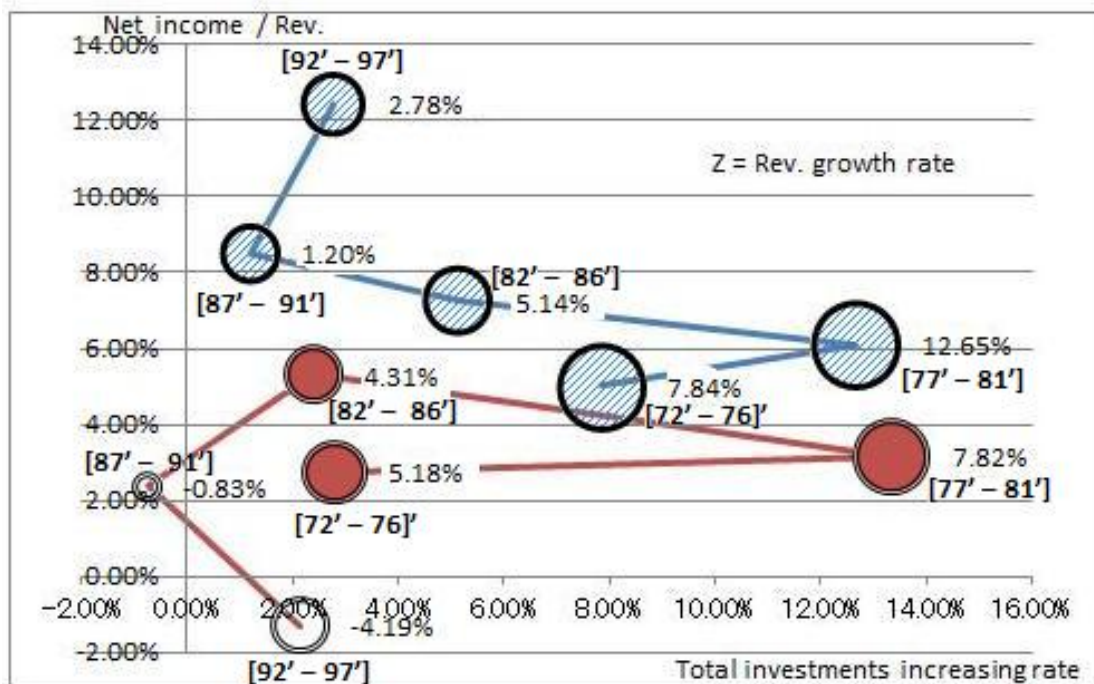


**Figure 4- 5. Net earnings of GE and WH, 1988-2000 (\$ millions).**

Source: GE, *Annual Report*, various years, WH, *Annual Report*, various years, CBS Corporation, *Annual Report*, various years, CBS Corporation, *Form 10-K*, various years, and Viacom, *Form 10-K*, various years.

The early 1990s signal the final point of divergence for both companies as industrial corporations, as reflected in figure 4-6, when GE and WH clearly take opposite trajectories in the period 1992 to 1997. While both increased their investment ratios, GE continued to increase net

income and business size while WH saw reductions in both. This emerged from something that occurred in the previous term, from 1987 to 1991. GE's ratio for business growth increased and investment reduced, while its net income ratio was going up, largely because GE's business growth expanded more than its increase in investment, and its restructuring of industrial business lines was fundamentally completed by 1986. WH experienced a decline in all of its variables during the same period. In contrast to GE, WH saw decreased investments and net income as a result of its business portfolios and financial crisis. In the other three periods GE and WH took similar paths, mainly because they were both industrial corporations operating under similar macro-economic circumstances. Both of the industrial corporations were hard pressed to increase profits with any degree of significance in the 1970s, a period that posed a major challenge for all American firms. In the 1980s, they both restructured their businesses and organizations under Reaganomics, which provided the platform for realignment of American firms. It is vital to point out what both GE and WH did as far back as the 1970s to 1980s, as the lead up to the last decades of the 20th century.



**Figure 4- 6. Correlation of investment and performance for GE and WH, 1972-1997.**

Source: GE, *Annual Report*, various years, WH, *Annual Report*, various years, CBS Corporation, *Annual Report* and Form 10-K, various years.

Note: All data take a five-year moving average. As a result, although the observed period from which the data is taken is from 1970 to 1999, the actual analyzed period is reduced to 1972-97. Both the business growth rate and investments increasing rate are processed through (1) calculating the ratio to the previous year, and (2) taking an average for every five-years (e.g. 1972-76, 1977-81). Net income as a percent of revenue is averaged for every five-years (e.g. 1972-76, 1977-81). Only the last set of three data represents a six-year average, 1992-97. This model has been modified to allow for international comparison. For detail, see Addendum A.

## 2. The Start of Transformation

GE and WH were responding to changes in the economic, political and social environment, post American Century, with similarities and differences shown in the two decades prior to 1990s, as evidenced by their respective investment trajectories<sup>447</sup>.

During the weak economic period of the 1970s and early 1980s, Reginald Jones (tenure: 1972 - 1981) took the helm of GE and Ronald Kirby (tenure: 1975 - 1983) was the CEO of

WH. Although there were some similarities, such as both companies having an MBA-holding CEO and both introducing strategic management tools (GE Matrix and PIMS at GE, Vabastram at WH), the GE business structure was already different to some degree from that of WH, as a result of the business expansion period from the 1950s to the 1960s. A very significant example of coping with the effects of 1970s inflation occurred when Jones acquired Utah International in 1976, at the time the largest merger in the U.S. corporate history, choosing an entry into the natural resources business to attain growth in profitability<sup>448</sup>. GE managed periods of inflation through diversifying and strengthening its materials sector, including chemicals, metallurgical products and natural resources, as well as services, including financial, information, broadcasting, installation maintenance and repair services, transportation equipment centered on aircraft engines and locomotives, and international operations<sup>449</sup>. Meanwhile WH strengthened its existing businesses through investments and M&A, while coping with the uranium pricing problem and the Three Mile Island Accident. Of note, WH, under CEO Kirby, announced in 1980 that it had acquired one of the nation's largest cable TV systems, the Teleprompter Corporation. The deal, concluded in 1981, was to complement its historic strength in broadcasting and served as the biggest acquisition in the history of WH<sup>450</sup>.

The natural resources business for GE and broadcasting business for WH were the key contributors to profitability, as seen on table 4-1.

**Table 4- 1. GE and WH revenue and operating profit (%) by segment, 1977-1980.**

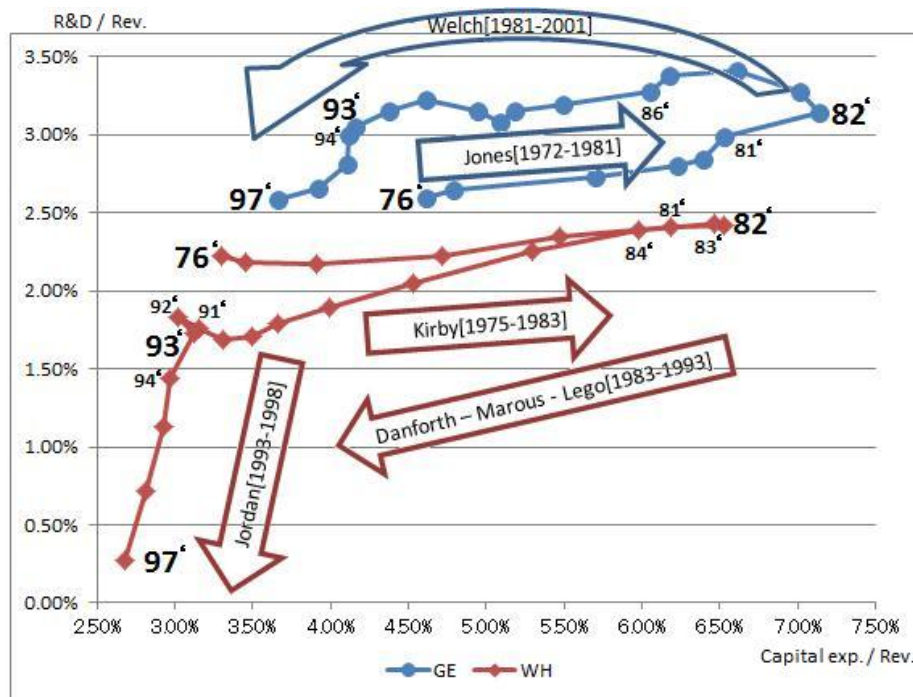
| GE                                 | 1977        |                      | 1978        |                      | 1979        |                      | 1980        |                      |
|------------------------------------|-------------|----------------------|-------------|----------------------|-------------|----------------------|-------------|----------------------|
|                                    | Revenue (%) | Operating Profit (%) | Revenue (%) | Operating Profit (%) | Revenue (%) | Operating Profit (%) | Revenue (%) | Operating Profit (%) |
| Consumer Products and Services     | 22.1%       | 22.4%                | 22.8%       | 23.5%                | 22.3%       | 21.3%                | 21.0%       | 19.3%                |
| Power Systems                      | 17.1%       | 7.6%                 | 16.6%       | 8.1%                 | 14.8%       | 6.5%                 | 15.1%       | 6.7%                 |
| Industrial Products and Components | 19.7%       | 17.0%                | 19.6%       | 17.5%                | 20.0%       | 18.2%                | 19.4%       | 19.6%                |
| Technical Systems and Materials    | 22.0%       | 22.0%                | 22.6%       | 22.4%                | 25.2%       | 25.3%                | 26.8%       | 26.7%                |
| Foreign Multi-industry Operations  | 13.6%       | 9.8%                 | 13.2%       | 10.1%                | 12.1%       | 9.1%                 | 12.1%       | 9.8%                 |
| GE Credit Coporation               | 0.4%        | 3.1%                 | 0.4%        | 3.2%                 | 0.4%        | 3.4%                 | 0.4%        | 4.0%                 |
| Utah International                 | 5.1%        | 18.1%                | 4.9%        | 15.3%                | 5.2%        | 16.2%                | 5.2%        | 13.9%                |
| WH                                 | 1977        |                      | 1978        |                      | 1979        |                      | 1980        |                      |
|                                    | Revenue (%) | Operating Profit (%) | Revenue (%) | Operating Profit (%) | Revenue (%) | Operating Profit (%) | Revenue (%) | Operating Profit (%) |
| Public Systems                     | 22.3%       | 16.1%                | 22.5%       | 20.2%                | 23.7%       | 18.1%                | 25.4%       | 17.2%                |
| Power Systems                      | 37.2%       | 26.6%                | 35.3%       | 27.2%                | 34.0%       | 34.2%                | 33.9%       | 40.8%                |
| Industry Products                  | 36.5%       | 51.7%                | 38.0%       | 44.5%                | 38.1%       | 40.0%                | 36.5%       | 32.7%                |
| Broadcasting                       | 2.8%        | 12.3%                | 2.9%        | 11.4%                | 2.9%        | 12.4%                | 3.0%        | 9.6%                 |
| Other                              | 1.2%        | -6.7%                | 1.3%        | -3.3%                | 1.3%        | -4.8%                | 1.3%        | -0.3%                |

Source: GE, *Annual Report*, various years and WH, *Annual Report*, various years.

Note: The table includes intersegment sales and excludes “interest and other financial charges” and “corporate items and eliminations”

Although both businesses accounted for a low share of the overall revenue structure, they comprised more than a ten percent share of operating profits. While their business portfolios varied to some degree, GE and WH took rather similar responses in terms of investment in the 1970s to early 1980s. Both consistently increased the investment ratio in new plants, improved facilities, increased capital expenditure, slightly increased the R&D ratio, and maintained a stable ratio in marketing and administration expenditure up until 1982, as shown in figures 4-7 and 4-8. Even though they extended or entered into non-manufacturing business, both relied on their industrial business until early into the 1980s.



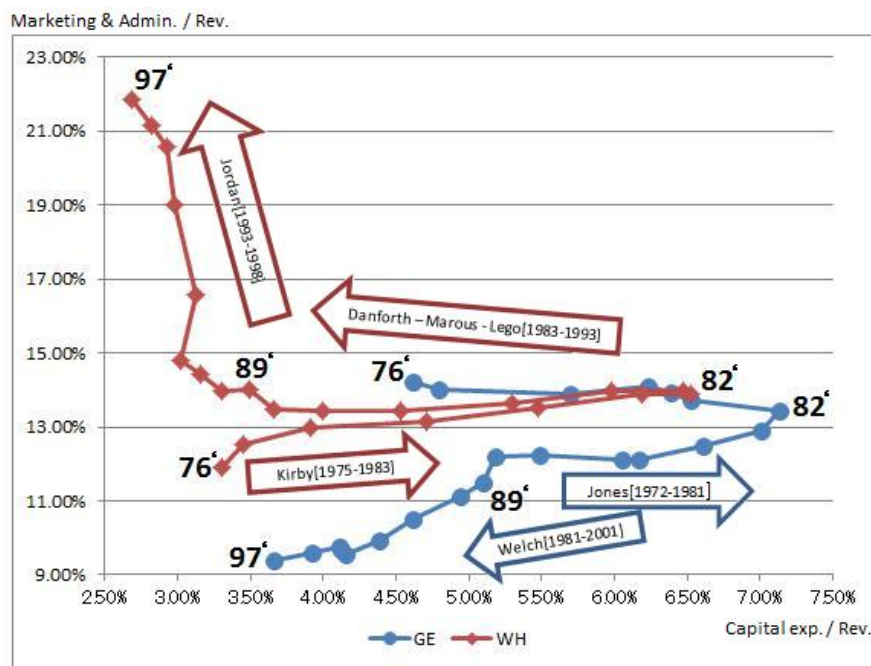


**Figure 4-7. Correlation of capital and R&D expenditures for GE and WH, 1976-1997.**

Source: GE, *Annual Report*, various years, WH, *Annual Report*, various years, CBS Corporation, *Annual Report*, various years.

Note: To derive the point of inflection of investment, all data take a five-year moving average. As a result, although the observed period from which the data is taken is from 1974 to 1999, the actual analyzed period is reduced to 1976-97.

The differences between these two large industrial enterprises gradually become apparent towards the 1990s. To one degree or another, GE and WH progressed on their respective restructurings through processes involving major M&A. Over the course of a decade, GE continued to increase investment in manufacturing, marketing and R&D, and commenced its re-growth from the second half of the 1980s. Alternatively, WH somewhat achieved business growth but struggled with its re-growth in comparison to GE. Importantly, WH's level of investment in manufacturing and R&D declined.



**Figure 4-8. Correlation of capital and marketing & administrative expenditures for GE and WH, 1976-1997.**  
 Source: GE, *Annual Report*, various years, WH, *Annual Report*, various years, CBS Corporation, *Annual Report*, various years.

Note: To derive the point of inflection of investment, all data take a five-year moving average. As a result, although the observed period from which the data is taken is from 1974 to 1999, the actual analyzed period is reduced to 1976-97.

### 3. Impact of the 1970s on Corporate Transformation

Although both GE and WH have similar investment trajectories in the 1970s, there were differences in the corporate financial positions of GE and WH, which first started to emerge in the 1970s. As shown on figure 4-1, figure 4-2 and Chapter 3, GE maintained or slightly strengthened its profitability and financial leverage under the disastrous conditions of the 1970s. On the other hand, WH declined its current ratio and its equity ratio, albeit slightly, while it managed to maintain its share of profitability. The reason that GE CEO Fred Borch chose CFO Jones as his successor was that he was deemed to be the right person to strengthen

the company's ability to generate consistent, predictable earnings after the business and organizational expansion in the 1960s<sup>451</sup>. In fact CEO Jones brought GE to a financially healthy state with a strong balance sheet and a record of sustained earnings growth<sup>452</sup>. WH CEO Kirby also tried to take a similar route, and did achieve this objective to some degree, such as an improved business portfolio and an increase of sales and earnings while coping with its difficult and unique financial litigation problems<sup>453</sup>. However, the efforts of WH did not quite arrive at the same conclusion as GE in terms of corporate financial standing. These divergent results affected both companies during the wave of accelerated corporate transformations that occurred in the 1980s.

To summarize, even though both companies took a similar investment trajectory in the 1970s, their corporate finance positions were different to varying degrees in the 1980s. In terms of achievements in the 1970s, GE succeeded in establishing a virtuous and successful cycle of investment and growth by pursuing the "No.1 or No.2 Strategy" under CEO Welch, a process by which GE selected the businesses worthy of continuous investment. Meanwhile, like GE, WH retained and strengthened the businesses which it carried over from the 1970s. A distinguishing factor was some part of this business portfolio was less high-tech in nature, such as office furniture, beverage bottling and land/community development. In addition, unlike GE, WH

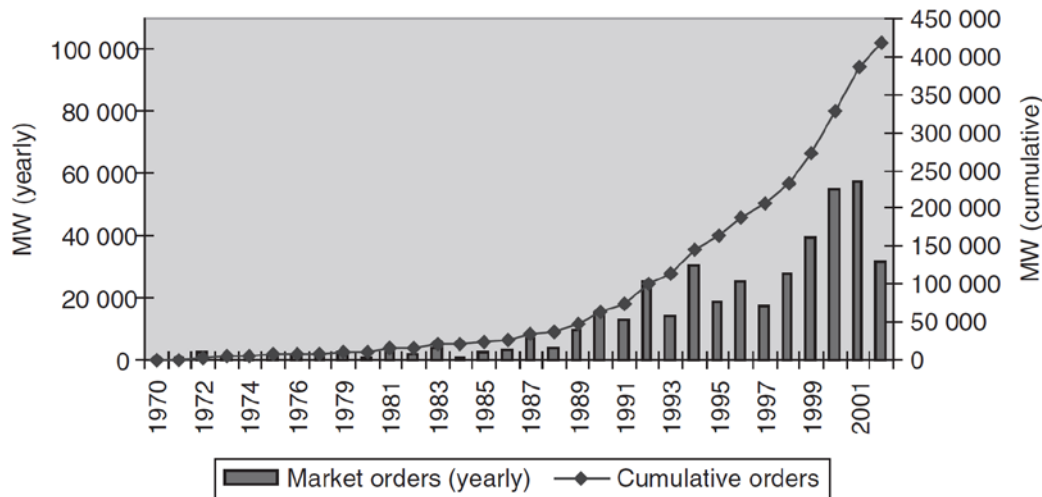
was unable to carry out huge investments in existing businesses or M&A due to profitability challenges and other troubles that took place in the 1970s. With increasing competition, this led to a decline in investments for WH in both R&D and capital, as seen in figures 4-8 and 4-9, both of which are crucial for the sustainability of an industrial corporation. The WH and GE cycles were evidently on opposite tracks.

### **III. Restructuring and Traditional Core Business**

#### **1. New Developments in the Steam Turbine Business**

Fueled by new technology, fierce global competition struck the traditional core business of GE and WH, namely steam turbines. Since coal-fired boilers had researched their limits of thermal efficiency, and growth in nuclear power did not meet expectations due to public resistance and the Three Mile Island accident of 1979, a new advanced steam turbine, called a combined cycle gas turbine (CCGT), rapidly grew to become the main product in the industry<sup>454</sup>. Increasing its share of annual installed capacity from just over 10% in 1987 to 35% in 1993, CCGT remained at around 30% of annual installations from the mid-1990s, during a period of rapid expansion in total power generation<sup>455</sup>. The reason was that electric utilities began to order

gas and combined turbines when improved gas turbine system emerged in the market in the late 1980s and 1990<sup>456</sup>. As shown in figure 4-9, the orders of CCGT had been expanding since the late 1980s, although the concept of CCGT was already established during the 1950s<sup>457</sup>.



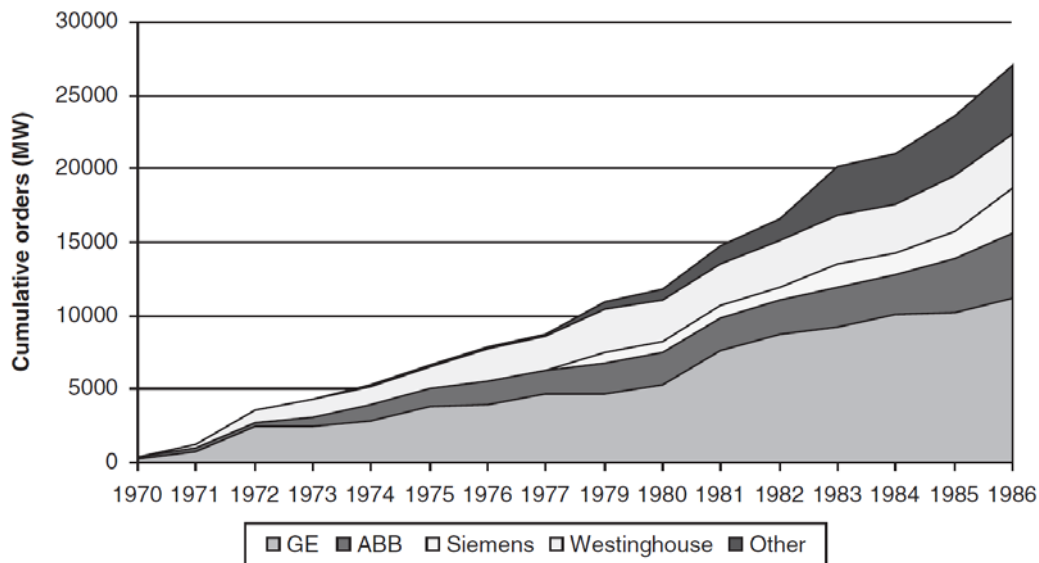
**Figure 4- 9. CCGT market development, 1970-2002 (total market orders in MW).**

Source: Anna Bergek, Fredrik Tell, Christian Berggren and Jim Watson, "Technological Capabilities and Late Shakeouts: Industrial Dynamics in the Advanced Gas Turbine Industry, 1987-2002," *Industrial and Corporate Change* 17, no. 2 (2008): figure 1, 337.

GE and WH were the first manufacturers to receive CCGT orders and, unlike foreign competitors, were capable of developing the technological capabilities<sup>458</sup>. In response to the great Blackout of 1965, gas turbine installations had experienced rapid growth by 1978<sup>459</sup>. Between 1966 and 1976, U.S. electric utilities installed 1,429 gas turbine units with outputs over 3500 kW, with GE and WH providing a number of them<sup>460</sup>. In 1978, in response to the first oil crisis in 1973, the National Energy Act was legislated by the U.S. Congress, comprised of five Acts (Energy Tax Act, Natural Gas Policy Act, National Energy Conservation Policy Act, Power Plant

and Industrial Fuel Use Act, and Public Utility Regulatory Policies Act). This had both negative and positive effects on the turbine business. While the rapid increase in the cost of natural gas discouraged electric utilities from installing gas turbines through the Natural Gas Policy Act and the Power Plant and Industrial Fuel Use Act, the Public Utility Regulatory Policies Act encouraged the use of gas turbines with efficient combined cycle configurations, particularly in industrial applications<sup>461</sup>. Compared to WH, which was confronted with a number of troubles in gas turbines<sup>462</sup>, GE could deliver the necessary technological capabilities in gas turbine and CCGT because GE was able to transfer knowledge from aircraft engines, maintain R&D and shift its focus to the European market while the U.S. market was faced with difficulties<sup>463</sup>.

When CCGT, due to its comparative cost advantages, began to gradually become the alternative, and preferred, option for power generating plants in the 1980s,<sup>464</sup> GE became a lead firm among global competitors while WH accounted for far less market share even though it was also a first mover for the product (see figure 4-10). By 1986, just before a period of rapid technological development, GE, with its cumulative market share of 41%, already had a larger stock of installations and more experience in CCGT technology than any other company, while WH's 14% share ranked it as the third competitor, behind ABB's 16% and ahead of Siemens's 11%<sup>465</sup>.



**Figure 4- 10. Global market share in CCGT cumulative orders, 1970-1986.**

Source: Anna Bergek, Fredrik Tell, Christian Berggren and Jim Watson, "Technological Capabilities and Late Shakeouts: Industrial Dynamics in the Advanced Gas Turbine Industry, 1987-2002," *Industrial and Corporate Change* 17, no. 2 (2008): figure 3, 351.

In 1987, when GE introduced the CCGT Frame 7F, which achieved higher efficiency and significant advances in performance, CCGT entered an intense technology race during a period of market expansion<sup>466</sup>. During the technology race, both firms were able to launch successive generations of turbines at about the same rate and with similar performance in terms of efficiency<sup>467</sup>, but GE could afford to internally develop and produce the CCGT while WH increasingly relied on partnerships with other firms, such as Mitsubishi Heavy Industries and Rolls Royce, for development and production of the product<sup>468</sup>. By 1998, when WH sold its power plant business to Siemens, WH could no longer be major player in the global CCGT market while GE managed to retain leadership in the business, as shown in table 4-2.

**Table 4- 2. Global market share in CCGT, 1987-2002.**

|                                  | Phase I<br>1987-1991 | Phase II<br>1992-1994 | Phase III<br>1995-1998 | Phase IV<br>1999-2002 |
|----------------------------------|----------------------|-----------------------|------------------------|-----------------------|
| GE                               | 28%                  | 26%                   | 22%                    | 54%                   |
| GEC-Alstom / Alstom <sup>a</sup> | 9%                   | 14%                   | 6%                     | 15%                   |
| ABB                              | 18%                  | 12%                   | 17%                    |                       |
| Siemens                          | 19%                  | 24%                   | 21%                    | 22%                   |
| Westinghouse                     | 5%                   | 7%                    | 13%                    |                       |
| Mitsubishi <sup>b</sup>          | 13%                  | 8%                    | 12%                    | 8%                    |
| Other                            | 8%                   | 9%                    | 9%                     | 1%                    |

a) GE licensee in the first three phases. In the fourth phase, Alstom acquired ABB's Power Generation Business. In 1989, the energy and transport businesses of Alstom merged with General Electric Company (GEC) of UK, forming GEC-Alstom.

b) Westinghouse licensee in the first phases.

Source: Adapted from Anna Bergek, Fredrik Tell, Christian Berggren and Jim Watson, "Technological Capabilities and Late Shakeouts: Industrial Dynamics in the Advanced Gas Turbine Industry, 1987-2002," *Industrial and Corporate Change* 17, no. 2 (2008): table 4, 357.

This was, at least partially, the result of WH's corporate strategy during the 1980s. WH was still the second-largest domestic player in the U.S. steam turbine industry, behind GE which accounted for a 35-40% share of domestic installations in 1988<sup>469</sup>. However, WH almost entirely left the gas turbine business in 1987, when it almost sold it to MHI<sup>470</sup>. In fact, according to the First Boston Corporation's analysis, WH was attempting to decrease its exposure to utility markets and operate its turbine business through joint ventures, due to a forecast of low growth in steam turbines that was expected to last until the middle of 1990s, made on the basis of present and projected market conditions<sup>471</sup>. Subsequently, in the face of renewed demand in 1989, WH charged its way back to CCGT business with its major new development programs<sup>472</sup> but still remained a follower throughout the 1990s in terms of global competition.



## 2. Power System Business over Transformation of Business Structure

The corporate strategy of the 1980s was to restructure existing business through M&A.

The top managements of WH and GE both shared a similar criterion for restructuring, they selected and focused resources on businesses growing faster than the slow growth in the economy<sup>473</sup>. However, the actual restructuring that took place was different due to the different business portfolios that had been built up by previous top management teams.

Table 4-3 and table 4-4 show the number of completed cases of mergers and acquisitions and divestitures for GE and WH during the 1980s. According to GE, they acquired 118 businesses during 1981 and 1982 alone, through acquisitions, joint ventures and formations of new companies, while there were only 82 M&A in the 1980s, as shown in table 4-3<sup>474</sup>. Similar to GE, although WH made 55 acquisitions and 70 divestitures between 1985 and 1987, only 27 M&A and 28 divestitures appear in the table for the 1980s<sup>475</sup>. Hence, both GE and WH undertook a much larger scale of M&A&D in the 1980s than the number shown in the tables. Even though the data in the table does not cover all cases, it still reflects certain tendencies in M&A&D between GE and WH.

**Table 4- 3. M&A&D of GE in the 1980s.**

| Mergers and Acquisitions       |    |              |   | Divestitures          |                                |              |   |                       |
|--------------------------------|----|--------------|---|-----------------------|--------------------------------|--------------|---|-----------------------|
| Macro Category                 |    | Mid Category |   | Macro Category        |                                | Mid Category |   |                       |
| Consumer Products and Services | 4  | 4.9%         | Professional Services<br>Other Consumer Products  | 3<br>1                | Consumer Products and Services | 2            | 3.4%<br>Professional Services<br>Other Consumer Products  | 1<br>1                |
| Consumer Staples               | 1  | 1.2%         | Household & Personal Products   | 1                     | Consumer Staples               | 2            | 3.4%<br>Textiles & Apparel  | 2                     |
| Energy and Power               | 8  | 9.8%         | Oil & Gas<br>Power<br>Other Energy & Power  | 4<br>2<br>2           | Energy and Power               | 4            | 6.9%<br>Oil & Gas<br>Power<br>Other Energy & Power<br>Water and Waste Management                                    | 1<br>1<br>1<br>1      |
| Financials                     | 20 | 24.4%        | Credit Institutions<br>Insurance<br>Diversified Financials<br>Brokerage<br>Other Financials                               | 9<br>7<br>2<br>1<br>1 | Financials                     | 6            | 10.3%<br>Insurance<br>Asset Management<br>Alternative Financial Investments<br>Brokerage<br>Other Financials        | 2<br>1<br>1<br>1<br>1 |
| Healthcare                     | 4  | 4.9%         | Healthcare Equipment & Supplies   | 4                     | Healthcare                     | -            | -   | 0                     |
| High Technology                | 12 | 14.6%        | Computers & Peripherals<br>Software<br>Semiconductors<br>Electronics<br>IT Consulting & Services                          | 5<br>3<br>2<br>1<br>1 | High Technology                | 13           | 22.4%<br>Semiconductors<br>Electronics<br>Software<br>Computers & Peripherals<br>IT Consulting & Services           | 5<br>3<br>3<br>1<br>1 |
| Industrials                    | 15 | 18.3%        | Transportation & Infrastructure<br>Machinery<br>Automobiles & Components<br>Other Industrials<br>Aerospace & Defense      | 7<br>3<br>2<br>2<br>1 | Industrials                    | 11           | 19.0%<br>Machinery<br>Building/Construction & Engineering<br>Aerospace & Defense<br>Transportation & Infrastructure | 5<br>4<br>1<br>1      |
| Materials                      | 4  | 4.9%         | Construction Materials<br>Chemicals<br>Metals & Mining  | 1<br>2<br>1           | Materials                      | 3            | 5.2%<br>Metals & Mining<br>Other Materials  | 2<br>1                |
| Media and Entertainment        | 7  | 8.5%         | Publishing<br>Broadcasting<br>Hotels and Lodging<br>Motion Pictures / Audio Visual<br>Recreation & Leisure                | 3<br>1<br>1<br>1<br>1 | Media and Entertainment        | 12           | 20.7%<br>Broadcasting<br>Cable<br>Motion Pictures / Audio Visual<br>Hotels and Lodging                              | 7<br>2<br>2<br>1      |
| Retail                         | 4  | 4.9%         | Discount and Department Store Retailing<br>Food & Beverage Retailing<br>Internet and Catalog Retailing<br>Other Retailing | 1<br>1<br>1<br>1      | Retail                         | 2            | 3.4%<br>Other Retailing   | 2                     |
| Telecommunications             | 3  | 3.7%         | Telecommunications Equipment<br>Other Telecom   | 2<br>1                | Telecommunications             | 3            | 5.2%<br>Telecommunications Equipment<br>Telecommunications Services   | 2<br>1                |
| Total                          | 82 |              |   |                       | Total                          | 58           |   |                       |

Source: Thomson One Banker's Mergers and Acquisitions database.

**Table 4- 4. M&A&D of WH in the 1980s.**

| Mergers and Acquisitions       |    |              |   | Divestitures   |                                |              |   |                       |
|--------------------------------|----|--------------|---|----------------|--------------------------------|--------------|---|-----------------------|
| Macro Category                 |    | Mid Category |   | Macro Category |                                | Mid Category |   |                       |
| Consumer Products and Services | 4  | 14.8%        | Professional Services<br>Home Furnishings<br>Other Consumer Products    | 1<br>2<br>1    | Consumer Products and Services | 5            | 17.9%<br>Professional Services<br>Home Furnishings<br>Other Consumer Products   | 3<br>1<br>1           |
| Energy and Power               | 5  | 18.5%        | Water and Waste Management<br>Power<br>Other Energy & Power             | 3<br>1<br>1    | Energy and Power               | 5            | 17.9%<br>Other Energy & Power<br>Oil & Gas<br>Power   | 3<br>1<br>1           |
| Financials                     | 0  | -            | -   | 0              | Financials                     | 3            | 10.7%<br>Diversified Financials<br>Credit Institutions  | 2<br>1                |
| High Technology                | 5  | 18.5%        | Computers & Peripherals<br>Electronics<br>Semiconductors                | 2<br>2<br>1    | High Technology                | 3            | 10.7%<br>Computers & Peripherals<br>Electronics<br>Semiconductors   | 1<br>1<br>1           |
| Industrials                    | 7  | 25.9%        | Building/Construction & Engineering<br>Machinery<br>Aerospace & Defense | 4<br>2<br>1    | Industrials                    | 7            | 25.0%<br>Machinery<br>Aerospace & Defense<br>Automobiles & Components<br>Building/Construction & Engineering<br>Other Industrials | 3<br>1<br>1<br>1<br>1 |
| Materials                      | 1  | 3.7%         | Metals & Mining   | 1              | Materials                      | 0            | -   | 0                     |
| Media and Entertainment        | 3  | 11.1%        | Broadcasting  | 3              | Media and Entertainment        | 3            | 10.7%<br>Broadcasting<br>Cable<br>Motion Pictures / Audio Visual  | 1<br>1<br>1           |
| Real Estate                    | 1  | 3.7%         | Real Estate Management & Development                                    | 1              | Real Estate                    | 0            | -   | 0                     |
| Telecommunications             | 1  | 3.7%         | Other Telecom   | 1              | Telecommunications             | 2            | 7.1%<br>Telecommunications Equipment  | 2                     |
| Total                          | 27 |              |   |                | Total                          | 28           |   |                       |

Source: Thomson One Banker's Mergers and Acquisitions database.

Comparing both firms over the decade, GE clearly had a much larger scale of M&A&D than WH, which suggests that GE was able to more drastically restructure its diversified business portfolio. The large size and healthy financial standing of GE in the 1970s enabled it to transfer into a high-growth business. The corporate strategies of each firm influenced the directions of

their respective M&A pursuits. GE acquired a number of financial service and healthcare businesses. Both firms owned financial service subsidiaries, yet GE chose to diversify its business and used M&A to expand externally to achieve growth while WH chose to focus on fewer businesses and to expand internally<sup>476</sup>. Regarding healthcare, WH withdrew from the business in the 1960s while, on the other hand, GE continued to operate in healthcare even during a difficult period in the early 1970s<sup>477</sup>. It then evolved into one of GE's high-growth businesses by the end of the 1990s. Meanwhile, WH selected businesses such as home furnishing and broadcasting to be its key business lines. Although GE also entered into broadcasting through its merger with RCA, WH's acquisition accounted for a large part of WH as a business. In addition, WH decided to retrench from home furnishing through M&A rather than selling it, while GE never entered into the sector<sup>478</sup>.

Within this variety of numerous M&A's, however, the turbine-related business was not a target. Rather, GE's top management considered the business to be squeezed due a lack of market and simply reduced its employment from 35,000 to 17,000<sup>479</sup>. In addition, both WH and GE placed an emphasis on services, by offering a refurbishment program that would bring a turbine back to original specifications, and extend its life by 10-15 years, for about 40% of the cost of installing a new turbine<sup>480</sup>. The shift to services business was most notable in nuclear power,

particularly for WH. During the 1980s WH continuously strengthened related services, such as waste management, by acquiring a subsidiary of Hittman Corp in 1982, Numanco and PCI Energy in 1984, Fauske & Associates in 1986, and LN Technologies and Scientific Ecology Group in 1989<sup>481</sup>. Meanwhile GE also shifted to services but downsized the size of its business. While building profitable fuel and services businesses, which grew from \$14 million in 1981 to \$78 million in 1982 and to \$116 million in 1986, GE reduced the number of salaried employees in the reactor business from 2,410 in 1980 to 160 by 1985<sup>482</sup>. Aside from this downsizing in the nuclear business, in the 1980s GE still continued to “research for advanced reactors in the event the day would come when the world’s view of nuclear changed”<sup>483</sup>.

These differences came from the WH’s superior competitiveness in the nuclear power industry, as shown in table 4-5. WH was the manufacturer of record for 25% of all nuclear reactors built or on order, and accounted for 44% of the U.S. market share<sup>484</sup>. In addition, WH’s U.S. market share for nuclear fuel exceeded 50%, this against competitors such as Exxon Nuclear, GE, Combustion Engineering, and Babcock & Wilcox<sup>485</sup>. In 1988, WH’s nuclear-related business earned approximately 50% of its revenue from maintenance services & training, 30% from nuclear fuel, and 10% each from spare parts and equipment<sup>486</sup>.

**Table 4- 5. Market share of nuclear reactors in the Free World by 1988.**

| Technology  | Vendor                    | Number of Units |        | Market Share<br>All Reactors |
|-------------|---------------------------|-----------------|--------|------------------------------|
| PWR         | WH                        | 89              | 24.9%  | 16.8%                        |
|             | WH Licensees <sup>a</sup> | 83              | 23.2%  | 15.7%                        |
|             | Total WH                  | 172             | 48.0%  | 32.5%                        |
|             | Combustion Engineering    | 18              | 5.0%   | 3.4%                         |
|             | Babcock & Wilcox          | 11              | 3.1%   | 2.1%                         |
|             | BBR                       | 1               | 0.3%   | 0.2%                         |
|             | Kraftwerk Union           | 17              | 4.7%   | 3.2%                         |
| PWR Totals  |                           | 219             | 61.2%  | 41.3%                        |
| BWR         | GE                        | 62              | 17.3%  | 11.7%                        |
|             | GE Licensees <sup>b</sup> | 17              | 4.7%   | 3.2%                         |
|             | Total GE                  | 79              | 22.1%  | 14.9%                        |
|             | Kraftwerk Union           | 7               | 2.0%   | 1.3%                         |
|             | ASEA-Atom                 | 11              | 3.1%   | 2.1%                         |
| BWR Totals  |                           | 97              | 27.1%  | 18.3%                        |
| PHWR        | AECL/Canadian Group       | 34              | 9.5%   | 6.4%                         |
|             | Kraftwerk Union           | 3               | 0.8%   | 0.6%                         |
|             | Larsen and Toubro         |                 | 0.0%   |                              |
|             | Walchandnager Industries  |                 | 0.0%   |                              |
|             | Richardson & Cruddas      | 5               | 1.4%   | 0.9%                         |
| PHWR Totals |                           | 42              | 11.7%  | 7.9%                         |
| Totals      |                           | 358             | 100.0% | 67.5%                        |

a) Includes Mitsubishi Heavy Industries (Japan) and Framatome (France).

b) Includes Hitachi and Toshiba (Japan).

Original Source: Westinghouse Electric, Nuclear Market Acceptance and Comparative Experience.

Source: First Boston, Equity Research: Westinghouse Electric Corporation, in "Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

The shift to services as a complement to the power system business had the objective of "growing faster than the slow growth economy," a corporate strategy objective that was shared by the top managements of both GE and WH. But the manner by which they shifted to services differed. In shifting to services, GE chose to downsize and allocate resources for research while WH expanded its service-related business through M&A, especially in the field of nuclear power.

### 3. Path Dependence from Past Diversification

These different approaches between GE and WH, as applied to their traditional core business of turbine and power systems, were the result of diversification and investments in previous decades. During the restructuring period, GE sustained a full line of products in power systems, consisting mainly of nuclear power, conventional and gas turbines. During the 1950s-70s period, GE firmly established competitiveness for large conventional steam turbines and gas turbines, which shared technological knowledge with its jet engines business (see chapter 2). This competitiveness left GE in a position to lead on CCGT during the 1980s and 1990s. Unlike WH and other competitors, GE was able to build an innovative CCGT product through internal knowledge and capacities, and maintained its number one ranking in global market share while reducing the size of its workforce. In nuclear power, which also came as a result of past diversification, GE fell behind WH by 1988 but still held the number two position and provided alternative technology. GE chose not to divest but, instead, strategically allocated its resources only to services and research.

On the other hand, WH reinforced its nuclear power business through M&A, while exploiting external resources through joint ventures and alliances in CCGT. Although WH also

provided a full line of products, starting in the late 1960s it was faced with problems in conventional steam and gas turbines (see chapter 2). Consequently, WH could not build enough competitiveness to allow it to obtain a major share of the global CCGT market. WH provided the product and continued its research through alliances with other firms, such as Mitsubishi. Meanwhile, WH expanded its nuclear power service business by acquiring related businesses, such as waste management. This was the logic behind their decision-making. While stepping down from providing a full product line on its own, WH focused its resources on businesses that had a strong position and cooperated with other firms in businesses that were weak.

Under the business restructuring of the 1980s, both GE and WH refocused their power system business, outside of the wave of M&A, to meet the restructuring criterion of growing faster than the slow growth economy. It was the primary target for shifting from a manufacturing to a service business. GE chose to downsize the size of its business, maintain focus where they put their resources, but still provide a full line of power system products independently. WH chose to select the product for which they had a strong position, expand related businesses through M&A, and resigned itself to providing other products by itself but through external resources.

#### **IV. Same Mind, Different Options**

This chapter examines the influence that actions of the past top managements of GE and WH had on the different corporate transformations and on business competitiveness in their traditional business during the last two decades of twentieth century. Although many aspects of the divergence of both firms have been revealed by previous studies, additional aspects are raised in this chapter.

The first aspect is that the divergence between the two in terms of corporate investment behavior started gradually in the early 1980s, then much accelerated in the early 1990s when WH had to cope with its failing financial service subsidiary. The financial standings of the 1970s partly determined what top management could do in the 1980s in terms of investments and M&A.

Another aspect is the “path dependence” set by the 1960s. During the 1980s both top managements of GE and WH shared a similar perspective: what both firms aimed at through restructuring: selecting businesses and focusing resources on businesses growing faster than the slow growth economy. Their business portfolios had been varied since the 1960s, but the 1980s presented new opportunities. In its industrial business, GE could expand relatively easily into high-tech business because previous top managers at GE had left the firm with more financial



capacity than WH. The latter conducted its restructuring with a target of relatively lower-tech businesses, an inheritance from the great vision of the 1960s. Although, WH tried to shift its power system business into a more service-based business, this to mitigate what was otherwise a stagnant market, the divergence in restructuring also surfaced in its traditional core business, one shared with GE. In responding to new product demands for steam turbines, GE took the lead in global competition by integrating internal knowledge and capacities, built by continuous investments in steam and gas turbines and in jet engines, but strictly focused its resources on services and in nuclear power research. On the other hand, WH dominated the global nuclear power market, firmly established competitiveness had been built by continuous investments going back to the 1950s, while stepping back from global competition in sales of new steam turbines and exploiting external resources through cooperation with other firms.

As a result of the restructuring that took place in the 1980s, both came out as highly diversified firms. But GE succeeded in integrating unrelated businesses through its strong top level coordination, as Fleck analyzed, or through its strategic control, as Chandler pointed out<sup>487</sup>. The exercising of strong coordination was conducted under a new headquarters-based governance structure, as William Ocasio and John Joseph reveal<sup>488</sup>. By realizing the “integrated

diversified company,” GE achieved much higher growth than WH. When both firms were confronted with troubles in their financial service businesses, WH could not stand against the massive losses without selling off a number of businesses while GE managed the challenge and then saw its business eventually become the most profitable within the firm. In November 1996, when WH CEO Michael Jordan announced that WH would be split into an industrial company, named Westinghouse Electric Corporation, and a media-related company, named CBS Corporation<sup>489</sup>, it suggests that WH was unable to construct a means to integrate unrelated businesses. Jordan’s plan to split into two companies failed, perhaps because WH had lost its integration as one firm.

The divergence in the corporate transformations between GE and WH might be best captured under the need to find new modes of integration, as one firm, in the face of new global competition.

## Chapter 5

### Alternative Perspectives on Corporate Transformation

"Now that certain things have become clear to you,

it may have had the opposite effect—making the missing pieces even more significant."

Haruki Murakami, *Colorless Tsukuru Tazaki and His Years of Pilgrimage*

This thesis has been written with a focus on the second half of twentieth century of GE and WH, two American first movers in the electrical machinery industry, with the aim of gaining an understanding of the historical aspects of corporate transformation. The first chapter provides the research framework, into which an understanding of managerial perceptions is incorporated, through an examination of arguments between Chandler and critics over the decline of the U.S. industrial enterprise in the second half of the twentieth century. Chapter two reveals the interrelation between diversification strategies and business competitiveness during the 1946 to 1970 period, which is sometimes referred to as the Golden Age of the United States. Chapter three verifies the different responses taken to address difficult economic conditions during the 1970s, with emphasis placed on the oil crisis, a period when the American economy

was stagnant and often referred to as the Great U-Turn. Finally, chapter four examines the differences in restructuring that accompanied their corporate transformations that took place from 1980 to 2000.

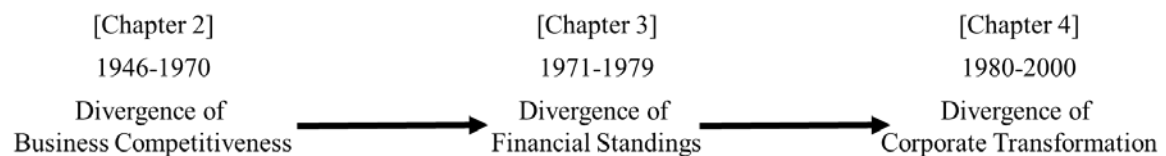
As described in the introduction to this thesis, although each chapter independently aims to find similarities and differences regarding top management actions and the business competitiveness of GE and WH, findings that provide a historically connection to the consequences of their respective corporate transformations in the late twentieth century. This current chapter intends to integrate each finding within the context of their respective corporate transformations, and provide the theoretical implications. The next section positions the main findings of the thesis into the historical streams of GE and WH. Later, these historical processes, those that influenced the resulting corporate transformations, are reflected within a theoretical framework. Finally the chapter concludes by indicating the limitations of this research and proposes areas for future study.

## **1. Business History of GE and WH in the Second Half of Twentieth Century**

### **(1) The Historical Path to Corporate Transformation**

GE and WH had been gradually extending their gap in differences since the end of WWII (see figure 5-1). Although GE, on average, was already twice the size of WH in terms of

sales and market share, both firms dominated the conventional steam turbine market in the U.S. during the postwar period. However, while they increasingly progressed their expansions and diversification of businesses, such as embedding in the military and social industrial complex, their relative business competitiveness began to diversify in their traditional core business, conventional steam turbines, although their profitability converged in the late 1960s when faced with foreign competitors.



**Figure 5-1. Nature of GE and WH divergence for each period.**

Source: Author.

The next decade, the 1960s, saw a divergence between the two firms in terms of their respective financial standings. Both firms relied on strategic planning to try to maximize corporate performance in a stagnant economy. While divesting unprofitable businesses, GE acquired Utah International, at the time the largest merger in U.S. corporate history. Although it was a diversification into an unrelated business line, the natural resource business, GE proceeded on the basis that it would improve profitability. WH, on the other hand, had to face unforeseen expenditures that emerged from its core businesses of steam turbines and nuclear power. The

problem related to the supply price for uranium, in particular, worsened its financial standing, extending the gap between them by the end of the 1970s.

Entering 1980, GE and WH had more dissimilarities than what they had in common. Even though they both competed in the power system business, their portfolio of other businesses resulted in extending the gap in financial standings even more than was the case prior to 1970. Nevertheless, what the top managements of GE and WH sought for corporate growth was somewhat similar. While there were a number of differences in manufacturing, both firms had financial and other service businesses in common. Subsequently, they both began achieving growth, although GE grew at a much greater pace than WH. Due to the gap in capital strengths, however, the two firms were into rather contrasting corporate transformations when they were both faced with huge losses in their financial business. While GE, with its strong financial standing, was capable of absorbing the loss and then went onto rapidly expand the business for significant profit, WH not only had to sell a number of business to cover the loss, in the end it also transformed itself into a media company, and was renamed CBS Corporation. Thus GE was able to successfully combine its traditional industrial business with services and high technology businesses, while WH metamorphosed into a new media conglomerate enterprise that was based on a traditional business of WH<sup>490</sup>.

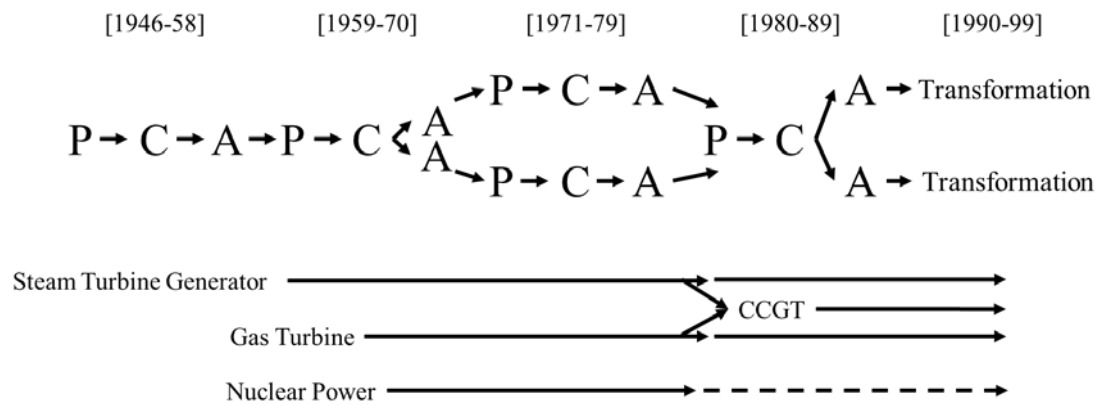
The result of this expanding gap between the two firms led to rather contrasting corporate transformations in the late 1990s. Then gap, itself, was the consequence of an accumulation of top management actions taken over five decades. More precisely, it was determined by the interrelation between path dependency, as an accumulation of past top management actions, and corporate strategy, as a reflection of top management actions taken in each period. The diversification/divesting strategies had particular influence on the corporate performance and business competitiveness of both firms. While the growth in sales and profit was attributed to diversification, existing business competitiveness in steam turbines, for example, was also affected by the distribution of management resources.

A diversification strategy can be regarded as the product of a set of top management actions. It has been broadly associated with top management actions in a number of manners, such as integrated sequence of decisions, managerial services, perceptions of decision-makers, course of action, keiei-koso-ryoku, business conceptions, managerial capabilities, entrepreneurial perceptions, dynamic capabilities and so on<sup>491</sup>. From these literatures, at least three basic actions of top management can be identified, perceiving the external environment, conceiving the future and taking action. To facilitate explanation, these three top management actions are called, as a set, managerial visaction<sup>492</sup>. It can be said that the different diversification strategies

were a result of differences in managerial vision, and this led to an expanded gap between GE and WH.

From 1946 to 1958, GE and WH pursued mostly the same vision (see figure 5-2). They were more or less obligated to diversify into military products, partly because it was perceived to be a public responsibility at the time. This led both firms to become embedded into parts of the military-industrial complex. In the expansion of military business, GE took the lead converting the steam turbine business to produce large custom-designed products, which required more human resources to build. Consequently, under a similar diversification strategy, the size of firm and its availability of business resources became factors of competition in the conventional steam turbine industry. While GE had access to sufficient human resources for both its military and turbine businesses, WH was challenged by a shortage of engineers because more engineers were required than they were able to secure. Subsequently WH experienced a decline in profitability in the turbine business and, by 1960, had also left the jet engine business. While they enlarged the gap in their military and turbine businesses, they still shared a number of similarities.





**Figure 5-2. Managerial visaction and the turbine business, 1946-1999.**

Source: Author.

Note: "P" indicates perceiving the external environment, "C" indicates conceiving the future, and "A" indicates taking action.

After appeasing a huge demand for steam turbines, the top managements of both firms shared perceptions of the external environment and had similar conceptions of the future, but each took their own actions on diversification between 1959 and 1970 (see figure 2). Both firms found potential business in education, health and community development, which appeared to have the support of the government's new social welfare program. Although they both entered into these markets, WH demonstrated a stronger commitment through the purchase of new businesses, while GE also established these businesses it was expanding its international business. When they started to become embedded in the social- industrial complex, in addition to the military-industrial complex, the turbine business had entry into a new industrial environment. The U.S. electric utilities gradually began awarding contracts to foreign firms and also sought new products, such as gas turbine and nuclear power in addition to much larger

steam turbines. GE was able to respond to the demand and maintain competitiveness for these products. Being successful in attaining almost the same market share in nuclear power as GE, WH was unable to manage massive orders of other turbines. Furthermore, its product quality and customer reputation was in decline in the late 1960s due to product technological issues. As a result, foreign competitors started to displace WH on new orders. A major reason of this problem was an inadequate investment in the turbine business, other than for nuclear power. Even though WH saw its competitiveness decline in its traditional business, WH still managed to improve corporate performance through diversification while GE, by 1970, was seeing its profitability decline through diversification. Entered the 1970s, the gap between them was extended more in their business structures as well as in the traditional turbine business.

The top managements of GE and WH eventually took different managerial visaction in the 1970s (see figure 2). Particularly after the first oil crisis in 1973, the respective top managements took different approaches to get through the national economic decline while also being concerned with double-digit inflation. GE top management, under CEO Reginald Jones, saw the most significant influence of the first oil crisis on the economic system to be galloping inflation, and began seeking a cure for inflation. For that reason, GE merged with Utah International in 1976, the largest acquisition at the time, as a valuable hedge against worldwide inflation. In

addition, their internal studies on countermeasure to inflation resulted in the launch of a management education program in 1979, called COIN (Effectively Coping with Inflation)<sup>493</sup>. While reinforcing its financial standing, GE embarked on multiple responses to cope with the energy crisis. GE did not focus on a particular technology, such as nuclear energy, but instead provided full-line power equipment and infrastructures. GE, in particular, received numerous orders for gas turbine after electric utilities became concerned over nuclear regulations, technological developments and uncertainty over the supply of uranium and plutonium treatment.

WH, on the other hand, attempted to cope with the energy crisis and rampant inflation by focusing on nuclear power and transforming back into an electrical equipment firm. Their logic was that the main long-term solution to the energy problem was more installations of nuclear power, which would use uranium as a possible candidate to substitute oil. In addition, nuclear energy would lead to a decline in the cost of electric energy, contributing to a slowdown in the rate of inflation because electricity was a basic driver for economic growth. The reason for emphasizing nuclear power was actually due to the decline of WH competitiveness in other turbine products, such as conventional steam turbines and gas turbines. WH faced a lawsuit from utilities due to problems with steam turbines and responded by repairing a number of its steam

and gas turbines that had been installed since the late 1960s. To make matters worse, WH encountered a huge problem in the nuclear power business in the middle of the 1970s. From 1975 to 1979, WH had to defend against 17 lawsuits launched by 27 public utility customers, this because WH was unable to supply uranium at the guaranteed price stated in its contracts, due to a rapid rise in the price of uranium that was caused by the formation of an international cartel of uranium production companies. As a consequence, the settlements from the legal actions generated \$493 million in losses. WH was, undoubtedly, facing a much harder financial position in the late 1970s than GE. By 1980, the gap had grown in financial standing as well as in lines of business and competitiveness in turbine products.

Contrary to the 1970s, GE and WH had perceived and conceived in a similar manner, but the actions taken were dissimilar, mainly because they were significantly different firms (see figure 2). Entering the 1980s, GE and WH commenced the process of restructuring their business portfolios in the face of fierce competition with foreign firms. Even though both entered the factory automation business and sold off electrical appliances, there were increasingly more differences due to their divergence in business operations. GE took a “No.1 or No.2” strategy under new CEO Jack Welch and executed its restructuring through a series of large scale M&A. GE obtained software services, insurance companies and disposed of its natural

resources businesses. Meanwhile, WH was also acquiring and divesting businesses though with a far less volume of M&A. WH acquired nuclear service, beverage bottling, broadcasting, and divested some of its broadcasting and businesses in the educational division.

The last half of 1980s was a business growth period for both GE and WH, centered on M&A and boosted by an international relaxation of monetary restrictions that resulted in the development and expansion of the global financial market. Both companies rode this wave. GE expanded their financial service subsidiaries through M&A, and merged RCA and other businesses to strengthen its holdings in lines such as medical equipment, plastics and locomotives. GE parted with parts of its RCA business, NBC being the exception, and business related to factory automation and TV manufacturing. WH mergers, on the other hand, focused mainly on broadcasting, furniture, nuclear service, real estate, and business related to residential construction, while it divested elevator, transmission and distribution equipment businesses. Perceiving financial services as vital source of profit, WH took an internal growth strategy for its financial business whereas GE pursued an external growth strategy. The more global competition increased in the 1980s, the more the existing business portfolio, a reflection of past decisions, became the basis for corporate growth. Under this restructuring, the common business for GE and WH, steam turbines, contributed to an expansion of the gap in business competitiveness. GE

maintained its competitiveness and leading firm position, including for the new CCGT product, while WH joined foreign firms as one of followers. Although WH was still a leading firm in nuclear power, the demand for nuclear power in the 1970s was lower than anticipated and worsened after the Three Mile Island accident in 1979. The low competitiveness eventually led WH to split its power system business.

When both had to pay for huge losses of their financial business, WH could not cover the loss while GE was able to weather the effects due to an abundance of internal funds attained through higher corporate growth. And the gap in operated businesses and financial standings resulted in different corporate transformations by the end of the century. GE was successful in combining manufacturing, services and financial businesses while WH focused on one of its traditional businesses, broadcasting, and turned itself into a large media company, known as the CBS Corporation. Hence, the divergence in corporate transformation can be seen as a result of a long road of managerial vision influences and to changes in the socioeconomic environment surrounding their business enterprises.

## (2) Interpreting the History in a Management Studies Context

In terms of a management research perspective, the history of these two corporate transformations can be summarized as “the transition from one type of organization into another” in

order to adapt to changes in the business environment. For instance, Raymond Miles and Charles Snow have proposed four ideal forms of organizational responses to adapt to the environment: Defenders, Prospectors, Analyzers, and Reactors<sup>494</sup>. GE and WH were situated in the rather complex environments, such as aerospace business, as described by Miles and Snow<sup>495</sup>. Thus it is difficult to draw a clear lines for GE and WH when considering the four types. However, even though their histories reveal a number of shared general characteristics of the four types, there can be classified by time-period on the basis of the characteristics of their prevailing CEOs and corporate strategies. GE changed from Prospector, to Defender, to Analyzer between 1946 and 2000<sup>496</sup>. During the 1950s and 1960s, CEOs of GE were primarily engaged in sales and marketing before becoming CEO, characteristic of Prospectors and Analyzers. As described above, GE was exploring the new business opportunities at the time. This is reflective of the Prospector type. In the 1970s, because of the strong finance background of the CEO, GE became a Defense type. During the last two decades of the century, the CEO came from a chemical engineering background, linked to the field of applied research. In addition, at the time GE looked to both concurrently reinforce its traditional core business and capture opportunities for new business. Based on Miles and Snow's classification, GE was transformed into an Analyzer.

On the other hand, WH changed from Defender, to Analyzer-Reactor, to Defender over the same period. Since the CEOs of WH came from banking, management consulting, and manufacturing engineering, WH can be classified as a Defender type organization during the 1950s and 1960s. From the 1970s to the early 1990s, WH became an Analyzer type because all the CEOs were previously engaged in applied engineering and came from the same business group, Industry and Defense. As result of their management, WH turned into a Reactor type, unable to respond effectively to environmental change and uncertainty. Later, under a CEO who's past came from business consulting and investment firms, WH became a Defender type.

From Miles and Snow's framework on managerial succession, GE and WH, while operating in the same business environment, exhibit different organizational types between 1946 and 2000.

## **2. Beyond Empirical Evidence: Implications for Management Research**

### **(1) Corporate Transformation and the Search for New Structure and New Strategy**

What does the history of these two corporate transformations tell us? What insight does this historical case study provide in terms of management research? Taking up GE and WH as a representative case of contrasts in the evolution of modern industrial firms, or Chandlerian



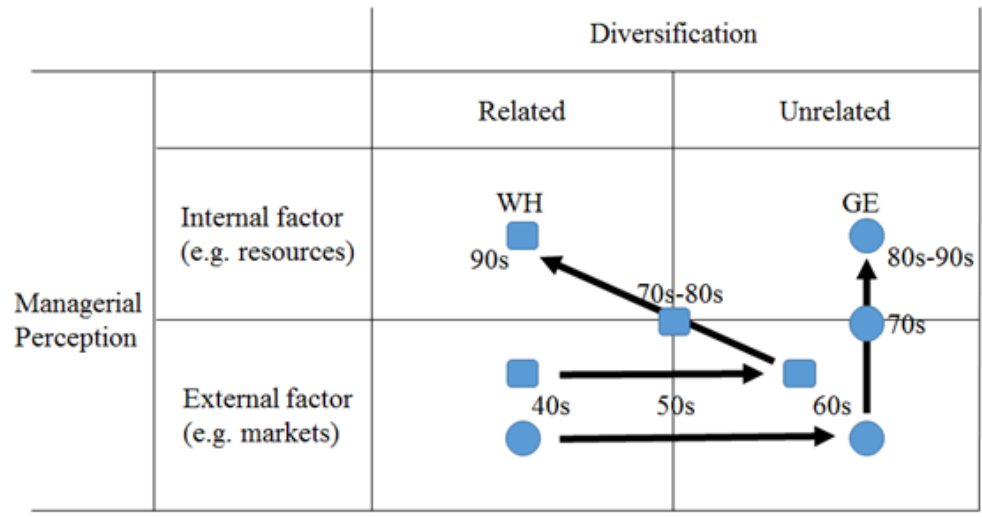
firms, in the postwar period, this thesis provides a comparative examination by focusing on the transition in terms of diversification and managerial perceptions.

The history of the two firms leads one to separate diversification into two categories, related diversification and unrelated diversification. One can assume it would be management perceptions that would lead to decisions on which category to pursue or divest.

As these diversifications are based on top management perceptions of the socio-economic environment, it is managerial perception that gives legitimacy to any proposed diversification. There are two possible reasons that may have influenced top management decisions on diversification. The first one would be internal reasons, such as the need to weigh available resources across the business portfolio. When top management perceived that they could utilize their existing resources, they entered new business. The second reason is external, such as connecting to complementary markets. The decision to launch a new business is made when they see a link can be made to its existing business, as complementary products.

Charting the GE and WH diversification paths between 1946 and 1999, the intersection of the axes can be depicted on the basis of four factors, as shown in figure 5-3. The horizontal axis indicates the diversification, which is divided into related and unrelated diversifications.

The vertical axis considers managerial perception, reflecting which factor top management more emphasizes to legitimate its diversification into new business.



**Figure 5-3. Characteristics of diversification for postwar GE and WH.**  
Source: Author.

In the 1940s, the top managements of GE and WH legitimized the need for related diversification by stressing the linkage to markets with existing business under the benign circle of electric power, although they were still diversified into national defense business, as an aftereffect to the war. Partly in response to demands from the government, they both expanded their defense business over the next decade so that it led them to steer away from related diversification, but not to return to the unrelated business seen in the 1960s. At the end of the decade, although GE expanded its existing and international businesses, both firms are situated at the lower right on the figure 5-3, when they began highly diversifying their business by expanding the logic of the benign circle.

Their manner of diversification diverged after the 1960s. WH top management recognized a disintegration of the benign circle in the early 1970s. Facing a severe cash crisis, WH began disposing a number of unprofitable businesses, both related and unrelated businesses, such as major appliances, auto rental, and desalination<sup>497</sup>. WH continued to operate both related and unrelated businesses as long as they were profitable, although the logic that legitimated the diversification was already gone. When WH began restructuring its business structure in the 1980s through M&A, the same profitability of business policy used in the 1970s continued, so they expanded to low-technology businesses such as furniture. Hence, WH's diversification of the 1970s and 1980s is plotted on the center of the grid due to its unsuitability to any category on the matrix. In the 1990s, however, WH took the path of becoming a media company through M&A&D, drawing from one of its traditional business lines, broadcasting. Because WH could not afford to hold onto its variety of business lines after the failure of its financial business, top management concentrated its resources on the most profitable businesses in the portfolio. By the end of the century, WH proceeded on related diversification in media and disposed of other manufacturing and services businesses. WH seemed to follow the logic of managerial enterprise, as emphasized by Chandler, but was implementing in a non-industrial business<sup>498</sup>.

GE, on the other hand, took a different path. Although they sold a number of businesses acquired in the 1960s, GE top management diversified into the natural resource business through its merger with Utah International. This unrelated diversification was motivated by other factors, such as profitability and inflation. Therefore the GE of the 1970s is plotted in the unrelated diversification category, but neither internal nor external categories on managerial perception. Over next two decades, GE advanced on a new unrelated diversification phase. Like WH, GE dismissed the logic of the benign circle by divesting the related businesses to their power system business, such as large transformer, air-conditioning, small appliances, consumer electronics and so on. Concurrently, GE top management began disposing of whatever business that did not follow the criteria: No. 1 or No. 2 in growth market, higher-margin and higher-growth, high pricing power, and consistent income growth<sup>499</sup>. Subsequently, they left businesses such as natural resources, semiconductors, and even profitable defense business. The result of restructuring left GE remaining to be an unrelated diversified firm, which operated from power system, medical equipment, to broadcasting and financial service businesses. However, despite this unrelated diversification, the GE of the 1980s, in terms of managerial perception, differed from the previous GE.

GE top management not only selected the business on the basis of the above criteria, attention was also paid to the integration of the business through sharing value and information. Instead of a highly hierarchical organization, according to Joseph and Ocasio's insightful studies on GE<sup>500</sup>, GE top management controlled the businesses and coordinated its organization by modifying its governance system in headquarters. For instance GE reduced the hierarchy in the 1980s and changed the role of the Corporate Executive Council, or CEC, to a meeting where Welch informed the executive members, all directly accountable to the CEO, of corporate strategic initiatives while serving as a central information exchange between the members<sup>501</sup>. Through the revised CEC, GE set sights to becoming an "integrated diversified company", as expressed by CEO Jack Welch<sup>502</sup>. In addition, GE shared best ideas and practices among its businesses through the CEC and a later program called Work-Out, which was the program to share ideas among other employees beyond top-level<sup>503</sup>. To integrate unrelated businesses, GE developed another governance system called the Operating System, which centralized the corporate reporting structure through the development of new governance channels and information sharing systems for employees<sup>504</sup>. Thus GE top management selected businesses that had something in common, in terms of speed of growth, competitive environment, and the sharing ideas or values. GE consequently took a different path from that of WH, and is placed

at the lower right in the figure 5-3. In a sense, GE did not follow the logic of managerial enterprise but developed another logic for corporate growth.

Figure 5-3 can be refined and restated as in figure 5-4. The left side of figure 5-4 is the world of logic that Alfred Chandler emphasized for the achievement of corporate growth. A firm located on the upper left in figure 4 is able to realize corporate growth through diversifying into the forward or backward businesses that are related to its existing business, well known as vertical integration<sup>505</sup>. Top management took on diversification to control materials and outlets for its product<sup>506</sup>. Thus, the fundamental determination to enter a business was based on internal factors, such as resources and core business. Since vertical integration usually responded to narrow opportunities, top management pursued further growth by moving into related product markets or by moving abroad<sup>507</sup>. The lower left on figure 4 reflects such a world of logic for corporate growth, through diversifying into related product markets<sup>508</sup>. It is true that diversification is based on the cost advantages arising from economies of scope, but firms begin diversifying when top management perceives an opportunity in the market<sup>509</sup>. The emphasis on this managerial perception in diversification is different from the one in vertical integration because it focuses more on external factor, such as markets. In any case, the left side of figure 4 is what Chandler insisted to be the logic for corporate growth, especially as a managerial enterprise. As

a consequence of diversification, managerial enterprises, which are “large industrial concerns in which operating and investment decisions are made by a hierarchy of salaried managers governed by a board of directors<sup>510</sup>,” adopted a multidivisional structure to solve administrative overload<sup>511</sup>. In other words, it can be said that the overload of top management is reduced by a multidivisional structure to release “managerial services,” to use Edith Penrose’s terminology, for another growth<sup>512</sup>.

|                       |                                  | Diversification      |                    |
|-----------------------|----------------------------------|----------------------|--------------------|
|                       |                                  | Related              | Unrelated          |
| Managerial Perception | Internal factor (e.g. resources) | Vertical Integration | Shared Integration |
|                       | External factor (e.g. markets)   | Diversification      | Unification        |

Economies of Scope      Economies of Combination

Organizational Structure      Governance Channel  
e.g. U- Form, M-Form

**Figure 5-4. Characteristics of diversification.**

Source: Author.

The right side of the figure is the world where Chandler had negative comments for corporate growth, as the tangled logic of diversification<sup>513</sup>. A firm located in the lower right on the figure 4 is unable to sustain its growth because unrelated diversification leads to a separation of top management in the corporate office from the middle management responsible for running

the operating divisions and battling for market share and profits<sup>514</sup>. In addition, top managers would begin to lose the capabilities needed to maintain a unified enterprise where the whole is more than the sum of its parts<sup>515</sup>. In the case of GE and WH, a valid reason for the over-diversification would be an expansion of the logic of related diversification, such as the benign cycle. They identified new ways of providing their products, a system product, and saw the opportunities. WH more committed to this approach and accordingly expanded their business. Managerial perception in this segment of the grid, therefore, also emphasizes external factors, like diversification. I call this lower right segment unification to distinguish it from diversification, where GE and WH tried to provide a system of products by unifying a number of products. The foundation of the unification strategy is based on the economies of selling a system with combined products, which I call economies of combination<sup>516</sup>. However, GE and WH were unable, during the 1960s and 1970s, to develop a new organizational structure to achieve corporate growth under this new strategy. As a result, they both declined in profitability. Chandler points out that it was this separation of top and middle management that was the fundamental problem in the strategy.

By solving the problem GE was able to advance to the upper right segment on the figure 4 and enjoy another round of corporate growth, a situation not deeply examined by Chandler.



As previously described, GE was able to achieve high growth by selecting its business under common criteria and integrating the businesses through the sharing of ideas, best practices, information and values. In other words, GE's top management perception was more concentrated on internal factors when they selected businesses. As a consequence, GE's business portfolio was still an unrelated diversification but with high growth. Behind this high growth, GE realized another form of economies of combination. GE did not go for the demand side of economies of combination, which is accomplished in the 1960s by combining each product demanded into one system of product demand, but instead focused on the supply side of economies of combination, by sharing information and looking to complement each other as a part of a unified product (e.g. financial services and plastic business<sup>517</sup>). In addition, rather than developing a new hierarchical organization, GE developed a new governance system to resolve the separation of top and middle management and still achieve the economies of combination. Thus GE regrowth was accomplished through a new type of integration, which I call shared integration for convenience.

The right side of the figure is the world of post-Chandler, where a firm does not follow Chandler's logic of corporate growth. When firms aim at unification to achieve growth, they can fail because of the lack of new organization to achieve the economies of combination. But

firms can be able to grow and demonstrate the economies of combination when they integrate unrelated businesses through a sharing of business resources and by reducing the overload on the top management of the new organization. While on the left side, the key factors for corporate growth are related diversification, economies of scope (and scale), and organizational structure (e.g. multidivisional structure), the right side of looks to unrelated diversification, economies of combination (and scale), and governance system / channel as keys for corporate growth.

In the case of GE and WH after the war and toward the end of the century, it can be said that it was a process of developing new organizations to match a new strategy, namely unrelated diversification. Chandler states that strategy follows structure, GE and WH have followed his principle. But it took over four decades to find the structure (i.e. governance system) which matched the new strategy for corporate growth. Until finding the structure, as Penrose describes, managerial resources became the limitation to corporate growth<sup>518</sup>. When GE began to find ways of releasing managerial services to pursue renewed growth, GE did grow under a different logic of the managerial enterprise.

(2) Nature of Managerial Capabilities

One of the research questions left by Chandler is an understanding of the evolution of diversification. More precisely, although he divided diversification into related and unrelated, he has not advanced an analysis of diversification, such as distinctions between concentric and conglomerate diversification strategies<sup>519</sup>. He knows that GE, an unrelated diversified Chandlerian firm, achieved a successful corporate growth during the 1980s by introducing strategic control and changing the role of headquarters<sup>520</sup>. After publishing *Scale and Scope: The Dynamics of Industrial Capitalism*, however, he started to examine the different characteristics between industries that reflect different technological features, such as between high-tech or low-tech, rather than focusing on why some unrelated diversified enterprises have been growing and maintained their business competitiveness<sup>521</sup>.

This thesis proposes that it does not matter whether a firm selects related or unrelated diversification for corporate growth but it is a vital factor that top management is capable of integrating a number of businesses into a unified enterprise. In addition, although it is recognized that an overload of top management limits corporate growth, as Chandler (and Penrose) verified, the hierarchical organization is not the only approach to reducing this overload. After widespread diversification strategies and multidivisional structuring amongst big business en-

terprises, it became rather difficult to differentiate strictly on the basis of adapting a new strategy and structure. As Joseph and Ocasio reveal, given the limits of structural differentiation between strategy and operations for strategic adaptation, diversified business enterprises required specialized structures for integration across levels and function<sup>522</sup>. Although it is difficult to manage a unification of unrelated businesses, as WH experienced, GE succeeded in developing a new governance system / channel and released managerial services for the next growth, as pointed out by Penrose.

The reason GE was able to develop the new organization was the fact that GE's top and middle managers had learned great managerial capabilities, as a result of continuous investment in management after the war and what Chandler indicates as a one of three most important investments to building competitive advantage<sup>523</sup>. Managerial capabilities, which Chandler avoids examining due to difficulties of generalization<sup>524</sup>, may be the vital role to not only creating new organizations but also realizing new approaches for corporate growth. Furthermore, based on a number of insights from previous studies of GE and its history of corporate transformation gained from this empirical study, it is the top managerial capabilities to integrate a business enterprise that counts, it is not just holding the old and new businesses but combining the

old and new businesses through new approaches for further corporate growth. When responding to a new business environment, alternate integration approaches can emerge for the “product”, such as integration by technology (e.g. standardized interface) or integration by long-term relationships (e.g. keiretsu)<sup>525</sup>. Top management teams also develop new ways of integrating the “organization”, as an integrated highly diversified firm (i.e. GE) that is able to achieve re-growth, while other top management teams struggle and cannot find the way (i.e. WH), so the recourse is back to the related diversified firm. In this sense, a critical aspect of managerial capabilities is to be able to develop approaches to integrate the firm. Managerial visaction is one of way of using historical background to capture managerial capabilities.

Through comparative studies of GE and WH, it can be said that firms will continuously grow as long as they keep evolving their “visible hand”, even during periods of rapid change on the socio-economic environment. Massive post-war changes in the business environment forced changes and corporate transformations amongst U.S. industrial enterprises, the historical development of the “visible hand” may also determine way for corporate transformation. Failure to develop the hand requires a return to a basic logic for corporate growth. By the end of the twentieth century, GE had found the new path for corporate growth. But the approach might be already out-of-date. A second wave of globalization is highly advanced<sup>526</sup>, and different forms

of unrelated diversification have already emerged. Apple, Google, and Amazon, all high growth firms, have been conducting unrelated diversification. There should be economies of scale, scope, combination, or even new types of economies to support their corporate growth. As discussed in this thesis, approaches to corporate growth involve on evolution. These firms developed ways to integrate and reduce the overload on top management. Furthermore the development of IT technology may lead to the development of a new hierarchical organization that further releases managerial services, yet to be developed at any degree of significance. In any case, the supposition is the firm will break out a state-of-the-art approach for sustained corporate growth that also continues to invest in management and build high managerial capabilities.

### **3. Topics for Further Research**

This thesis is based on a comparative study of only two American electrical manufacturing firms in the second half of twentieth century. Therefore there remains a number of unanswered aspects. For instance, the two firms are examined in terms of the role of management in utilizing productive resources, as per the “early Chandler’s” perspective<sup>527</sup>. It does not consider the “later Chandler” perspective that emphasized the role of management in developing productive resources<sup>528</sup>. Thus future research should also examine the building of capabilities, such

as the coordinating capabilities that Fleck insists on and the dynamic capabilities that Teece et al. state<sup>529</sup>. Focusing on this specific point may contribute to a more generalized view of managerial capabilities and top management, which Chandler avoids due to difficulties in generalizing<sup>530</sup>. In addition, this study is limited to the U.S. Further study in terms of international comparisons is needed to better understand organizational capabilities of electrical manufacturing firms, as in Tell's study between U.S. and Europe firms<sup>531</sup>.

Joseph and Ocasio's governance channel structure is another way to understand why some highly diversified enterprises are able to sustain corporate growth. There is a need for future study to compare GE's governance system with that of other firms. In terms of managerial perceptions, as Kahneman's works demonstrate<sup>532</sup>, insight can be provided by historically exploring managers' cognitive habits, such as heuristics and biases. The intent is to reveal another aspect of corporate transformation by new research on capabilities, the governance system of the firms, and managerial perceptions.

## **Addendum A**

### **Model for Investment Trajectory Analysis:**

#### **A Case Study of American and Japanese Electronics Enterprises**

##### **I. Visualizing Corporate Investments**

Corporate investment is a key indicator providing evidence of top management directions and influence, and is often a result of management “perceptions” and “conceptions”. Since the 1980s it has become difficult to obtain in-house corporate documents that reveal these management perceptions. In response, a unique investment data processing model is introduced, to compensate for this lack of historical documentation, namely the Investment Trajectories Analysis (ITA). Addendum A describes the original model on which ITA was based, and then how it was influenced and modified by the outcomes of business history discussions, particularly the works of Alfred D. Chandler. Finally, a case study is introduced to draw out behavioral difference between enterprises, by analyzing American and Japanese electronics enterprises in the late 20th century to the early 21st century.



## II. Kodaira and Kodama Model

Kodaira and Kodama (2005, 2007) propose two analytical models, called “Business Model Analysis Chart (BMAC)” and “Expenses on Sales-related Activities Trajectory Analysis Chart (ESAC).” These models aim to identify the relationship between a CEO’s investments and related decisions by visualizing the corporate strategy. Also discussed is the link between R&D investments and capital spending.

### 1. Background of the Model

Kodama (1991) was the first to make the argument<sup>533</sup>. In his research results, Kodama interpreted that the trend of R&D expenses surpassing capital investment, as experienced by many Japanese manufacturing firms in the late 1980s, reflected a shift from the *producing organization* to the *thinking organization*<sup>534</sup>, which he considered not to be a decline of R&D investment efficiency but more the secret of strength of Japanese manufacturing competitiveness<sup>535</sup>. Although his view was widely accepted under the bubble economy in Japan, an opposite interpretation then emerged. The phenomenon of R&D exceeding capital investment was then considered to reflect poor performance and inefficiency of R&D investment and led to a return to capital investment. This under the backdrop of a sluggish Japanese economy, called “the lost decades”, and a declining competitiveness of Japanese manufacturers<sup>536</sup>.

Araoka (2004) raises doubt about this emerging interpretation when pointing out a fundamental defect in data analysis, and then affirms Kodama's view through a data analysis covering 1980 to 2002. He indicates that the "commercializing investment," i.e. R&D plus capital investment, remained stable as a percentage of sales from the 1980s to the 1990s, but the R&D investment ratio increased and was offset by decreases in capital investment. This supports Kodama's interpretation that manufacturing enterprises seek to increase capital productivity through employing a substitution of capital investment with R&D<sup>537</sup>.

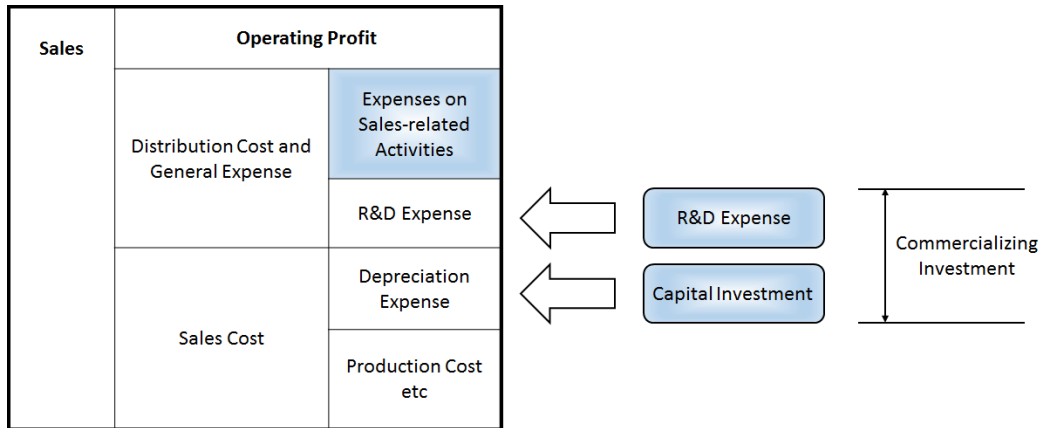
While Kodaira and Kodama (2005) are supported by Araoka's argument, they consider commercializing investment to be an essential factor in assessing corporate structural change. Based on these arguments, Kodaira and Kodama (2005, 2007) build models to analyze corporate changes at the micro level, under the hypothesis that Kodama's interpretation is correct.

## 2. KK Model

Kodaira and Kodama (2005, 2007) develop a simple analytical model (hereafter the KK model) that attempts to visualize and determine the point and time of corporate strategic change (and business model change) of Japanese manufacturing firms, through the use of a scatter diagram on spreadsheet software<sup>538</sup>.

### (1) The Assumption behind the KK model

This model is developed from the assumption that setting the parameters of decision-making for a manufacturing enterprise CEO should involve consideration of the relationships between three important factors: R&D expense, capital investment and expenses on sales-related activities. Figure A-1 breaks down sales, as a comprehensive indicator of corporate performance, into its underlying factors: (1) operating profit, (2) expenses on sales-related activities and R&D expense, and (3) depreciation expense and production cost. Among these factors, operating profit stands out as an outcome variable that reflects the result of decisions rather than a true variable of decision-making, whereas depreciation expense is a dependent variable arising from capital investment decisions that result in an accumulation of capital. Production cost, on the other hand, fundamentally depends on the technology at use at the time. As it is necessary to introduce new materials and manufacturing technology for competitive production, the Chief Technical Officer or manufacturing manager are given responsibility for such decision-making. The CEO makes decisions on the general allocation of resources and, as a result, has an impact on decisions taken by others. In effect, R&D expense, capital investment and expenses on sales-related activities are the parameters under which a CEO's decisions are made, within the variables in Figure A-1.



**Figure A- 1 Relation between R&D expense, capital investment, and expenses on sales-related activities.**  
 Source: Kazuichiro Kodaira and Fumio Kodama,ama, “Saiko-keiei-sekininsha (CEO) no senryaku tenkan no kashika,” *Technology and Economy*, no.483, (2007): p.45.

(2) Three Parameters of the KK model

Under the above assumption, Kodaira and Kodama (2005, 2007) focus on the three variables as a means to quantitatively visualize corporate strategy. In Figure A-1, R&D expenses are reflected under the “distribution cost and general expense”. Characteristics of this expense category include: (1) has a direct effect on operating profits, (2) once decided, it is not easy to reduce the scale of investment as a good half of the expenses are derived from personnel expenses, an essential investment for running a continuous business, and (3) it can still be cut as an effective means to improve short-term profitability, although this would accelerate the pace at which a firm matures.

As capital investment is reflected under assets, it is captured in the KK as depreciation expense. Evaluating the scale of long-term investment requires a gaining of understanding of

how the ratio of capital investment to sales influenced the sales revenue. Although senior management can occasionally defer the timing of capital investments, this would not immediately improve profitability because capital investment is off the income statement, business earnings are affected by changes in depreciation expense<sup>539</sup>. Thus, capital investment can serve as an appropriate parameter in understanding corporate strategy and business model changes as well as R&D expense.

Expenses on sales-related activities are calculated by subtracting R&D expense from the distribution cost and general expense. Even though the data includes other costs, it is still valid to apply this methodology to determine the level of sales-related expense if verified to be reflective<sup>540</sup>. If the product sales target is the objective, the CEO can increase expenses on sales-related activities in order to promote the product in the marketplace, such as employing a marketing strategy. Thus, expenses on sales-related activities serve as an appropriate third parameter for analyzing corporate strategy.

In summary, the KK model aims to capture the manufacturing enterprise strategy by means of these three variables, R&D expense, capital investment and expenses on sales-related activities.

### (3) Method of Data Processing

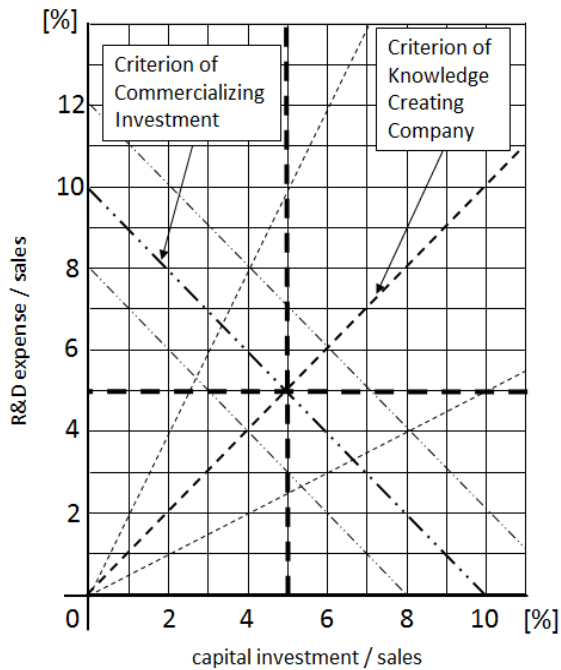
The corporate data employed under the KK model are sales and the three parameters discussed above. The data is taken from unconsolidated financial data sourced from *Yukashoken Hokokusho* (Annual Securities Report), which is the Japanese equivalent to SEC filing requirements, such as Form 10-K in the U.S.<sup>541</sup>. As for capital investment, the level of investment in plant and equipment is derived by subtracting land investment from capital investment. In order to more clearly capture the point of strategic change, data for all three parameters take a five-year moving average<sup>542</sup>. In addition, all data is not considered on a deflator. Rather, the data is used as a ratio of sales to the three other data on KK model and offsets the deflator effect, although it still exists the impact is considered to be sufficiently minor that it can be ignored<sup>543</sup>.

### (4) Analysis and Interpretation

The KK model consists of two parts, BMAC and ESAC. The first draws a scatter diagram on a graph, where the horizontal axis (x) shows capital investment / sales and the vertical axis (y) shows R&D expense / sales, and serves as the primary model to verify the tendency of corporate strategy and the point of strategic change. The second introduces expenses on sales-related activities / sales on the x-axis, while retaining R&D expense / sales on the y-axis, which is complementary to the results of the first model.

BMAC covers two aspects of the manufacturing enterprise, promoting a knowledge creation company (here after knowledge creation)<sup>544</sup> and commercializing investment, with this captured in an analytical model that is able to concurrently evaluate knowledge creation and commercializing investment<sup>545</sup>. The criterion for knowledge creation relies on the ratio of R&D expense divided by capital investment, and that of commercializing investment looks at the total value of R&D expense and capital investment as a ratio of sales. 5% is the median for both the R&D expense ratio and the capital investment ratio as applied to sales, this derived from the top-100 R&D expense leaders amongst Japanese manufacturing enterprises listed on the stock exchange, so 5% is set as the base-line for both ratios. On this basis, the path to knowledge creation slopes upward from left to right while the path to commercializing investment slopes downward from left to right, as on Figure A-2<sup>546</sup>.

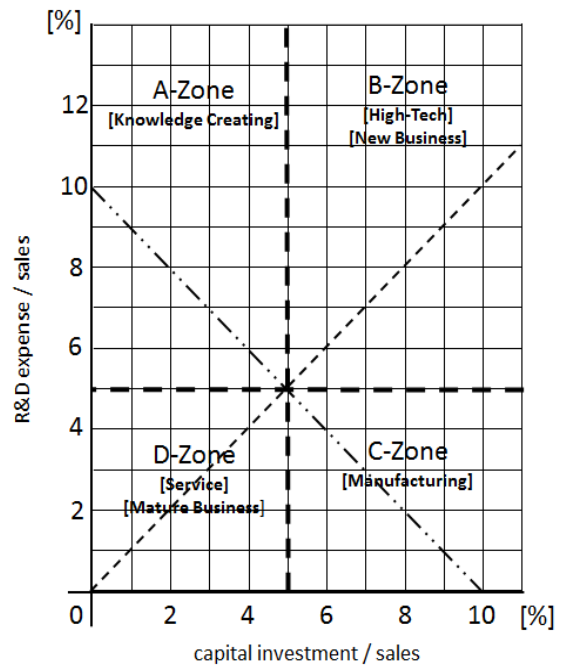
Also detailed is a business model for Japanese manufacturing enterprises<sup>547</sup>. As shown on Figure A-3, the chart is divided into four zones on the basis of 5% thresholds. Each zone indicate a specific attribute of the business model, whereby A-Zone is knowledge creation, B-Zone is either high-tech or new business, C-Zone is manufacturing and D-Zone is either service or mature business. For example, if the investment line transfers from C-Zone to A-Zone, this reflects a change in the enterprise business model from manufacturing to knowledge creation.



**Figure A-2 Business Model Analysis Chart**

Source: Kazuichiro Kodaira and Fumio Kodama, "Erectoronusu sangyo no keiei modelu bunseki: 80-nendai kara 2000-nen made no choki kozo henka," Business Model Association Proceeding, (2005): p.29.

Note: The Figure translated and modified by the author on the basis of the source.



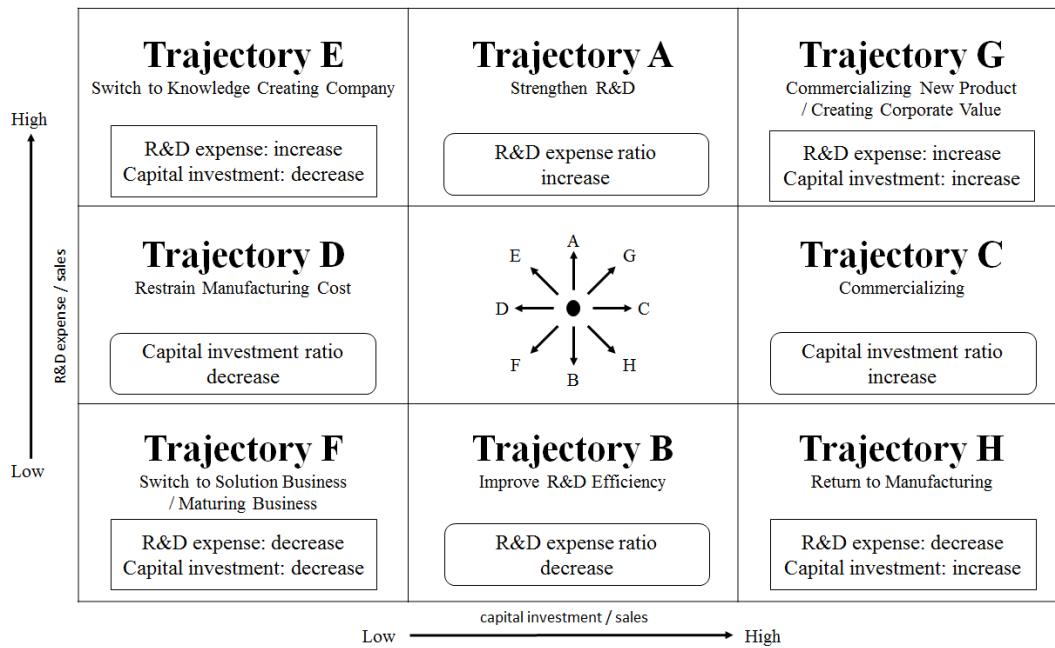
**Figure A-3 Positioning Business Model**

Source: Kazuichiro Kodaira and Fumio Kodama, "Erectoronusu sangyo no keiei modelu bunseki: 80-nendai kara 2000-nen made no choki kozo henka," Business Model Association Proceeding, (2005): p.29.

Note: The Figure translated and modified by the author on the basis of the source

On the basis of the framework above, BMAC plots a scatter diagram on the graph to record the tendencies of corporate strategy and the point of strategic change. In drawing the scatter diagram, it visualizes the trajectory of a corporate investment strategy. There are eight interpretations for each direction by which the trajectory can take route, as per figure A-4.





**Figure A- 4 Correlation of criteria for commercializing investment and knowledge creation.**

Source: Fumio Kodama, *Gijutsu keiei senryaku* (Tokyo, Japan: Ohm-sha, 2007): p.9.

Note: The Figure translated and modified by the author on the basis of the source.

**Trajectory A - Strengthen R&D:** Trajectory A reflects an increase in the R&D expense ratio while the capital investment ratio remains fixed. It affirms the manufacturer has favored to strengthen R&D.<sup>548</sup>

**Trajectory B – Improve R&D Efficiency:** Conversely, if the R&D ratio (only) is decreased, it indicates a cut in R&D spending<sup>549</sup>.

**Trajectory C - Commercializing:** When capital investment increases with the R&D ratio unchanged, it reflects the stage of product manufacture that occurs after completion of product development<sup>550</sup>.

**Trajectory D - Restrain Manufacturing Cost:** After completing capital investment, manufacturing costs are restrained to assure profits<sup>551</sup>.

**Trajectory E - Switch to Knowledge Creating Company:** If the commercializing investment (R&D expense + capital investment) is fixed, the trajectory then moves the line of commercializing investment (see figure A-3)<sup>552</sup>. When a decrease in capital investment is allocated to R&D, the trajectory reflects a conversion to a knowledge creation company, in other words, a thinking organization<sup>553</sup>.

**Trajectory F - Switch to Solution Service or Maturing Business:** Trajectory F indicates two possibilities, either switching to a solution service, such as a system integrator business, or to a maturing business. It is not essential for a system and software development to invest as a large amount of capital investment and R&D expense when compared to manufacturing<sup>554</sup>. In the case of a maturing business, the spending on both R&D and capital investment can be reduced in order to generate profits, as a countermeasure to the maturing business and products<sup>555</sup>.

**Trajectory G - Commercialize New Products or Create Corporate Value:** Trajectory G reflects both ratios as increased, suggesting two possible situations. One could reflect the commercialization of a new product or business. In starting up a business, both ratios are likely to

increase relative to the size of investment, as sales are relatively low at the early stages. The other possibility is one of creating corporate value. This is evidenced when a manufacturer takes an offensive strategy, such as the addition of commercializing investment or maintaining the same amount of commercializing investment during a phase of decreasing sales<sup>556</sup>.

**Trajectory H - Return to Manufacturing:** The opposite direction of Trajectory E demonstrates a return to manufacturing, observed when manufacturers take on capital investment with an aim to expanding its product market share<sup>557</sup>.

While BMAC analyzes manufacturing enterprises to interpret trajectories, ESAC is employed as a complement to BMAC, to more correctly understand the interpretation of trajectories such as G and F<sup>558</sup>. For example, when a firm takes trajectory F on BMAC and also takes an ESAC trajectory, demonstrated by an increase in the expenses on sales-related activities ratio, this reveals the firm has switched to a solution service business, mainly because the expenses on sales-related activities ratio is higher with service businesses. Through BMAC, with ESAC as a complement, the KK model analyzes manufacturing enterprises in order to determine tendencies in corporate strategies and points of change.

### **III. Investment Trajectory Analysis Model<sup>559</sup>**

The Investment Trajectory Analysis Model (ITA) is developed from the KK model and is designed to introduce the analysis of corporate changes and business history. The model provides quantitative evidence of top management's decision-making and of financial performance, through an historical examination on the basis of business history arguments.

#### **1. Background of the Model**

In business history, the “decision” has been one of the central themes from the early<sup>560</sup> days to the present<sup>561</sup>. One result of decision-making is corporate strategy<sup>562</sup>. The concept of strategy was first introduced to the management research field by Alfred D. Chandler<sup>563</sup>. In pursuing his studies on the factors for an emerging modern industrial enterprise and on competitive advantage, his focus shifted from a vertical / horizontal integration strategy and hierarchical organization, to one with a three-pronged-investment and organizational capability. Chandler (1990) reaches the proposition that investments in production, distribution and management are the defining factors for the emerging modern industrial enterprise<sup>564</sup>. Although it changed the description attached to investment, investment was subsequently considered as one of the key factors in his framework<sup>565</sup>. In other words, how a firm takes on investment is a reflection of decision-making through corporate strategy.

Mowery (2010), however, points out that Chandler's analysis rarely penetrated far more deeply than the investment itself<sup>566</sup>. And this applies, to some extent, to other works in business history. Although numerous insightful works in business history use investment data for empirical evidence, Mowery may be true that investment is not fully analyzed. Also, it potentially raises other aspects of the enterprise when analyzing the investment itself, since investment is reflected in top management's knowledge information for corporate growth and profitability<sup>567</sup>.

Under the above context, ITA is developed to provide quantitative evidence of corporate divergence and strategic change resulting from investments and decision-making of top management.

## 2. Methods of Data Processing and Analysis

ITA consists of two components. The first part is very similar to the KK model and explores the point of investment change through three sets of data, capital expenditures / sales (x-axis); R&D expenditures / sales (y-axis); and expenses on sales-related activities / sales (z-axis). It draws a scatter diagram in three dimensions or, more accurately, two diagrams in two dimensions: (1) capital expenditures / sales (x-axis) and R&D expenditures / sales (y-axis); and (2) capital expenditures / sales (x-axis) and expenses on sales-related activities / sales (y-axis).

The data introduced in the second diagram, the additional dimension, differs from the KK

model because the focus is not on “manufacturing (capital expenditures) as related to innovation (R&D expenditures)” but is placed on “manufacturing (capital expenditures) in relation to service (expenses on sales-related activities)<sup>568</sup>”.

The other part is a scatter diagram providing three sets of data, the net income / revenue ratio, the total investment / revenue ratio and the rate of increasing (or decreasing) revenue growth<sup>569</sup>. This diagram describes the correlation between the tendency of investment and outcome of performance, and verifies the periods of corporate change in terms of both aspects.

All data used in both diagrams take a five-year moving average, to readily understand the tendency of objects and differences between objects<sup>570</sup>. As a result, the actual analyzed period is reduced to two years in the beginning and same for the end for the observed data. The data of revenue growth on the latter diagram, the correlation of input and output, are processed through (1) calculating the ratio to the previous year, and (2) taking an average for every five-years (e.g. 1972-76, 1977-81). Net income and total investment as a percent of revenue is averaged over five-years (e.g. 1972-76, 1977-81)<sup>571</sup>.

In examining financial performance data, ITA indicates both the point of change of the corporate growth and of the strategic change, or divergence. It also provides useful evidence for an international comparison of manufacturing enterprises. Large amounts of investment do not

always lead to higher profitability. As numerous previous researches reveal, differences exist between US and Japanese firms and profitability, for one, reflects underlying fundamental and national differences<sup>572</sup>. ITA is also able to analyze periods when R&D expense data is unavailable<sup>573</sup>. On the other hand, ITA interprets only the direction of trajectory and not the business model, which is analyzed on the basis of the 5% line. Given the 5% line of the KK model is based on Japanese manufacturing enterprises, it is not appropriate to use it in analyzing foreign (non-Japanese) enterprises. In fact, when Kodama, Kodaira, and Okada (2009) comparatively analyze Japanese and U.S. manufacturers, the positioning business model is not evaluated. It requires an examination of historical context and other data to arrive at an interpretation. ITA introduces quantitative evidence of corporate decisions and change.

#### **IV. Case Study: A Comparative Analysis of GE, WH, Toshiba, and Hitachi**

To demonstrate the application of ITA as a means of grasping corporate change, the following analyzes four large electric/electronics enterprises, two are American companies (GE and WH), and two are Japanese companies (Toshiba and Hitachi: hereafter TC and HL)<sup>574</sup>.

## 1. Data

All data is gathered from General Electric Company, *Annual Report*, 1972-2010, Westinghouse Electric Corporation, *Annual Report*, 1972-1996, CBS Corporation, *Annual Report*, 1997-1999, Toshiba Corporation, *Yuka-shoken-hokokusho*, 1986-2010, Hitachi, Limited, *Yuka-shoken-hokokusho*, 1986-2010. To employ consolidated financial data and compare equally as possible, Japanese company data terms are shorter because of the lack of availability of consolidated financial data in public data sources.

All data takes a five-year moving average. The revenue data of GE and WH does not include those of the financial service divisions, although the net income is does. This is because the accounting methods employed in financial business is different from that of manufacturing, and it is inappropriate to simply sum up both data for use in analysis. This also allows one to analyze the degree to which a manufacturing firm is contingent on its core business, outside of financial services<sup>575</sup>. Similarly, the three other data are consolidated with exclusion of the financial unit. The data for R&D expenses uses only company-sponsored data. In GE and WH, R&D expenses consist of three expenditures, company-sponsored, customer-sponsored, and government-sponsored. For ITA, company-sponsored R&D is regarded as being representative of top management's decision-making, therefore only company-sponsored data is used as

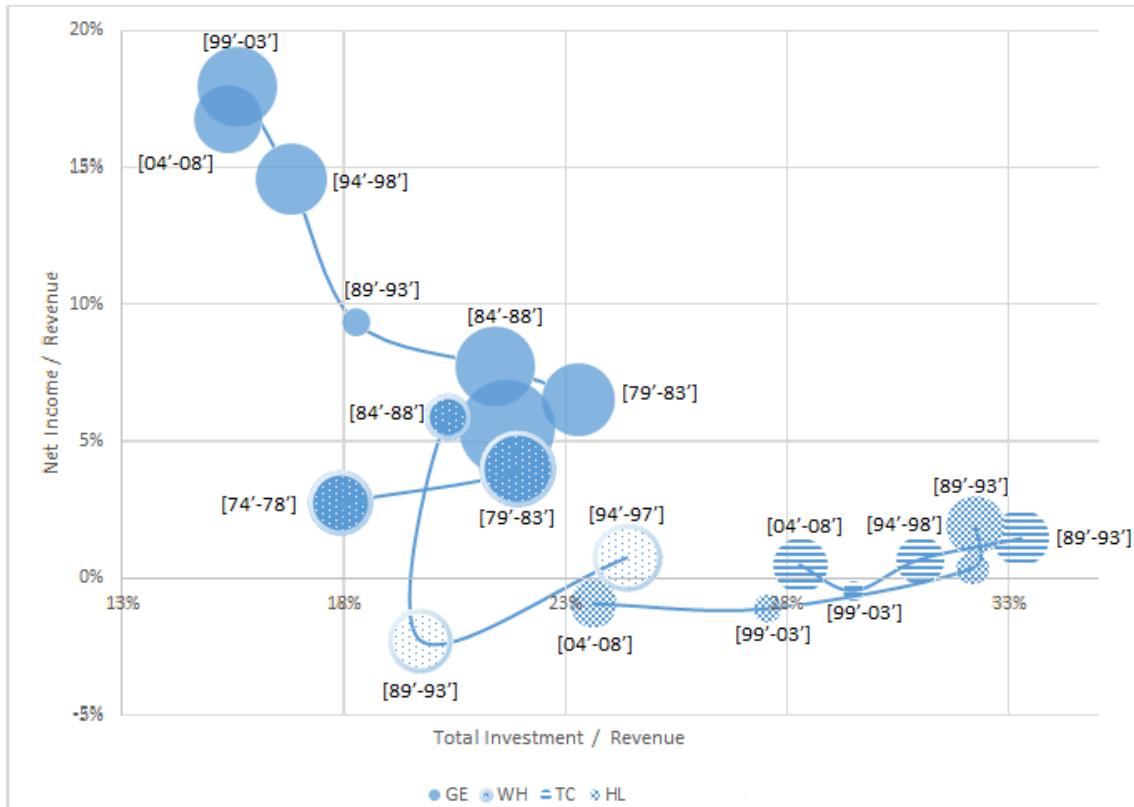


R&D expenditures. Taken from the consolidated statement of cash flows, additions to property, plant and equipment<sup>576</sup> is used to represent capital expenditures. Unlike the KK model, the ITA looks to maintain consistency of data by not subtract land investment from capital investment. “Expense of sales-related activities” uses “selling, general and administrative expense” data found on the consolidated statement of earnings, which subtracts R&D expense<sup>577</sup>.

## 2. Result of Analysis and Interpretation<sup>578</sup>

The results of analysis are reflected in Figures A-5, 6 and 7. All figures reveal differences between the four enterprises. Firstly, they clearly indicate differences between nationalities. GE and WH, American enterprises, favor higher profitability over investments while TC and HL of Japanese enterprise take an opposite tendency. These different tendencies between American and Japanese enterprises derive from fundamental differences in individual corporate behaviors, such as the corporate system<sup>579</sup>, and corporate, market and profit views<sup>580</sup>.

ITA, a case study in support of previous research conclusions on differences between the nationalities of enterprises, captures each different tendency in corporate behavior and the point of strategic change or divergence. GE and WH have taken relatively similar investment behaviors and performances toward the end of 1980s.



**Figure A- 5 Correlation of investment to performance for four electrical manufacturing firms.**

Source: General Electric Company, *Annual Report*, 1972-2010, Westinghouse Electric Corporation, *Annual Report*, 1972-1996, CBS Corporation, *Annual Report*, 1997-1999, Toshiba Corporation, *Yuka-shoken-hokokusho*, 1987-2010, Hitachi, Limited, *Yuka-shoken-hokokusho*, 1987-2010.

There are two divergent point between them, around the early 1980s and the early 1990s.

The early 1980s was the time for both enterprises to transition to new top management. GE and

WH commenced the process of restructuring their business portfolios. GE took a “No.1 or

No.2” strategy under Jack Welch and executed a series of large scale M&A to restructure itself

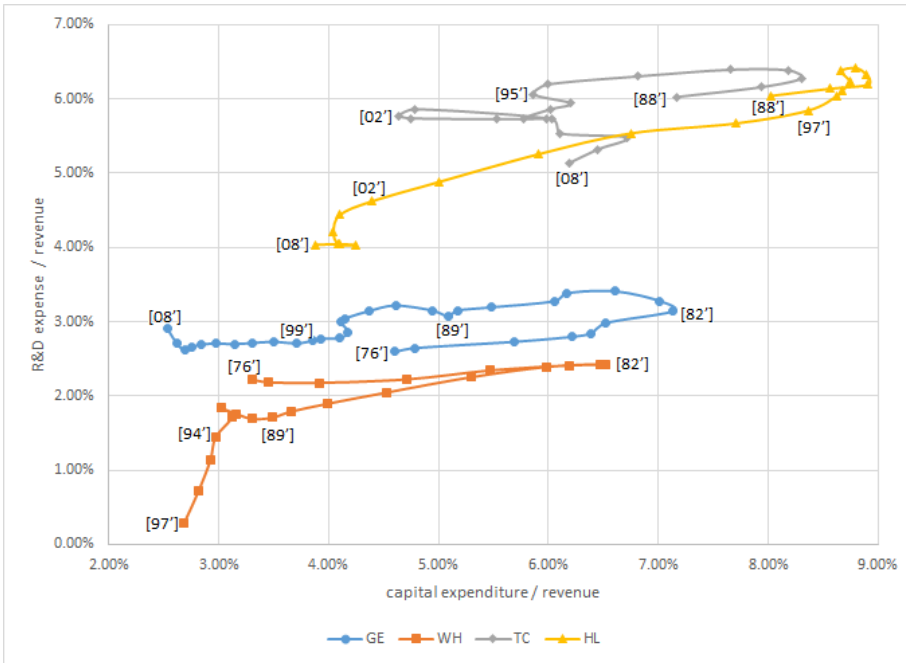
while WH was also acquiring and divesting businesses under an alternate management tool,

Vabastram (the Value Based Strategic Management System), though with far less volume of

M&A when compared to GE<sup>581</sup>.

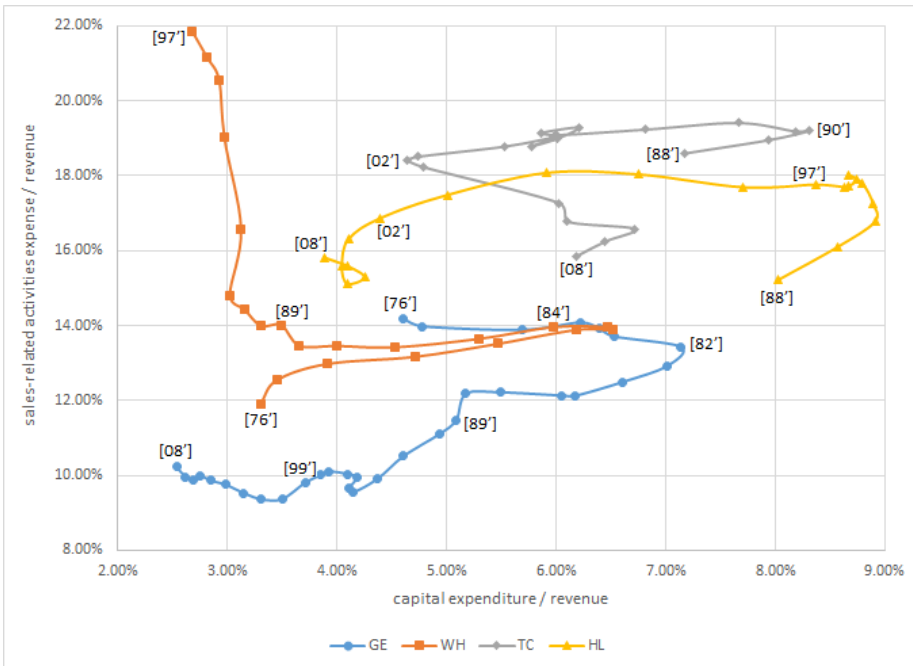
The second point of divergence results from the management of 1980s. GE increased its profitability and revenue growth while WH was running a loss and was downsizing its business scale as a result of struggles with the financial service business. Toward the end of 1990s, GE maintained business growth, profitability, and R&D investment while decreasing capital expenditures and expenses on sales-related activities. This reflects the fact that GE remained as an industrial corporation with high growth and new profitable business lines. Meanwhile WH, by the close of the decade, was rapidly transformed into a media service company, which drastically decreased R&D expenses and increased expenses on sales-related activities, as on figure A-6 and 7.

TC and HL have similar investment behaviors and performances toward the end of 1990s. The point of divergence emerged in the early 2000s. TC started to increase capital investment and recovered a positive net income margin, while HL continued to decrease all investments and was unable to obtain a positive average net income in the 2000s<sup>582</sup>.



**Figure A- 6 Correlation of capital and R&D expenditures for four electrical manufacturing firms.**

Source: General Electric Company, *Annual Report*, 1972-2010, Westinghouse Electric Corporation, *Annual Report*, 1972-1996, CBS Corporation, *Annual Report*, 1997-1999, Toshiba Corporation, *Yuka-shoken-hokokusho*, 1987-2010, Hitachi, Limited, *Yuka-shoken-hokokusho*, 1987-2010.



**Figure A- 7 Capital and sales-related activities expenditures for four electrical manufacturing firms.**

Source: General Electric Company, *Annual Report*, 1972-2010, Westinghouse Electric Corporation, *Annual Report*, 1972-1996, CBS Corporation, *Annual Report*, 1997-1999, Toshiba Corporation, *Yuka-shoken-hokokusho*, 1987-2010, Hitachi, Limited, *Yuka-shoken-hokokusho*, 1987-2010.

When comparing the industrial enterprises less WH, GE and HL pursue a similar investment ratio, higher than TC, even though there is a major gap in profitability and growth between the two. GE and TC are considered to be similar enterprises and historically, since the early 20th century, have had a close cooperative relationship. However, different approaches started to appear in the 1980s and these accelerated in the 2000s<sup>583</sup>.

An ITA approach reveals (1) different characteristics between Japanese and American enterprises in terms of investment and profitability, (2) the point of divergent between enterprises, more clearly demonstrated in the GE and WH analysis of the early 1990s, (3) the points of strategic change within each firm.

## **V. Quantitative Story for Business History**

This Addendum A describes the ITA approach and demonstrates its validity through a case study of Japanese and American electric / electronics enterprises, as represented on the scatter diagrams presented. The dots on the diagrams are telling us a story. The story of how the decision-making of enterprise was changing in response to changes in the world environment.

Only half of the story is told. There is something that the trajectory isn't showing us.

What has not been revealed are the underlying reasons that led to the decisions that were taken (i.e. what was the discussion?). When interpreting the results of ITA, full and due consideration should be placed on the prevailing historical macro-economic context and the organizational context for each of the enterprises. While acknowledging limitations of the ITA approach, it can still be considered to be a useful tool for the provision of quantitative evidence and an addition to business history research.

## Bibliography

### Books

- Abe, Etsuo. *Daiei teikoku no sangyo haken: Igrisu tekko kigyo koboshi* [The Industrial Supremacy of the British Empire: The History of Rise and Fall of British Iron and Steel Firms]. Tokyo, Japan: Yuhikaku, 1993.
- Aguilar, Francis. J. *General Managers in Action: Policies and Strategies*. New York: Oxford University Press, 1992.
- Arrighi, Robert S. *Revolutionary Atmosphere: The Story of the Altitude Wind Tunnel and the Space Power Chambers*. Washington, D.C.: NASA History Division, Office of Communications NASA Headquarters, 2010.
- Backman, Jules. *The Economics of the Electrical Machinery Industry*. New York: New York University Press, 1962.
- Bauer, Martin W. *Atoms, Bytes and Genes: Public Resistance and Techno-Scientific Responses*. New York: Routledge, 2015.
- Castells, Manuel. *The Information Age: Economy, Society, and Culture, Vol. 1: The Rise of the Network Society*. 2nd ed., with a new preface. Chichester, UK: Wiley-Blackwell, 2010.
- Chandler, Alfred D., Jr. *Strategy and Structure: Chapters in the History of the Industrial Enterprise*. Paperback ed., with a new introduction by Alfred D. Chandler, Jr. Cambridge: MIT Press, 1990. First published 1962 by MIT press.
- . *The Visible Hand: The Managerial Revolution in American Business*. Paperback ed. Cambridge: Belknap Press of Harvard University Press, 1993. First published 1977 by Belknap Press of Harvard University Press.
- . *Scale and Scope: The Dynamics of Industrial Capitalism*. With the assistance of Takashi Hikino. Paperback ed. Cambridge: Belknap Press of Harvard University Press, 1994. First published 1990 by Belknap Press of Harvard University Press.

- . *Inventing the Electronic Century: The Epic Story of the Consumer Electronics and Computer Industries*. With the assistance of Takashi Hikino and Andrew von Nordenflycht. Paperback ed., with a new preface by Alfred D. Chandler, Jr. Cambridge: Harvard University Press, 2005. First published 2001 by Free Press.
- . *Shaping the Industrial Century: The Remarkable Story of the Modern Chemical and Pharmaceutical Industries*. Cambridge: Harvard University Press, 2005.
- Coe, Jerome T. *Unlikely Victory: How General Electric Succeeded in the Chemical Industry*. New York: American Institute of Chemical Engineers, 2000.
- Dawson, Virginia P. *Engines and Innovation: Lewis Laboratory and American Propulsion Technology*. NASA History Series, NASA Document SP-4306. Washington, D.C.: National Aeronautics and Space Administration Office of Management Scientific and Technical Information Division, 1991.
- DeGrasse, Robert. W., Jr. *Military Expansion, Economic Decline: the Impact of Military Spending on U.S. Economic Performance*. Expanded ed. Armonk: M. E. Sharpe, 1983.
- Dugger, William M. *Underground Economics: A Decade of Institutional Dissent*. Armonk: M. E. Sharpe, 1992.
- Eccles, Robert G. and Nitin Nohria. *Beyond the Hype: Rediscovering the Essence of Management*. With James D. Berkley. Boston: Harvard Business School Press, 1992.
- Eckstein, Otto. *The Great Recession: with a Postscript on Stagflation*. Amsterdam: North-Holland, 1978.
- Fligstein, Neil. *The Transformation of Corporate Control*. Cambridge: Harvard University Press, 1990.
- Fruhan, William E., Jr. *Financial Strategy: Studies in the Creation, Transfer, and Destruction of Shareholder Value*. Homewood: Richard D. Irwin, 1979.
- Fuller, John G. *The Gentlemen Conspirators: The Story of the Price-Fixers in the Electrical Industry*. New York: Grove Press, 1962.
- Galambos, Louis and Joseph Pratt. *The Rise of Corporate Commonwealth: United States Business and Public Policy in the 20th Century*. New York: Basic Books, 1988.



- Gaughan, Patrick A. *Mergers, Acquisitions, and Corporate Restructurings*. 3rd ed., University ed. New York: John Wiley & Sons, 2002.
- Gavetti, Giovanni and William Ocasio, ed. *Cognition and Strategy*. Advances in Strategic Management 32. Bingley: Emerald Group Publishing, 2015.
- Ghemawat, Pankaj. *Games Businesses Play: Cases and Models*. Cambridge: MIT Press, 1997.
- Gordon, Robert J. *Productivity Growth, Inflation, and Unemployment: The Collected Essays of Robert J. Gordon*. Foreword by Robert M. Solow. Cambridge, UK: Cambridge University Press, 2003.
- Greenwood, Ronald G. *Managerial Decentralization: A Study of the General Electric Philosophy*. Enlarged 2nd ed. Hive Management History Series 89. Easton: Hive Publishing, 1982.
- Hannah, Leslie and Kazuo Wada. *Miezaruru te no hangyaku: Chandora gakuha hihan* [Delusions of Durable Dominance or the Invisible Hand Strikes Back]. Tokyo, Japan: Yuhikaku, 2001.
- Hashimoto, Teruhiko. *Candora keieishi no kiseki: Noryoku besu no gendai kigyoshi* [Traces of Chandler's Approach of Business History: A History of the Modern Business Enterprises as a Base of Organizational Capabilities], Kyoto, Japan: Minervashobo, 2007.
- Haynes, Richard F. *The Awesome Power: Harry S. Truman as Commander in Chief*. Baton Rouge: Louisiana State University Press, 1974.
- Helfat, Constance E., Sydney Finkelstein, Will Mitchell, Margaret A. Peteraf, Harbir Singh, David J. Teece, Sidney G. Winter. *Dynamic Capabilities: Understanding Strategic Change in Organization*. Malden: Blackwell Publishing, 2007.
- Herling, John. *The Great Price Conspiracy: The Story of the Antitrust Violations in the Electrical Industry*. Washington, D.C.: Robert B. Luce, 1962.
- Hirsh, Richard F. *Technology and Transformation in the American Electric Utility Industry*. Lilburn: Fairmont Press, 2005.
- Hordeski, Michael F. *Emergency and Backup Power Sources: Preparing for Blackouts and Brownouts*. Cambridge: Cambridge University Press, 1989.

- Itami, Hiroyuki, ed. *Nichi bei kigyo no riekiritsu kakusa* [Corporate Profitability in Japan and the U.S.]. Tokyo, Japan: Yuhikaku, 2006.
- Janssen, Leon and Gene Medford. *Envision: A History of the GE Healthcare Business, 1893-2008*. Waukesha: Meadow Brook Farm Publishing, 2009.
- Jones, Geoffrey. *Multinationals and Global Capitalism: From the Nineteenth to the Twenty-first Century*. Oxford: Oxford University Press, 2005.
- Kahneman, Daniel. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux, 2011.
- Kobayashi, Kesaji. *GE. sekai kigyo sirizu* [World Enterprise Series]. Tokyo, Japan: Toyo Keizai, 1970.
- Kodama, Fumio. *Analyzing Japanese High Technologies: The Techno-Paradigm Shift*. London, UK: Printer Publishers, 1991.
- Kodama, Fumio. *Emerging Patterns of Innovation: Sources of Japan's Technological Edge*. Boston: Harvard Business School Press, 1995.
- Kodama, Fumio. *Gijutsu keiei senryaku* [Strategic Management of Technology]. Tokyo, Japan: Ohm-sha, 2007.
- Leyes, Richard A. and William A. Fleming. *The History of North American Small Gas Turbine Aircraft Engines*. Reston: American Institute of Aeronautics and Astronautics, 1999.
- Markides, Constantinos C. *Diversification, Refocusing, and Economic Performance*. Cambridge: MIT Press, 1995.
- Matsui, Kazuo and Koichi Okumura. *Beikoku no kigyo baisyu gapei: M&A&D* [The Corporate Mergers and Acquisitions in the U.S.: M&A&D]. Tokyo, Japan: Toyo Keizai Shinposha, 1987.
- Miles, Raymond E. and Charles C. Snow. *Organizational Strategy, Structure, and Process*. In collaboration with Alan D. Meyer and with contributions by Henry J. Coleman, Jr. New York: McGraw-Hill, 1978.
- . *Fit, Failure, and the Hall of Fame: How Companies Succeed or Fail*. New York: Free Press, 1994.

- Misa, J. Thomas. *Leonard to the Internet: Technology and Culture from the Renaissance to the Present*. 2nd ed. Baltimore: Johns Hopkins University Press, 2011.
- Mishina, Kazuhiro. *Senryaku ruzen no ronri* [The Logic of Strategy Failure]. Tokyo, Japan: Toyo Keizai Shinposha, 2004.
- Morikawa, Hidemasa. *A History of Top Management in Japan: Managerial Enterprise and Family Enterprises*. Oxford: Oxford University Press, 2001. Originally publishes as *Toppu manejimento no keieishi: Keieisha kigyo to Kazoku kigyo* (Tokyo, Japan: Yuhikaku, 1996.)
- Morone, Joseph G. *Winning in High-tech Markets: The Role of Genera Management*. Boston: Harvard Business School Press, 1993.
- Nakagawa, Keiichiro. *Hikaku keieishi josetsu* [An Introduction to the Comparative Business History]. Tokyo, Japan: the University of Tokyo Press, 1981.
- Natsume, Keiji. *Gendai amerika kigyo no keiei senryaku* [Strategic Management on Modern American Company], Kyoto, Japan: Minervashobo, 1994.
- Nishikawa, Junko. *Amerika koku-uchu sangyo: Rekishi to genzai* [The American Aerospace Industry: History and the Present]. Tokyo: Nihon Keizai Hyouronsha, 2008.
- Nohria, Nitin, Davis Dyer and Frederick Dalzell. *Changing Fortunes: Remaking the Industrial Corporation*. New York: John Wiley & Sons, 2002.
- Okochi, Akio. *Keiei-koso-ryoku: Kigyosha katsudo no shiteki kenkyu* [Entrepreneurial perception: A study in entrepreneurial history]. Tokyo, Japan: University of Tokyo Press, 1979.
- Oldfield, Homer R. *King of the Seven Dwarfs: General Electric's Ambiguous Challenge to the Computer Industry*. Los Alamitos: IEEE Computer Society Press, 1996.
- Peck, Merton J. and Frederic M. Scherer. *The Weapons Acquisition Process: An Economic Analysis*. Boston, MA: Division of Research, Graduate School of Business Administration, Harvard University, 1962.
- Penrose, Edith. *The Theory of the Growth of the Firm*. 4th ed. With a new introduction by Christos N. Pitelis. Oxford: Oxford University Press, 2009.
- Piore, Michael J. and Charles Sabel. *The Second Industrial Divide: Possibilities for Prosperity*. New York: Basic Books, 1984.

- Porter, Michael E. *Cases in Competitive Strategy*. New York: Free Press, 1983.
- Rothschild, William E. *The Secret to GE's Success*. New York: McGraw-Hill, 2007.
- Rumelt, Richard P. *Strategy, Structure and Economic Performance*. Cambridge: Harvard University Press, 1974.
- Sakakibara, Kiyonori. *Inobeshon no shuekika* [Profiting from Technological Innovations]. Tokyo, Japan: Yuhikaku, 2005.
- Sakamoto, Kazuichi. *GE no soshiki kakushin: 21seiki-gata-sosiki he no chosen* [Organizational Innovation on GE: Challenge to 21st Century Organization Model]. Kyoto: Horitubunkasya, 1997.
- Sato, Sadayuki. *Konguromaritto: Amerika no atarashii biggu bijinesu* [Conglomerate: New Big Business in the U.S.]. Tokyo, Japan: Mainichishinbunsha, 1969.
- Sato, Sadayuki. *20 seikimatsu no Amerika shihonshugi* [American Capitalism in the Late 20th century]. Tokyo, Japan: Shinnihonshuppan, 1993.
- Schatz, Ronald W. *The Electrical Workers: A History of Labor at General Electric and Westinghouse, 1923-60*. The Working Class in American History Series. Urbana: University of Illinois Press, 1983.
- Scherer, Frederic M. *The Weapons Acquisition Process: Economic Incentives*. Boston, MA: Division of Research, Graduate School of Business Administration, Harvard University, 1964.
- Scranton, Philip. *Endless Novelty: Specialty Production and American Industrialization, 1865-1925*, Princeton: Princeton University Press, 1997.
- Scranton, Philip and Patrick Fridenson. *Reimagining Business History*, Baltimore: Johns Hopkins University Press, 2013.
- Shackle, G. L. S. *Imagination and the Nature of Choice*. Edinburgh, UK: Edinburgh University Press, 1979.
- Slywotzky, Adrian J. and David J. Morrison. *The Profit Zone: How Strategic Business Design will Lead You to Tomorrow's Profits*. With Bob Andelman. Paperback ed. New York: Three Rivers Press, 2002.
- Sobel, Robert. *RCA*. New York: Stein and Day, 1986.

- Sultan, Ralph G. *Pricing in the Electrical Oligopoly, Vol. 1: Competition or Collusion*. Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1974.
- . *Pricing in the Electrical Oligopoly, Vol. 2: Business Strategy*. Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1975.
- Taniguchi, Akitake. *Kyodai kigyo no seiki: 20seiki America shionsyugi no keisei to kigyo-godo* [The Century of Giant Corporation: Formation of American Capitalism and Business Trust in the 20th Century], Tokyo, Japan: Yuhikaku, 2002.
- Teece, David J. *Dynamic Capabilities and Strategic Management: Organizing for Innovation and Growth*. New York: Oxford University Press, 2009.
- Tichy, Noel M. and Stanford Sherman. *Control Your Destiny or Someone Else Will*. Revised ed. New York: HarperCollins, 2001.
- Udagawa, Masaru, Satoshi Sasaki, and Masachika Shinomiya, ed. *Shippai to saisei no keieishi* [A Business History on Failure and Restoration of Japanese Enterprise]. Tokyo, Japan: Yuhikaku, 2005.
- Ueno, Yasuhiro. *Senryaku honsha no manejimento: Takakuka senryaku to soshiki kozo no saikento* [Strategic Management of Headquarters]. Tokyo, Japan: Hakuto-Shobo, 2011.
- Utterback, James M. *Mastering the Dynamics of Innovation*. Boston: Harvard Business School Press, 1994.
- Walker, J. Samuel. *Three Mile Island: A Nuclear Crisis in Historical Perspective*. Paperback ed. Berkeley: University of California Press, 2006. First published 2004 by University of California Press.
- Walton, Clarence C. and Frederick W. Cleveland, Jr. *Corporations on Trial: The Electric Cases*. Belmont: Wadsworth, 1964.
- Welch, Jack. *Jack: Straight from the Gut*. With John A. Byrne. New York: Warner Books, 2001.

## Articles, Essays and Chapter

- Abe, Etsuo. "Chandora moderu to Morikawa Hidemasa shi no keieisha kigyo ron [the Chandler's model and Hidemasa Morikawa's perspective on managerial enterprise]." *Japan Business History Review* 28, no.4 (1993): 55-65.
- . "Kakushin no gainen to keieishi [The Concept of Innovation and Business History]." *Meiji Business Review* 42, no.1 (1995):53-78.
- . "Keieishi ni okeru Chandora riron no igi to mondaiten: Chandora moderu wa auto obu deito ka? [The Meaning and Problems of Chandler's Theory in Business History: Is the Chandler's Model Out of Date?]." *Meiji Business Review* 51, no.3 (2004):57-69.
- . "Chandora moderu no ikusue [The Future of the Chandlerian Model]." *Japan Business History Review* 44, no. 3 (2009a): 44-59.
- . "Alfred Chandler's Model of Business Enterprise Structure and the Japanese-Style Enterprise System: Are They Compatible?" *Japanese Research in Business History* 26, (2009b): 59-74.
- . "Kokusai kyosoryoku to chandora moderu: Chandora ha kokusai kyosoryoku wo donoyoni miteita ka [International Competition and Chandlerian Model: How has Alfred Chandler Comprehended International Competition?]." In *Kokusai kyosoryoku no keieishi* [A Business History on International Competitiveness], edited by Takeshi Yuzawa, Tsuneo Suzuki, Takeo Kikkawa, and Satoshi Sasaki, 15-33. Tokyo, Japan: Yuhikaku, 2009c.
- . "Kigyo no kyokai (sijo to soshiki no sogo-shinto): Posuto Chandora moderu no tankyu [The Boundaries of the Firm (Interpenetration between Markets and Firms): A Quest for the Post-Chandlerian Model]." *Memoirs of Institute of Social Sciences, Meiji University* 51, no.1 (2012): 61-84.
- . "The Future of the Chandlerian Model." *Meiji Business Review* 60, no.1 (2013):9-31.
- Aguilar, Francis J. and Richard Hamermesch. "General Electric, Strategic Position: 1981." In *The Coming of Managerial Capitalism: A Casebook on the History of American Economic Institutions*, edited by Alfred D. Chandler, Jr. and Richard S. Tedlow, 776-804. Homewood: Richard D. Irwin, 1985.
- Allen, Bruce T. "Tacit Collusion and Market Sharing: the Case of Steam Turbine Generators." *Industrial Organization Review* 4, no. 1 (1976): 48-57.

- Amatori, Franco and Geoffrey Jones. "Introduction." In *Business History around the World*, edited by Franco Amatori and Geoffrey Jones, 1-7. New York: Cambridge University Press, 2003.
- Ambrosini, Véronique and Cliff Bowman. "What are Dynamic Capabilities and Are They a Useful Construct in Strategic Management?" *International Journal of Management Reviews* 11, no. 1 (2008): 29-49.
- Anchordoguy, Marie. "Chandler and Business History in Japan." *Business History Review* 82, no. 2 (2008): 301-308.
- Aspray, William. "Edwin L. Harder and the Anacom: Analog Computing at Westinghouse." *IEEE Annuals of the History of Computing* 15, no. 2 (1993): 35-52.
- Aupperle, Kenneth E., William Acar, and Debmalya Mukherjee. "Revisiting the Fit-performance Thesis Half a Century Later: A Historical Financial Analysis of Chandler's Own Matched and Mismatched Firms." *Business History* 56, no. 3 (2014): 341-371.
- Bailey, Elizabeth E. and Ann F. Friedlaender. "Market Structure and Multiproduct Industries." *Journal of Economic Literature* 20, no. 3 (1982): 1024-1048.
- Bergek, Anna, Fredrik Tell, Christian Berggren and Jim Watson. "Technological Capabilities and Late Shakeouts: Industrial Dynamics in the Advanced Gas Turbine Industry, 1987-2002." *Industrial and Corporate Change* 17, no. 2 (2008): 225-392.
- Chandler, Alfred D., Jr. "The Conglomerates and the Merger Movement of the 1960s." In *The Coming of Managerial Capitalism: A Casebook on the History of American Economic Institutions*, edited by Alfred D. Chandler, Jr. and Richard S. Tedlow, 737-775. Homewood: Richard D. Irwin, 1985.
- . "The Enduring Logic of Industrial Success." *Harvard Business Review* 90, no. 2 (1990): 130-140.
- . "The Functions of the HQ Unit in the Multibusiness Firm." *Strategic Management Journal* 12, Special Issue: Fundamental Research Issues in Strategy and Economics (1991): 31-50.

- . “What is a Firm?: A Historical Perspective.” *European Economic Review* 36, no. 2-3 (1992): 483-492.
- . “Competitiveness and Capital Investment: The Restructuring of U.S. Industry.” *Business History Review* 68, no. 1 (1994): ix-xiv.
- . “The Competitive Performance of U.S. Industrial Enterprise since the Second World War.” *Business History Review* 68, no. 1 (1994): 1-72.
- . “The United States: Engines of economic growth in the capital-intensive and knowledge-intensive industries.” In *Big Business and the Wealth of Nations*, edited by Alfred D. Chandler, Jr., Franco Amatori, and Takashi Hikino, 63-101. Paperback ed. Cambridge, UK: Cambridge University Press, 1999. First published 1997 by Cambridge University Press.
- . “Commercializing High-Technology Industries.” *Business History Review* 79, no. 3 (2005): 595-604.
- . “How High Technology Industries Transformed Work and Life Worldwide from the 1880s to the 1990s.” *Capitalism and Society* 1, no.2 (2006): <http://www.beppress.com/cas/vol1/iss2/art1>.
- . “History and Management Practice and Thought: An Autobiography.” In *Management Laureates: A Collection of Autobiographical Essay, Vol. 1*, edited by Arthur G. Bedeian, 203-236. Reprinted in *Journal of Management History* 15, no. 3 (2009): 236-260.
- Child, John. “Organizational Structure, Environment, and Performance: The Role of Strategic Choice.” *Sociology* 6, no. 1 (1972): 1-22.
- . “Strategic Choice in the Analysis of Action, Structure, Organizations and Environment: Retrospect and Prospect.” *Organization Studies* 18, no. 1 (1997): 43-76.
- Cole, Arthur H. “Entrepreneurship and Entrepreneurial History: The Institutional Setting.” In *Change and the Entrepreneur: Postulates and the Patterns for Entrepreneurial History*. Prepared by the Research Center in Entrepreneurial History, Harvard University, 85-107. Cambridge: Harvard University Press, 1949.



- Colpan, Asli M and Takashi Hikino. "Foundations of Business Groups: Towards an Integrated Framework." In *The Oxford Handbook of Business Groups*, edited by Asli M. Colpan, Takashi Hikino, and James R. Lincoln, 15-66. Oxford, UK: Oxford University Press, 2014.
- Curtis, Mike. "United States: Advanced Turbine System." In *Innovation in Energy Technology: Comparing National Innovation Systems at the Sectoral Level*, edited by OECD, 295-317. Paris, France: OECD Publishing, 2006.
- Downing, George D. "The Changing Structure of a Great Corporation." In *The Emergent American Society, Vol. I: Large-Scale Organization*, edited by W. Lloyd Warner and Darab B. Unwalla, 158-240. New Haven: Yale University Press, 1967.
- Edelstein, Michael. "War and the American Economy in the Twentieth Century." In *The Cambridge Economic History of the United States, Vol III, The Twentieth Century*, edited by Stanley L. Engerman and Robert E. Gallman, 329-405. Cambridge, UK: Cambridge University Press, 2000.
- Feldstein, Martin. "American Economic Policy in the 1980s: A Personal View." In *American Economic Policy in the 1980s*, edited by Martin Feldstein, 1-79. With an introductory Essay by Martin Feldstein. Chicago: University of Chicago Press, 1994.
- Fleck, Denise L. "The Building and Development of the American Electrical Manufacturing Industry and its Top Two Companies: General Electric & Westinghouse." *Relatórios COP-PEAD*, no. 388 (2009): 2-66.
- Fligstein, Neil. "Chandler and the Sociology of Organizations." *Business History Review* 82, no. 2 (2008): 241-250.
- Fransman, Martin. "Information, Knowledge, Vision and Theories of the Firm." *Industrial and Corporate Change* 3, no. 3 (1994): 713-757.
- Fridenson, Patrick. "Business Failure and the Agenda of Business History" *Enterprise & Society* 5, no. 4 (2004): 562-582.
- . "Business History and History." In *The Oxford Handbook of Business History*, edited by Geoffrey Jones and Jonathan Zeitlin, 9-36. Oxford, UK: Oxford University Press, 2007.

Fukuzawa, Mitsuhiro. “‘Dainamikku keipabirithi’ [Dynamic Capability].” In *Soshikiron rebyu II: gaibu kankyo to keiei soshiki* [Organizational Theory Review II: External Environment and Management Organization], edited by the Academic Association for Organization Science, 41-84. Tokyo, Japan: Hakuto-Shobo Publishing, 2013.

Galambos, Louis. “The U.S. Corporate Economy in the Twentieth Century.” In *The Cambridge Economic History of the United States, Vol III, The Twentieth Century*, edited by Stanley L. Engerman and Robert E. Gallman, 927-967. Cambridge, UK: Cambridge University Press, 2000.

———. “Identity and the Boundaries of Business History: An Essay on Consensus and Creativity.” In *Business History around the World*, edited by Franco Amatori and Geoffrey Jones, 11-30. New York: Cambridge University Press, 2003.

Gergoire, Denish A., Andrew C. Corbett, and Jeffery S. McMullen. “The Cognitive Perspective in Entrepreneurship: An Agenda for Future Research.” *The Journal of Management Studies* 48, no. 6 (2011): 1443-1477.

Ghemawat, Pankaj and Anita McGahan. “Order Backlogs and Strategic Pricing: The Case of the U.S. Large Turbine Generator Industry.” *Strategic Management Journal* 19, no. 3 (1998): 255-268.

Gras, N. S. B. “Why Study Business History?” *Canadian Journal of Economics and Political Science* 4, no3, (1938): 320-340.

Hall, David J. and Maurice A. Saias. “Strategy Follows Structure!” *Strategic Management Journal* 1, no. 2 (1980): 149-163.

Hall, Bronwyn H. “The Impact of Corporate Restructuring on Industrial Research and Development.” In *Brookings Papers on Economic Activity: Microeconomics 1990*, edited by Martin Neil Baily and Clifford M. Winston, 85-135. Washington, D.C.: Brookings Institution Press, 1994.

———. “Corporate Restructuring and Investment Horizons in the United States, 1976-1987.” *Business History Review* 68, no. 1 (1994): 110-143.

- Hannah, Leslie. "Survival and Size Mobility among the World's Largest 100 Industrial Corporations, 1912-1995." *American Economic Review* 88, no. 2 (1998): 62-65.
- Hayes, Robert H. and William J. Abernathy. "Managing Our Way to Economic Decline." *Harvard Business Review* 58, no. 4 (1980): 67-77.
- Harrington, Michael. "The Social-Industrial Complex." *Looking Forward*, no. 10, League for Industrial Democracy, New York, 1968. Online at <https://archive.org/details/TheSocial-industrialComplex> as of August 16, 2014.
- Hikino, Takashi. "Managerial Control, Capital Market, and the Wealth of Nations." In *Big Business and the Wealth of Nations*, edited by Alfred D. Chandler, Jr., Franco Amatori, and Takashi Hikino, 480-496. Paperback ed. Cambridge, UK: Cambridge University Press, 1999.
- . "Keieisha kigyo, kigyonai noryoku, senryaku to soshiki, soshite seizai seika [Managerial Enterprises, Internal Capabilities, Strategy and Structure, and Economic Performance]." *Japan Business History Review* 44, no. 3 (2009): 60-70.
- Hiroyuki, Itami. "Keieishi to keieigaku" [Business History and Management Studies]." In *Keieishi-gaku no 50 nen* [Fifty Years of Business History in Japan], edited by Keieishi Gakkai, 42-51. Tokyo: Nihon Keizai Hyouronsha, 2015.
- Hvala, Joanne, Anne C. Perry, and Jean J. Boddewyn. "General Electric Trading Company: The Sogoshosha that wasn't." *Journal of Global Marketing* 3, no.4, (1990): 7-32.
- Jes Iversen, Martin. "Measuring Chandler's Impact on European Business Studies since the 1960s." *Business History Review* 82, no. 2 (2008): 279-292.
- John, Richard R. "Elaborations, Revisions, Dissents: Alfred D. Chandler, Jr.'s 'The Visible Hand' after Twenty Years." *Business History Review* 71, no. 2 (1997): 151-200.
- . "Turner, Beard, Chandler: Progressive Historian." *Business History Review* 82, no. 2 (2008): 227-240.
- . "Business Historians and the Challenge of Innovation," literature review of *The Challenge of Remaining Innovative: Insights from Twentieth Century American Business*, edited

- by Sally HJ. Clarke, Naomi R. Lamoreaux, and Steven W. Usselman. *Business History Review* 85, no. 1 (2011): 185-201.
- Johnson, Arthur M. "Agenda for the 1970's: The Firm and the Industry." *The Journal of Economic History* 31, no. 1 (1971): 106-117.
- Jones, Geoffrey. "In Memoriam: Alfred Chandler, 1918-2007." *Business History Review* 81, no. 2 (2006): 326-327.
- Jones, Geoffrey and R. Daniel Wadhvani. "Entrepreneurship." In *The Oxford Handbook of Business History*, edited by Geoffrey Jones and Jonathan Zeitlin, 501-528. Oxford, UK: Oxford University Press, 2007.
- Joseph, John and William Ocasio. "Architecture, Attention, and Adaptation in the Multibusiness Firm: General Electric from 1951 to 2001." *Strategic Management Journal* 33, no. 6 (2012): 633-660.
- Kazusa, Yasuyuki. "Sogoteki Seihin Seisaku no Keizoku to Danzetsu: Denki Sangyo niokeru GE-sha to Toshiba" [Continuation and Discontinuation of Full-line Product Policy: GE and Toshiba in Electrical Manufacturing Industry]." In *Nichi Bei Kankei Keieishi [History of Japan-U.S. Business Relations: From the High Growth of the Economy to the Present]*, edited by Haruhito Shiomi and Hori Ichiro, 84-112. Nagoya: The University of Nagoya Press, 1998.
- Kipping, Matthias and Behlül Üsdiken. "Business History and Management Studies." In *The Oxford Handbook of Business History*, edited by Geoffrey Jones and Jonathan Zeitlin, 96-119. Oxford, UK: Oxford University Press, 2008.
- Kodaira, Kazuichiro and Fumio Kodama. "Saiko-keiei-sekininsha (CEO) no senryaku tenkan no kashika [Visualization of Strategic Changes Made by CEO]." *Technology and Economy*, no.483 (2007): 44-50.
- Kodama, Fumio, Kazuichiro Kodaira, and Aiko Okada. "Senryaku yenkan no kashika no koromi: Nichi-bei hikaku [Visualization of Corporate Strategy Shift: A U.S.-Japan Comparison]." *the Journal of Science Policy and Research Management* 24, no.1 (2009): 6-15.

- Kor, Yasemin Y., Joseph T. Mahoney and Steven C. Michael. "Resources, Capabilities and Entrepreneurial Perceptions." *Journal of Management Studies* 44, no. 7 (2007): 1187-1211.
- Lamoreaux, Naomi R. "Reframing the Past: Thoughts about Business Leadership and Decision Making under Uncertainty." *Enterprise & Society* 2, no. 4 (2001): 632-659.
- Lamoreaux, Naomi R., Daniel M Raff, and Peter Temin. "Beyond Markets and Hierarchies: Toward a New Synthesis of American Business History." *American Historical Review* 108, no. 2 (2003): 404-433.
- . "Against Whig History." *Enterprise & Society* 5, no. 3 (2004): 376-387.
- . "Economic Theory and Business History." In *The Oxford Handbook of Business History*, edited by Geoffrey Jones and Jonathan Zeitlin, 37-66. Oxford, UK: Oxford University Press, 2008.
- Langlois, Richard N. "The Vanishing Hand: The Changing Dynamics of Industrial Capitalism." *Industrial and Corporate Change* 12, no. 2 (2003): 351-385.
- . "Chandler in a Large Frame: Markets, Transaction Costs, and Organizational Form in History." *Enterprise & Society* 5, no. 3 (2004): 355-375.
- Lazonick, William. "Understanding Innovation Enterprise: Toward the Integration of Economic Theory and Business Theory." In *Business History around the World*, edited by Franco Amatori and Geoffrey Jones, 31-61. New York: Cambridge University Press, 2003.
- . "The Chandlerian Corporation and the Theory of Innovative Enterprise." *Industrial and Corporate Change* 19, no. 2 (2010): 317-349.
- . "Alfred Chandler's Managerial Revolution: Developing and Utilizing Productive Resources." In *The Oxford Handbook of Management Theorists*, edited by Morgen Witzel and Malcolm Warner, 361-384. Oxford: Oxford University Press, 2013.
- Lipartito, Kenneth. "Connecting the Cultural and the Material in Business History." *Enterprise & Society* 14, no. 4 (2013): 686-704.

- Louçã, Francisco and Sandro Mendonça. “Steady Change: the 200 Largest US Manufacturing Firms throughout the 20th Century.” *Industrial and Corporate Change* 11, no. 4 (2002): 817-845.
- Lovins, Amory B. “The Economics of a US civilian Nuclear Phase-out.” *Bulletin of the Atomic Scientists* 69, no. 2 (2013): 44-65.
- McCraw, Thomas K. “Alfred Chandler: His Vision and Achievement.” *Business History Review* 82, no. 2 (2008): 207-226.
- Meade, Edward Sherwood. “The Economies of Combination.” *Journal of Political Economy* 20, no. 4 (1912): 358-372.
- Miranti, Paul J. “Chandler’s Paths of Learning.” *Business History Review* 82, no. 2 (2008): 293-300.
- Miyamoto, Matao. “Kigyoshashi ron [Entrepreneurial History Studies].” In *Keieishi-gaku no 50 nen* [Fifty Years of Business History in Japan], edited by Keieishi Gakkai, 62-71. Tokyo: Nihon Keizai Hyouronsha, 2015.
- Miyata, Kenichi. “Oyo-keieisi toha nanika?: Keieishi-gaku no rezon detoru saikento [What is Applied Business History?: Revisiting the Raison d’être of Business History].” *Studies in Business Administration* (the Meiji University graduate school bulletin) 29, (2008):147-166.
- . “1970-nendai kara 1990-nendai niokeru GE no senryaku tenkan: Jonzu no seizougyo sinka kara ueruchi no sabisugyoka [A Strategic Change at GE from the 1970s to the 1990s: The Transition from Manufacturing to Service business in the Jones and Welch Periods].” *Studies in Business Administration* (Meiji University Graduate School Bulletin), no.32 (2010): 91-110.
- . “Westinghouse Electric Corporation in the Late 20th Century: A View from an Investment Trajectory Analysis Perspective.” *Studies in Business Administration* (Meiji University Graduate School Bulletin), no.34 (2011a):115-130.
- . “Corporate Transformation and Conglomerates in the U.S.: A Comparison of General Electric Company V.S. Westinghouse Electric Corporation, c. 1970 – c. 1999,” *Studies in Business Administration* (Meiji University Graduate School Bulletin), no.35 (2011b): 1-17.

- . “A Comparative Study of Toshiba and Hitachi in “the Lost Decades”: Corporate Investments and Strategic Attributes.” *Studies in Business Administration* (Meiji University Graduate School Bulletin), no.36 (2012): 165-182.
- Miyata, Kenichi and Daisuke Watanabe. “Seihin akitekucha no dainamizumu to soshikinouryoku: Beikoku desukutoppu PC wo jirei toshite [Dynamism of Product Architecture and Organizational Capability: A Comparative Analysis of Desktop Personal Computers in the U.S.]” *Organizational Science* 46, no. 3 (2013): 32-48.
- Morehouse, David. “Oil Supply: U.S. Perspective on a Global Market.” In *Petroleum 1996: Issues and Trends*, edited by Energy Information Administration, Office of Oil and Gas, U.S. Department of Energy, 1997. Online at [http://www.eia.gov/pub/oil\\_gas/petroleum/analysis\\_publications/petroleum\\_issues\\_trends\\_1996/ENTIRE.PDF](http://www.eia.gov/pub/oil_gas/petroleum/analysis_publications/petroleum_issues_trends_1996/ENTIRE.PDF) as of April 7, 2014.
- Morikawa, Hidemasa. “Naze keieisha kigyo ga hatten suru no ka? [Why Managerial Enterprise have Developed?]” In *Keieisha Kigyo no Jidai* [The Age of Managerial Enterprise], edited by Hidemasa Morikawa, 1-24. Tokyo, Japan: Yuhikaku, 1991.
- . “Kabushiki shoyu no bunsan to keieisha kigyo: Abe Etsuo shi no hihan ni kotaete [Distribution of Stock Ownership and Managerial Enterprises: In Response to the Criticism of Etsuo Abe].” *Keio Keiei Ronshu* 12, no.3 (1995): 105-117.
- . “Toitsu rondai wo meguru togi: keieisha soshiki [Discussion of the Plenary Session: Top Management Organization].” *Japan Business History Review* 14, no. 1 (1979): 74-85.
- Mowery, David. “Alfred Chandler and Knowledge Management within the Firm.” *Industrial and Corporate Change* 19, no.2 (2010): 483-507.
- Murakami, Michikazu. “Kiki ishiki kara umareta inovashon manegimento [Innovation Management as a Result of a Sense of Crisis].” *Works*, no.37 (1999): 10-13.
- Nagano, Mamoru, Shinichi Kamei and Takashi Kondo. “Nihon kigyo no kenkyu-kaihatsu to setsubi toshi: Kenkyu-kaihatsu no keieisenryaku-ka nojissho bunseki [The Economics of R&D Innovation: An Empirical Study of Japanese Firms].” *Journal of Mitsubishi Research Institute*, no.49 (2008): 4-22.

- Nishimura, Shigehiro. "IGEC no jigyobu-ka to kokusai senryaku no tenkan [The Absorption of International General Electric Company and Changes in General Electric's International Strategy]." *Japan Business History Review* 35, no. 3 (2000): 52-79.
- Ocasio, William. "Towards an Attention-Based View of the Firm." *Strategic Management Journal* 18, Summer Special Issue: The Interactions of Organizational and Competitive Influences on Strategy and Performance (1997): 187-206.
- . "Attention to Attention." *Organization Science* 22, no.5 (2011): 1286-1296.
- Ocasio, William and John Joseph. "Governance Channels and Organizational Design at General Electric: 1950-2001." In *Organization Design: The Evolving State-of-the-Art*, edited by Richard M. Burton, Bo Eriksen, Dorthe Døjbak Håkonsson, and Charles C. Snow, 267-284. Information and Organization Design Series 6. Boston: Springer Publishers, 2006.
- . "Rise and Fall, or Transformation? The Evolution of Strategic Planning at the General Electric Company, 1940-2006." *Long Range Planning* 41, no. 3 (2008): 248-272.
- O'Sullivan, Mary A. "Living with the U.S. Financial System: The Experiences of General Electric and Westinghouse Electric in the Last Century." *Business History Review* 80, no. 4 (2006): 621-655.
- Panzar, John C. and Robert D. Willing "Economies of Scope." *American Economic Review* 71, no. 2 (1981): 268-272.
- Popp, Andrew. "Making Choices in Time." *Enterprise & Society* 14, no. 3 (2013): 467-474.
- Porter, Michael E. "From Competitive Advantage to Corporate Strategy." *Harvard Business Review* 65, no. 3 (1987): 43-59.
- Prahalad, C. K., and Gary Hamel. "The Core Competence of the Corporation." *Harvard Business Review* 68, no. 3 (1990): 79-90.
- Raff, Daniel M. "How to Do Things with Time." *Enterprise & Society* 14, no. 3 (2013): 435-466.
- Sabel, Charles F. and Jonathan Zeitlin. "Neither Modularity nor Relational Contracting: Inter-Firm Collaboration in the New Economy." *Enterprise & Society* 5, no. 3 (2004): 388-403.



- Saloner, Garth. "Modeling, Game Theory, and Strategic Management." *Strategic Management Journal* 12, Special Issue: Fundamental Research Issues in Strategy and Economics (1991): 119-136.
- Sasaki, Satoshi. "Nihon no kigyosha katsudo no shutaiteki joken to dainamizumu [The Subjective Conditions and the Dynamism on Entrepreneurial Activities in Japan]." *Organizational Science* 38, no. 1 (2004): 34-43.
- Shepherd, W. Geoffrey. "A Comparison of Industrial Concentration in the United States and Britain." *Review of Economic and Statistics* 43, no. 1 (1961): 70-75.
- Shimada, Masakazu. "Kigyoshashi sairon toshite no Shibusawa Eiichi: 'Keiei-koso-ryoku' gainen wo mochiite [A Reconsideration of Entrepreneurial History: Applying the Concept of 'Scheme-Forming Ability' to Eiichi Shibusawa]." *Business Review, Faculty of Business Administration, Bunkyo Gakuin University* 21, no. 1 (2011): 1-15.
- Shinomiya, Toshiyuki. "Keieishi kenkyu deno tsuginaru shisa no kyocho: Keieishigaku ni okeru aratana konnichiteki igi no kochiku wo mezashite [On the Plural Parallax of Research in Business History]." *Studies in the Humanities. Social Sciences* 23, (2010): 49-65.
- Shiomi, Haruhito. "Nichi-bei kankei keieishi no kadai [A Theme of Business History of Japanese-U.S. Relation]." In *Nichi-bei kankei keieishi: Kodo seicho kara genzai made* [A Business History on Japanese-U.S. Relation: from the Japanese Miracle to the Present], edited by Haruhito Shiomi and Ichiro Hori, 1-18. Nagoya, Japan: The University of Nagoya Press, 1998.
- . "Nichi-bei kankei keieishi no 1990-nendai to chandora moderu no ichi [The 1990s of Business History of Japanese-U.S. Relation and the Position of the Chandlerian Model]." In *Nichi-bei kigyo no gurobaru kyoso senryaku: Nyu ekonomi to "ushinawareta ju-nen" no saikensyo* [Japanese and U.S. Enterprises in Global Competitive Strategy: Reverification of New Economy and "the Lost Decade"], edited by Haruhito Shiomi and Takeo Kikkawa, 385-395. Nagoya, Japan: The University of Nagoya Press, 2008.
- . "Chandora moderu to chosei yoshiki [The Chandlerian Model and Coordination Structure]." *Nagoya University of Foreign Studies Journal of the School of Contemporary International Studies* 5 (2009): 1-30.

———. “Posuto-chandora moderu heno doko [Trends toward the Post-Chandlerian Model].” *Nagoya University of Foreign Studies Journal of the School of Contemporary International Studies* 6 (2010): 93-111.

Suzuki, Yoshitaka. “Gendai no kigyō: Rekishiteki kosatsu [Modern Enterprise: Historical Study].” In *MBA no tameno nihon keieishi* [Japanese Business History for MBA Programmes], edited by Yoshitaka Suzuki, Tomoko Hashino and Keishi Shiratori, 1-25. Tokyo, Japan: Yuhikaku, 2007.

———. “Keieishi no hoho” [Method of Business History].” In *Keieishi-gaku no 50 nen* [Fifty Years of Business History in Japan], edited by Keieishi Gakkai, 3-11. Tokyo: Nihon Keizai Hyouronsha, 2015.

Taniguchi, Akitake. “America kyodai kigyō no koporaito gabanance (1899nen-1999nen): Torishimariyaku to shikkouyakuinn no bunseki [Corporate Governance of American Giant Corporation (1899-1999): Analyzing Members of the Board of Directors and Operating Officers].” *Ritsumeikan Economic Review* 54, no.3, (2005): 52-73.

Taniguchi, Akitake and Shin Hasegawa. “Sentaku to shuchū niyoru ishitsuika no shinko: Denki-kikai-sangyō: GE to Toshiba [The Progress of Differentiation through “Selection and Concentration”: Electric Manufacturing Industry: GE and Toshiba].” In *Nichi-bei kigyō no gurobaru kyōso senryaku: Nyū-ekonomi to “ushinawareta-jyū-nen” no sai-kensyō* [Comparison of the Japanese and US Corporation in Global Competitive Strategy: Re-verification of New Economy and “Lost decade”], edited by Haruhito Shiomi and Takeo Kikawa, 156-187. Nagoya, Japan: Nagoya University Press, 2008.

Teece, David J. “Economies of Scope and the Scope of the Enterprise.” *Journal of Economic Behavior & Organization* 1, no. 3 (1980): 223-247.

———. “Alfred Chandler and ‘Capabilities’ Theories of Strategy and Management.” *Industrial and Corporate Change* 19, no. 2 (2010): 297-316.

Teece, David J., Gary Pisano, and Amy Shuen. “Dynamic Capabilities and Strategic Management.” *Strategic Management Journal* 18, no. 7 (1997): 509-533.

Uda, Osamu. “Posuto chandora jidai no keieishi ni kansuru ichi kōsatsu: Nihon ni okeru chandora moderu hihan wo megutte [A Study of Business History in the Era of Post Chandler:

- Concerning Criticism of the Chandlerian Model in Japan].” *The Nihon University journal of business* 72, no.2 (2002): 81-106.
- . “GE-sha niokeru konpyuta jigyoubu no seisei [Formation of Computer Division in General Electric Company].” *Nihon University Journal of Business* 72, no. 2-4 (2004): 381-402.
- . “Shutai to kyakutai no kyo-shinka puroseshu: ‘Kankeisei no keieishi’ josetsu [The Co-evolutionary Process between Subjects and Objects: The Introduction to "Business History of Relationship"].” *Information Science Studies* 20 (2011): 53-65.
- Utterback, James M. and William J Abernathy. “A Dynamic Model of Process and Product Innovation.” *OMEGA* 3, no. 6 (1975): 639-656.
- Vietor, Richard H. K. “Government Regulation of Business.” In *The Cambridge Economic History of the United States, Vol III, The Twentieth Century*, edited by Stanley L. Engerman and Robert E. Gallman, 969-1012. Cambridge, UK: Cambridge University Press, 2000.
- Vogel, David. “The Corporation as Government: Challenges & Dilemmas.” *Polity* 8, no. 1 (1975): 5-37.
- Wadhawani, R. Daniel and Geoffrey Jones. “Schumpeter’s Plea: Historical Reasoning in Entrepreneurship Theory and Research.” In *Organizations in Time: History, Theory, Methods*, edited by Marcelo Bucheli and R. Daniel Wadhawani, 192-216. Oxford: Oxford University Press, 2014.
- Whittington, Richard. “Alfred Chandler, Founder of Strategy: Lost Tradition and Renewed Inspiration.” *Business History Review* 82, no.2 (2008): 267-277.
- Witt, Ulrich. “Imagination and Leadership: The Neglected Dimension of an Evolutionary Theory of the Firm.” *Journal of Economic Behavior & Organization* 35, (1998): 161-177.
- Yonekawa, Shinichi. “Kigyoshashi [Entrepreneurial History].” In *Keieishigaku no niju nen: kaiko to tenbo* [The Twenty Years of the Business History Society of Japan: Retrospect and Prospect], edited by the Business History Society of Japan, 27-33. Tokyo, Japan: University of Tokyo Press, 1985.

———. “Shohyo keiei-koso-ryoku: Kigyosha katsudo no shi-teki kenkyu [A Review of Entrepreneurial Perception: A Study in Entrepreneurial History], by Okochi, Akio.” *Japan Business History Review* 14, no. 1 (1979): 86-88.

Yonekura, Seiichiro. “Inobeishon kenkyu sengen: Keieishi ni okeru inobeishon kenkyu (Declaration of Research on Innovation: Research of Innovation in Business History).” *Business Review* 45, no. 1 (1997): 121-128.

Young, Dennis R. “An Interview with Alfred D. Chandler, Jr.” *Nonprofit Management & Leadership* 4, no. 3 (1994): 345-351.

Yuzawa, Takeshi. “Kokusai kyosoryoku no keieishi [Business History on International Competitiveness],” *Japan Business History Review* 41, no.4, (2007): 27-34.

Zeitlin, Jonathan. “The Historical Alternatives Approach.” In *The Oxford Handbook of Business History*, edited by Geoffrey Jones and Jonathan Zeitlin, 120-168. Oxford, UK: Oxford University Press, 2008.

## Governmental Reports

Federal Power Commission, Bureau of Power. *Gas Turbine Electric Plant Construction Cost and Annual Production Expenses: First Annual Supplement, 1973*. Washington, D.C.: U.S. Government Printing Office, 1973.

Lean, David F., Jonathan D. Ogur, and Robert P. Rogers. *Competition and Collusion in Electrical Equipment Markets: an Economic Assessment*. Bureau of Economics Staff Report to the Federal Trade Commission, 1982.

Ministry of Economy, Trade and Industry, Government of Japan. *White paper on international economy and trade 2001: External Economic Policy Challenges in the 21th Century*, 2001.

National Security Council, “United States Objectives and Programs for National Security: A Report to the President Pursuant to the President's Directive of Jan. 31, 1950 from Secretaries of State and Defense. Apr. 7, 1950,” NSC 68, Washington, D.C., 1950. Online at <http://galenet.galegroup.com/servlet/DDRS> as of August 16, 2015.

- Office of Management and Budget, "Table 3.1. Outlays by Superfunction and Function: 1940–2020," Online at <https://www.whitehouse.gov/omb/budget/Historicals> as of February 24, 2015.
- Office of Management and Budget, "Table 3.2. Outlays by Superfunction and Function: 1962–2020," Online at <https://www.whitehouse.gov/omb/budget/Historicals> as of February 24, 2015.
- U.S. Atomic Energy Commission. *The Nuclear Industry, 1969*. Washington, D.C.: U.S. Government Printing Office, December 3, 1969.
- U.S. Atomic Energy Commission. *The Nuclear Industry, 1970*. Washington, D.C.: U.S. Government Printing Office, November 18, 1970.
- U.S. Congress. *Congressional Record*. 86th Cong., 1st sess., 1959. Vol. 105, pt. 11.
- U.S. Department of the Air Force, "(U) B-47 with Westinghouse J-54 Engine: Memorandum by Thomas D. White, General, U.S. Air Force Vice Chief of Staff, to the Chairman, Joint Chiefs of Staff. May 17, 1956," Washington, D.C., 1956. Online at <http://galenet.gale-group.com/servlet/DDRS> as of August 16, 2014.
- U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1960, 81th Annual Edition*. Washington, D.C.: U.S. Government Printing Office, 1960.
- U.S. Department of Commerce, Bureau of Economic Analysis, "Gross Domestic Product: Current-dollar and 'Real' GDP," Online at <http://www.bea.gov/National/index.htm> as of August 16, 2015.
- U.S. Bureau of the Census. *The Statistical History of the United States: from Colonial Times to the Present*. With an Introduction and User's Guide by Ben J. Wattenberg. New York: Basic Books, 1976.
- U.S. Department of Commerce, Bureau of the Census. *Census of Manufactures: 1947, vol.2, Statistics by Industry*. Washington, D.C.: United States Government Printing Office, 1949.
- U.S. Department of Commerce, Bureau of the Census. *Census of Manufactures: 1958, vol.2, Industry Statistics, part 2, Major Groups 29 to 39*. Washington, D.C.: United States Government Printing Office, 1961.

U.S. Department of Commerce, Bureau of the Census, *Census of Manufactures: 1967, vol.2, Industry Statistics, part 3, Major Groups 34-39 and 19*. Washington, D.C.: U.S. Government Printing Office, 1971.

U.S. Department of State, Office of the Historian, "NSC-68, 1950, Milestones: 1945-1952," Online at <https://history.state.gov/milestones/1945-1952/NSC68> as of August 16, 2015.

### Newspaper and Periodicals

Antich, Mike and Grace Suizo. "Consolidation of the Fleet Leasing Industry: 1986-Present." *Automotive Fleet*, April 3, 2013, 60-64.

Araoka, Takuya. "Seizogyo no kenkyu kaihatsu toshi kaishu: 'Uri Sute' kara dakkyaku wo [Collecting R&D Investment in Manufacturing: Escape from 'Bargain Sale']." *Nikkei*, August 10, 2004.

*Business Week*. "The Turbine Troubles that Plague Westinghouse." April, 6, 1974, 54-55.

*Business Week*. "Nuclear Dilemma: The Atom's Fizzle in an Energy-Short World." March, 25, 1978, 54-68.

Feder, Barnaby J. "Is Westinghouse out of the Woods?" *New York Times*, March 15, 1981. Online at <http://www.nytimes.com/1981/03/15/business/is-westinghouse-out-of-the-woods.html>.

*Free Lance-Star*. "Testimony Shows Uranium Contracts Tied to Sales." December, 2, 1977, 27.

Greider, William. "Uranium Cartel Stirs Questions of Energy Policy: World Uranium 'Producers' Club' Succeeded Spectacularly." *Washington Post*, May 8, 1977, First Section; A1.

Loomis, Carol J. "How GE Manages Inflation." *Fortune*, May 4, 1981, 121-124.

McInnes, Neil. "Aggressive Swiss: Brown, Boveri & Co. is Challenging Westinghouse and GE on their Own Ground." *Barron's National Business and Financial Weekly*, February 5, 1968, 9, 15, 19.

Neil, Jacoby H. "The Corporate Conglomeration." *The Center Magazine*, Spring 1969. Reprinted in *the Coming of Managerial Capitalism: A Casebook in the History of American*

*Economic Institutions* by Alfred D. Chandler, Jr. and Richard S. Tedlow, 740-755. Homewood: Richard D. Irwin, 1985.

*New York Times*. "Mining Company Happy With Subsidiary Role: Mining Company Is Pleased With Subsidiary Role." December 20, 1976.

Nulty, Peter. "Behind the Mess at Westinghouse." *Fortunes*, November 4, 1991, 93-99.

———. "Westinghouse What an Outsider has to Tackle." *Fortunes*, July 26, 1993, 102-103.

Schwartz, Tony. "Corporations Look to Cable TV." *New York Times*, October 18, 1980, first business page and 34.

Smith, Edgar P. "The Recharging of Westinghouse." *Fortune*, December, 1952, 119-122, 185-195.

Smith, Gene. "Uranium Industry is Now Mining Profits." *New York Times*, June 18, 1977, 27 and 31.

Smith, Richard A. "The Incredible Electrical Conspiracy, Part 1." *Fortune*, April, 1961, 132-137 and 170-180.

———. "The Incredible Electrical Conspiracy, Part 2." *Fortune*, May, 1961, 161-164.

Steward, Thomas A. "Westinghouse Gets Respect at Last." *Fortunes*, July 3, 1989, 92-98.

*Time*. "Mr. Expansion." October 8, 1951. Online at <http://content.time.com/time/magazine/article/0,9171,859401,00.html>.

## Archival Sources

Executive Speeches and Reports to Share Owner. miSci Archives. Schenectady, NY.

Downs Collection, R&D Planning Series. miSci Archives. Schenectady, NY.

Records of the Westinghouse Electric Corporation. Library and Archives at the Heinz History Center. Pittsburgh, PA.

Wise, George. *General Electric's Century: A History of the General Electric Company from its Origins to 1986*, unpublished manuscript, 1989.

CBS Corporation. Form 10-K. Washington, D.C.: Securities and Exchange Commission, 1998-1999.

### Corporate Reports

CBS Corporation. *Annual Report*. New York, 1997-1998.

CBS Corporation. *Form 10-K*. Washington, D.C.: Securities and Exchange Commission, 1998-1999.

General Electric Company. *Annual Report*. New York, 1945-2010.

Hitachi, Limited. *Yukashoken hokokusho* [Annual Securities Report]. Tokyo: Financial Services Agency, 1986-2010.

Toshiba Corporation. *Yukashoken hokokusho* [Annual Securities Report]. Tokyo: Financial Services Agency, 1986-2010.

Westinghouse Electric Corporation. *Annual Report*. Pittsburgh, 1945-1996.

Westinghouse Electric Corporation. *Nuclear Energy Digest*. Pittsburgh, July 1987.

Viacom Inc. *Form 10-K*. Washington, D.C.: Securities and Exchange Commission, 1999-2000.

### Dissertations

Downing, George D. "The Process of Change in the Social System of a Large, Complex Corporation." PhD diss., Michigan State University, 1964.

Fleck, Denise L. "The Dynamics of Corporate Growth." PhD diss., McGill University, 2001.



Lagasse, Paul D. "The Westinghouse Aviation Gas Turbine Division, 1950-1960: A Case Study of the Role of Failure in Technology and Business." Master's thesis, University of Maryland, 1997. Online at <http://www.enginehistory.org/GasTurbines/Westinghouse/WestinghouseAGT.pdf>. As of August 16, 2015.

O'Sullivan, Mary A. "Innovation, Industrial Development, and Corporate Governance." PhD diss., Harvard University, 1996.

Tell, Fredrik. "Organizational Capabilities: A Study of Electrical Power Transmission Equipment Manufacturers, 1878-1990." PhD diss., Linköpings Universitet, 2000.

### Working Papers, Proceedings and Academic Reports.

Curtis, Mike. "The Innovation of Energy Technologies and the U.S. National Innovation System: The Case of the Advanced Turbine System." Washington, D.C.: U.S. Department of Energy, December, 2003. Online at <http://www.oecd.org/sti/inno/31967844.pdf> as of August 16, 2015.

Fleck, Denise L. "Building up Capabilities for Sustained Corporate Growth." Paper submitted to the Third International Workshop on Globalization and Corporate Strategies for the XXIst Century: The Brazilian Innovation Challenge, Rio de Janeiro, Brazil, November 2005. <http://www.ibrarian.net/navon/page.jsp?paperid=4832699&searchTerm=>.

Jones, Geoffrey and R. Daniel Wadhvani. "Entrepreneurship and Business History: Renewing the Research Agenda." HBS Working Paper 07-007, Harvard Business School, Harvard University, Boston, MA, 2006. <http://hbswk.hbs.edu/item/entrepreneurship-and-business-history-renewing-the-research-agenda>.

Kodaira, Kazuichiro and Fumio Kodama. "Erectoronikusu sangyo no keiei modelu bunseki: 80-nendai kara 2000-nen made no choki kozo henka [Business Model Analysis on Electronics Industry: Long Term Structural Change from the 1980s to 2000]." Business Model Association Proceeding, October 2005, Tokyo, Japan.

- Sakakibara, Kiyonori and Masaharu Tsujimoto. "Nihon kigyo no kenkyu-kaihatsu no koritsusei ha naze teika shitanoka [Why did R&D Productivity of the Japanese Firms Declined?]." ESRI Discussion Paper Series No.47, Economic and Social Research Institute Cabinet Office, Tokyo, Japan, 2003. [http://www.esri.go.jp/jp/archive/e\\_dis/e\\_dis047/e\\_dis047.html](http://www.esri.go.jp/jp/archive/e_dis/e_dis047/e_dis047.html).
- Shimizu, Koichi. "Kigyo heno 'seido no seiji keizaigaku'teki' apurochi ('Institutional Political Economy' Approach to Firms)." In *Seido no keizaigaku no taikeika* [Systematization of Institutional Political Economy], edited by Kiichiro Yagi. Research Report of the Grant in Aid of the Monbusho, B (I), 1996-1999, 1999. Online at <http://www.e.okayama-u.ac.jp/~kshimizu/downloads/kigyo.pdf>.
- Unger, Darian and Howard Herzog. "Comparative Study on Energy R&D Performance: Gas Turbine Case Study." Final report prepared for Central Research Institute of Electric Power Industry (CRIEPI), August 1998. Online at [web.mit.edu/energylab/www/pubs/el98-003a.pdf](http://web.mit.edu/energylab/www/pubs/el98-003a.pdf) as of August 16, 2015.
- Watson, W. Jim. "The 'Success' of the Combined Cycle Gas Turbine." In *Proceeding of the IEEE International Conference on Opportunities and Advances in International Electric Power Generation*, Conference Publication no. 419, 87-92. London, UK: Institution of Electrical Engineers, 1996.
- . "Constructing Success in the Electric Power Industry: Flexibility and the Gas Turbine." SPRU Electronic Working Paper no. 64, University of Sussex, Brighton, UK, 2001. Online at <http://www.sussex.ac.uk/spru/research/swps>.
- Yuzawa, Takeshi. "Recent Trends of Business History in Japan." Paper presented at the 2009 Asia Pacific Economic and Business History Conference, Tokyo, Japan, February 2009. <http://apebhconference.files.wordpress.com/2009/09/yuzawa1.pdf>

Other

- Bergin, Thomas J., ed. *50 year of Army Computing: from ENIAC to MSRC, A Record of a Symposium and Celebration, November 13 and 14, 1996*, ARL-SR-93, 2000, Online at [www.arl.army.mil/www/pages/shared/documents/50\\_years\\_of\\_army\\_computing.pdf](http://www.arl.army.mil/www/pages/shared/documents/50_years_of_army_computing.pdf) 50 year of Army Computing: from ENIAC to MSRC as of August 15, 2015.
- Crawford, Charles W. "Oral History of the Tennessee Valley Authority: Interview with Robert A. Monroe, October 22, 1970." Transcribed by Sharon Hesse. Oral History Research Office, Memphis State University, 1970. Online at <https://archive.org/stream/oralhistoryof-ten00monr#page/n5/mode/2up> as of August 16, 2015.
- Kodama, Fumio. "Gijutsu keiei senryaku no kashika no kokoromi [an Attempt of Visualizing Strategic Management of Technology]." Prepared for Gijutsu Keiei Jinzai Ikusei Seminar, May 29, 2013. Online at <http://eufd.org/seminar/tms05.html> as of August 16, 2015.
- Loft, Arne. "Gas Turbine Development at General Electric," The Edison Tech Center. Online at <http://www.edisontechcenter.org/gasturbines.html#3> as of August 7, 2015.
- Massey, Steve. "Who Killed Westinghouse?," Pittsburgh Post-Gazette.com. Online at <http://old.post-gazette.com/westinghouse/prologue.asp> as of August 7, 2015.
- Scherer, Harold Jr., an oral history conducted by William Aspray, IEEE History Center, Hoboken, NJ., USA, February 1, 1994, Engineering and Technology History Wiki. Online at [http://ethw.org/Oral-History:Harold\\_Scherer](http://ethw.org/Oral-History:Harold_Scherer) as of August 16, 2015.
- Somerscales, Euan F. C. and Robert L. Hendrickson. "America's First Power Generating Gas Turbine," Brochure of Landmark Designations, the History and Heritage Program of American Society of Mechanical Engineers (ASME). Online at <https://www.asme.org/get-media/8d177f38-a3b8-400a-8990-9c75e78add08/100-Belle-Isle-Gas-Turbine.aspx> as of August 16, 2015.
- Tell, Fredrik. "Capabilities, Innovation, and Industry Dynamics: Technological Discontinuities and Incumbents," Prepared for DIMETIC Lectures, March 22, 2010. Online at <http://dime.dime-eu.org/node/378> as of August 21, 2015.
- Wilcox, George, an oral history conducted by William Aspray and Robert Lawrence, IEEE History Center, Hoboken, NJ., USA, December 9, 1993, Engineering and Technology History Wiki. Online at [http://ethw.org/Oral-History:George\\_Wilcox](http://ethw.org/Oral-History:George_Wilcox) as of August 16, 2015.

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- <sup>1</sup> Taniguchi, *Kyodai kigyo*, 1;
- <sup>2</sup> Chandler, *Scale and Scope*, 3, 14.
- <sup>3</sup> Chandler, "The Competitive Performance," 2-4.
- <sup>4</sup> *Ibid*, 5.
- <sup>5</sup> Jones, *Multinationals*, 31.
- <sup>6</sup> Galambos and Pratt, *The Rise of Corporate Commonwealth*, 185.
- <sup>7</sup> Chandler, *Scale and Scope*, 34.
- <sup>8</sup> Galambos and Pratt, *The Rise of Corporate Commonwealth*, 201.
- <sup>9</sup> Hannah and Wada, *Miezaruru te no hangyaku*, 58.
- <sup>10</sup> Hayes and Abernathy, "Managing Our Way,"
- <sup>11</sup> Louçã and Mendonça, "Steady Change," 818.
- <sup>12</sup> Nohria, Dyer and Dalzell, *Changing Fortunes*, 266, 272.
- <sup>13</sup> Abe, "Kakushin," 57-58.
- <sup>14</sup> Iversen, "Measuring Chandler's Impact," 280. According to Iversen, Chandler's articles attracted a total of 3,869 citations while North's works were cited in the 3,905 during those five decades.
- <sup>15</sup> Lazonick, "Alfred Chandler's," 363.
- <sup>16</sup> Abe, "Chandora moderu no ikusue," 44-50.
- <sup>17</sup> Lazonick, "Alfred Chandler's," 372-376.
- <sup>18</sup> *Ibid*, 376.
- <sup>19</sup> Lazonick, "Alfred Chandler's," 372. On the detail of the early Chandler's model, for instance, see Etsuo Abe, "Keieishi ni okeru Chandora riron," *Meiji Business Review* 51, no.3 (2004): 57-69; Etsuo Abe, "Alfred Chandler's Model," *Japanese Research in Business History* 26, (2009b): 59-74; Teruhiko Hashimoto, *Candora keieishi no kiseki: Noryoku besu no gendai kigyoshi* (Kyoto: Minervashobo, 2007); William Lazonick, "Alfred Chandler's Managerial Revolution: Developing and Utilizing Productive Resources," in *The Oxford Handbook of Management Theorists*, (Oxford: Oxford University Press, 2013), 361-384; Haruhito Shiomi, "Chandora moderu to chosei yoshiki," *Nagoya University of Foreign Studies Journal of the School of Contemporary International Studies* 5 (2009): 1-30; Osamu Uda, "Posuto chandora jidai no keieishi ni kansuru ichi kousatsu: Nihon ni okeru chandora moderu hihan wo megutte," *The Nihon University journal of business* 72, no.2 (2002): 81-106.

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<sup>20</sup> Chandler, "History and Management," 244-247.

<sup>21</sup> Chandler, *The Visible Hand*, 1.

<sup>22</sup> Chandler, "History and Management," 246.

<sup>23</sup> *Ibid*, 242, 250

<sup>24</sup> Chandler, "The Enduring Logic," 132.

<sup>25</sup> Abe, "Alfred Chandler's Model," 64. Although organizational capabilities do not appear in his figure, organizational character can be used as an alternative concept.

<sup>26</sup> *Ibid*, 61.

<sup>27</sup> *Ibid*.

<sup>28</sup> *Ibid*.

<sup>29</sup> *Ibid*, 63-64.

<sup>30</sup> Lazonick, "Alfred Chandler's," 374.

<sup>31</sup> *Ibid*, 375.

<sup>32</sup> Chandler, "History and Management," 252-253.

<sup>33</sup> As primarily discussing the later Chandler's works, for instance, see Etsuo Abe, "Chandora moderu no ikusue," *Japan Business History Review* 44, no. 3 (2009a): 44-59; Etsuo Abe, "The Future of the Chandlerian Model," *Meiji Business Review* 60, no. 1 (2013): 9-31; Teruhiko Hashimoto, *Candora keieishi no kiseki: Noryoku besu no gendai kigyoshi* (Kyoto: Minervashobo, 2007); William Lazonick, "Alfred Chandler's Managerial Revolution: Developing and Utilizing Productive Resources," in *The Oxford Handbook of Management Theorists*, (Oxford: Oxford University Press, 2013), 361-384; Paul J. Miranti, "Chandler's Paths of Learning," *Business History Review* 82, no. 2 (2008): 293-300; Haruhito Shiomi, "Chandora moderu to chosei yoshiki," *Nagoya University of Foreign Studies Journal of the School of Contemporary International Studies* 5 (2009): 1-30.

<sup>34</sup> Chandler, *Inventing the Electronic Century*, xi.

<sup>35</sup> Chandler, *Shaping the Industrial Century*, 9.

<sup>36</sup> *Ibid*, 9-10.

<sup>37</sup> *Ibid*, 10.

<sup>38</sup> James M. Utterback and William J Abernathy. "A Dynamic Model of Process and Product Innovation." *OMEGA* 3, no. 6 (1975): 639-656; James M. Utterback, *Mastering the Dynamics of Innovation* (Boston: Harvard Business School Press, 1994).

<sup>39</sup> Utterback, *Mastering the Dynamics of Innovation*, 24.

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<sup>40</sup> Lazonick, "Alfred Chandler's," 376.

<sup>41</sup> Chandler, *Inventing the Electronic Century*, 4.

<sup>42</sup> Hikino, "Keieisha kigyo," 65.

<sup>43</sup> John, "Business Historians and the Challenge of Innovation," 186,

<sup>44</sup> For instance, see Thomas K McCraw, "Alfred Chandler: His Vision and Achievement," *Business History Review* 82, no. 2 (2008): 207-226. These papers also provide useful discussion: Etsuo Abe, Chandora moderu no ikusue," *Japan Business History Review* 44, no. 3 (2009a): 44-59; Etsuo Abe, "The Future of the Chandlerian Model," *Meiji Business Review* 60, no. 1 (2013): 9-31; Franco Amatori and Geoffrey Jones, "Introduction," in *Business History around the World*, (New York: Cambridge University Press, 2003) 1-7; Matthias Kipping and Behlül Üsdiken, "Business History and Management Studies," in *The Oxford Handbook of Business History* (Oxford, UK: Oxford University Press, 2008) 96-119; Naomi R. Lamoreaux, Daniel M Raff, and Peter Temin, "Economic Theory and Business History," in *The Oxford Handbook of Business History* (Oxford, UK: Oxford University Press, 2008) 37-66; Haruhito Shiomi, "Posuto-chandora moderu heno doko," *Nagoya University of Foreign Studies Journal of the School of Contemporary International Studies* 6 (2010): 93-111.

<sup>45</sup> Langlois, "Chandler in a Large Frame," 371-372; Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies," 407; Sabel and Zeitlin, "Neither Modularity nor Relational Contracting," 388, 390-393. For detail on their differences, see Etsuo Abe, Chandora moderu no ikusue," *Japan Business History Review* 44, no. 3 (2009a): 44-59; Etsuo Abe, "The Future of the Chandlerian Model," *Meiji Business Review* 60, no. 1 (2013): 9-31; Etsuo Abe, "Kigyo no kyokai (sijo to soshiki no sogo-shinto): Posuto Chandora moderu no tankyu," *Memoirs of Institute of Social Sciences, Meiji University* 51, no.1 (2012): 61-84; Teruhiko Hashimoto, *Candora keieishi no kiseki: Noryoku besu no gendai kigyoshi* (Kyoto: Minervashobo, 2007); Haruhito Shiomi, "Posuto-chandora moderu heno doko," *Nagoya University of Foreign Studies Journal of the School of Contemporary International Studies* 6 (2010): 93-111. It also helps to understand their different perspectives, see Lazonick, "Understanding Innovation Enterprise," 55-61.

<sup>46</sup> Langlois, "The Vanishing Hand," 364-365, 374.

<sup>47</sup> *Ibid*, 372.

<sup>48</sup> *Ibid*, 369.

<sup>49</sup> *Ibid*, 375-376

<sup>50</sup> *Ibid*, 372.

<sup>51</sup> Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies," 421-422.

<sup>52</sup> *Ibid*, 423.

<sup>53</sup> *Ibid*.

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<sup>54</sup> Ibid, 424.

<sup>55</sup> Ibid, 428-429.

<sup>56</sup> Fligstein, "Chandler," 250.

<sup>57</sup> Anchordoguy, "Chandler," 303.

<sup>58</sup> Chandler, *Strategy and Structure*, 384.

<sup>59</sup> Chandler, *Inventing the Electronic Century*, 3.

<sup>60</sup> Ibid.

<sup>61</sup> Ibid.

<sup>62</sup> Gras mentions that economic determinism in economic history leaves no important place for free choice, decision, or management, and reveals itself as essentially economic libertarianism in business history. Nakagawa describes that Gras' research approach to examine the defined aspects of business activity that are developed by specific process and decision-making, he acknowledges that senior management have sufficient latitude for some decision-making even though social and economic conditions determine decisions to a certain extent. It is fine to understand that business history has considered the decision-making aspect from its early history. For more detail, see N. S. B. Gras, "Why Study Business History?" *Canadian Journal of Economics and Political Science* 4, no3, (1938): 331; Keiichiro Nakagawa, *Hikaku Keieishi Josetsu* (Tokyo, Japan: the University of Tokyo Press, 1981), 49.

<sup>63</sup> Patrick Fridenson, "Business History and History," in *The Oxford Handbook of Business History*, (Oxford, UK: Oxford University Press, 2008), 12.

<sup>64</sup> For instance, see Naomi R. Lamoreaux, "Reframing the Past: Thoughts about Business Leadership and Decision Making under Uncertainty," *Enterprise & Society* 2, no. 4 (2001): 632-659; Jonathan Zeitlin, "The Historical Alternatives Approach," in *The Oxford Handbook of Business History* (Oxford, UK: Oxford University Press, 2008), 128; Toshiyuki Shinomiya, "Keieishi kenkyu deno tsuginaru shisa no kyocho," *Studies in the Humanities. Social Sciences* 23, (2010): 58-61.; Daniel M. Raff, "How to Do Things with Time," *Enterprise & Society* 14, no. 3 (2013): 435-466; Takeo Kikkawa, "Fifty Years of Business History in Japan," *Japanese Research in Business History* 30 (2013): 13; Yoshitaka Suzuki, "Keieishi no hoho," in *Keieishi-gaku no 50 nen* (Tokyo: Nihon Keizai Hyouronsha, 2015), 3-11.

<sup>65</sup> Johnson probably is the foremost business historian for stressing the importance of this aspect although he mentioned that Chandler and Galambos recognized the importance of managerial perceptions in their article published in 1970. For more detail see Arthur M. Johnson, "Agenda for the 1970's: The Firm and the Industry," *The Journal of Economic History* 31, no. 1 (1971): 114. However Okochi recalled that Johnson already had a draft of the paper regarding the topic in 1968. See Akio Okochi, *Keiei-koso-ryoku: Kigyosha Katsudo no Shi-teki Kenkyu*, (Tokyo, Japan: University of Tokyo Press, 1979), ii and references.

<sup>66</sup> Johnson, "Agenda," 113.

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<sup>67</sup> Ibid, 113-115.

<sup>68</sup> For instance, Okochi, *Keiei-koso-ryoku* and *Roruzu-Roisu Kenkyu: Kigyo Hatan no Eikoku-teki Iso*, (Tokyo, Japan: University of Tokyo Press, 2001). According to the references of his books, his entrepreneurial perception is combined not only with Johnson's idea but also with that of the Japanese philosopher Kiyoshi Miki.

<sup>69</sup> Yonekawa, "Kigyoshashi," 32.

<sup>70</sup> Yonekura, "Inobeishon kenkyu sengen," 127;

<sup>71</sup> Yoshitaka, "Keieishi no hoho," 7.

<sup>72</sup> Ibid, 10-11.

<sup>73</sup> See Geoffrey Jones and R. Daniel Wadhvani, "Entrepreneurship and Business History: Renewing the Research Agenda," HBS Working Paper 07-007, Harvard Business School, Harvard University, Boston, MA, 2006; Geoffrey Jones and R. Daniel Wadhvani, "Entrepreneurship," in *The Oxford Handbook of Business History* (Oxford, UK: Oxford University Press, 2007), 501-528; R. Daniel Wadhvani and Geoffrey Jones, "Schumpeter's Plea: Historical Reasoning in Entrepreneurship Theory and Research," in *Organizations in Time: History, Theory, Methods* (Oxford: Oxford University Press, 2014), 192-216; Matao Miyamoto, "Kigyoshashi ron," in *Keieishi-gaku no 50 nen* (Tokyo: Nihon Keizai Hyouronsha, 2015), 62-71.

<sup>74</sup> Jones and Wadhvani, "Entrepreneurship," 503.

<sup>75</sup> Wadhvani and Jones, "Schumpeter's Plea," 197 and 208-209.

<sup>76</sup> Sasaki, "Nihon no kigyosha," 35-36.

<sup>77</sup> Ibid.

<sup>78</sup> Yonekawa, "Kigyoshashi," 30.

<sup>79</sup> Jones and Wadhvani, "Entrepreneurship," 520.

<sup>80</sup> Ibid.

<sup>81</sup> Penrose, *The Theory of the Growth*, 30 and 46.

<sup>82</sup> Ibid, 41.

<sup>83</sup> Ibid.

<sup>84</sup> Abe, "Kokusai kyosoryoku," 19-20. Also see Alfred D. Chandler, Jr., "What is a Firm?: A Historical Perspective," *European Economic Review* 36, no. 2-3 (1992): 483-492.

<sup>85</sup> Shimizu, "Kigyo heno," 19. In addition, he indicate that evolutionary economics should understand the core competence as not only product development capability but whole corporate system. On the



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other hand, he considers that neoclassical economics is unable to explain the differences of efficiency or performance between firms although it analyzes the representative organizational forms (Shimizu, "Kigyo heno," 6.).

<sup>86</sup> Witt, "Imagination and Leadership," 2.

<sup>87</sup> Popp, "Making Choices," 468. For instance, see G. L. S. Shackle, *Imagination and the Nature of Choice*, (Edinburgh: Edinburgh University Press, 1979); G. L. S. Shackle, *Business, Time and Thought*, ed. Stephen Frowen, (London: Macmillan Press, 1988); G. L. S. Shackle, *Expectation, Enterprise, and Profit: The Theory of the Firm*, (London: Routledge, 2003).

<sup>88</sup> Shackle, *Imagination*, vii.

<sup>89</sup> Popp, "Making Choices," 470-471.

<sup>90</sup> Child, "Organizational Structure," 13-16.

<sup>91</sup> *Ibid*, 15-16; Child, "Strategic Choice," 43.

<sup>92</sup> Miles and Snow, *Organizational Strategy*, 5-8.

<sup>93</sup> *Ibid*, 153.

<sup>94</sup> *Ibid*.

<sup>95</sup> Teece, *Dynamic Capabilities*, 88; Ambrosini and Bowman, "What are Dynamic Capabilities," 30; Fukuzawa, "Dainamikku," 50. The referred paper is David J. Teece, Gary Pisano, and Amy Shuen, "Dynamic Capabilities and Strategic Management," *Strategic Management Journal* 18, no. 7 (1997): 509-533.

<sup>96</sup> Teece, "Alfred Chandler," 305.

<sup>97</sup> Teece, *Dynamic Capabilities*, 4 and 48-49.

<sup>98</sup> *Ibid*, 17.

<sup>99</sup> *Ibid*, 22 and 35.

<sup>100</sup> *Ibid*, 34 and 45.

<sup>101</sup> *Ibid*, 59.

<sup>102</sup> For instance, see William Ocasio, "Towards and Attention-Based View of the Firm," *Strategic Management Journal* 18, (1997): 187-206 and William Ocasio, "Attention to Attention," *Organization Science* 22, no.5 (2011): 1286-1296.

<sup>103</sup> Ocasio, "Towards and Attention-Based View," 1 and 203.

<sup>104</sup> Ocasio, "Attention to Attention," 1286.

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<sup>105</sup> Ocasio, "Towards and Attention-Based View," 203.

<sup>106</sup> Kenneth Lipartito, "Connecting the Cultural and the Material in Business History," *Enterprise & Society* 14, no. 4 (2013): 702.

<sup>107</sup> Lamoreaux, "Reframing the Past," 651. In addition, regarding the approach of business success and failure, also see Patrick Fridenson, "Business Failure and the Agenda of Business History," *Enterprise & Society* 5, no. 4 (2004).

<sup>108</sup> After WH changed its name to CBS Corporation on Dec. 1, 1997, CBS then merged with Viacom on May 4, 2000. Present CBS is established at the end of 2005, when old Viacom was separated into two companies. Although the "Westinghouse" brand still exists today, almost all products are provided by firms unrelated to the previous Westinghouse Electric Corporation, but that are licensed under the Westinghouse brand by the Westinghouse Electric Corporation, which was established as the Westinghouse brand licensing company in 1998 under CBS. The Westinghouse nuclear power business exists as Westinghouse Electric Company, which has been part of the Toshiba group since 2006.

<sup>109</sup> For instance, Yuzawa put a question to how to evaluate GE's success as a manufacturing firm although GE was successful as an enterprise through shifting to more financial businesses. On the other hand, Nohria, Dyer and Dalzell mentions that the transformation of WH was good from the shareowner's perspective because it provided more than a doubling in share value. For more detail, see Takeshi Yuzawa, "Kokusai-kyosoryoku no Keieishi," *Japan Business History Review* 41, no. 4 (2007): 28; Nohria, Dyer and Dalzell, *Changing Fortunes*, 3.

<sup>110</sup> Nohria, Dyer and Dalzell, *Changing Fortunes*, 15-16.

<sup>111</sup> Kazuichi Sakamoto, *GE no Soshiki Kakushin: 21seiki-gata-sosiki he no Chosen* (Kyoto: Horitubunkasya, 1997), 155-191. William E. Rothschild, *The Secret to GE's Success* (New York: McGraw-Hill, 2007) 167-186.

<sup>112</sup> Sakamoto, *GE no Soshiki Kakushin*, 191; Rothschild, *The Secret to GE's Success*, 170.

<sup>113</sup> Rothschild, *The Secret to GE's Success*, 170. Although some scholars contend SBU was introduced to GE in 1972, the language had already been introduced previously. In 1972, Reginald Jones defined the rules by which specific strategic actions were taken with respect to the SBU. For more detail, see Robert G. Eccles and Nitin Nohria with James D. Berkley, *Beyond the Hype: Rediscovering the Essence of Management* (Washington, D.C.: Beard Books, 2003) 95.

<sup>114</sup> Nohria et al., *Changing Fortunes*, 16; originally quoted from "General Electric Company: Quality of Earnings Analysis," 5: Reginald Jones who took the helm of GE announced that "with our new strategic planning process, we are learning how to allocate our resources to the right places, at the right time, for optimum growth and profitability—and at the same time, contain our risk," and added "many companies claim they do strategic planning, but the process may or may not be anything more than intuitive wheeling-and-dealing by the top man."

<sup>115</sup> Mary A. O'Sullivan, "Living with the U.S. Financial System: The Experiences of General Electric and Westinghouse Electric in the Last Century," *Business History Review* 80, no. 4 (2006): 629.

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<sup>116</sup> Ibid, 652-653.

<sup>117</sup> Kenichi Miyata, "Corporate Transformation and Conglomerates in the U.S.: A Comparison of General Electric Company V.S. Westinghouse Electric Corporation, c. 1970 – c. 1999," *Studies in Business Administration* 36, (2011): 11-12.

<sup>118</sup> Denise L. Fleck, "*The Dynamics of Corporate Growth*," (PhD diss., McGill University, 2001), 172-174.

<sup>119</sup> Ibid, 236.

<sup>120</sup> Of course, as Cole indicates, there would be a member among top management with somewhat more influence than other members. However, it is hard to specify whom the member is from the historical materials used in this presentation. This is one of the limitations of this study. However, it still provides research of the disparity between business enterprises with some insight. Regarding Cole's explanation, see Arthur H. Cole, *Business Enterprise in its Social Setting*, (Cambridge, MA: Harvard University Press, 1959), 200.

<sup>121</sup> Itami, *Keieishi to Keieigaku*, 44. Itami proposes that one of basic characteristics of business history / historical research is to examine the context variables which are the vital factors in the specific time.

<sup>122</sup> Chandler, *Scale and Scope*, 213.

<sup>123</sup> Ibid.

<sup>124</sup> For the affection of antitrust to overdiversification in postwar, see Fligstein, *Transformation*, 191-225.

<sup>125</sup> "Allis-Chalmers to Stop Making Generators," *Wall Street Journal*, December 21, 1962.

<sup>126</sup> Fleck, "*The Dynamics of Corporate Growth*," especially chapter 6.

<sup>127</sup> Chandler, *Strategy and Structure*, 363.

<sup>128</sup> Chandler, *Strategy and Structure*, 393-394.

<sup>129</sup> Aupperle, Acar, and Mukherjee, "Revisiting the Fit-performance Thesis Half a Century Later," 351, 358. In their study, they define the each mismatched (new strategy and old structure) and matched (new strategy and new structure) periods as followed: WH's mismatched period is from 1928 to 1937, the matched period is from 1939 to 1948/1962; GE's mismatched from 1942 to 1951, and the matched from 1953-1962.

<sup>130</sup> Of course, Aupperle, Acar, and Mukherjee recognize the limitation of their study. See Aupperle, Acar, and Mukherjee, "Revisiting the Fit-performance Thesis Half a Century Later," 361-363.

<sup>131</sup> O'Sullivan, "Living with the U.S. Financial System."

<sup>132</sup> Ibid, 648.

<sup>133</sup> Schatz, *The Electrical Workers*, 167.

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<sup>134</sup> Ibid.

<sup>135</sup> Ibid, 238.

<sup>136</sup> Ibid, 232 and 238, and Greenwood, *Managerial Decentralization*, 192.

<sup>137</sup> Greenwood, *Managerial Decentralization*, 188-192. Schatz points out that “Boulwarism” was so flashy and so effective labor policy but there are many similarities with past policies developed by Gerard Swope and Owen Young. See Schatz, *The Electrical Workers*, 170.

<sup>138</sup> Downing, “The Process of Change,” 1964; Kobayashi, *GE*, 1970; Greenwood, *Managerial Decentralization*, 1986; O’Sullivan, “Innovation, Industrial Development, and Corporate Governance” 1996; Sakamoto, *GE*, 1997; Ocasio and Joseph, “Governance Channels and Organizational Design,” 2006; Rothschild, *GE’s Success*, 2007; Ocasio and Joseph, “Rise and Fall,” 2008; and Joseph and Ocasio, “Architecture, Attention, and Adaptation,” 2012.

<sup>139</sup> Downing, “The Process of Change,” 1964, 71-93; Greenwood, *Managerial Decentralization*, 1986, 16-24.

<sup>140</sup> Ocasio and Joseph, “Governance Channels,” 2006, 275-276; and Ocasio and Joseph, “Rise and Fall,” 2008, 254-256..

<sup>141</sup> Kobayashi, *GE*, 1970, 166-175.

<sup>142</sup> O’Sullivan, “Innovation,” 1996, 243-244.

<sup>143</sup> Sakamoto, *GE*, 1997, 105.

<sup>144</sup> Rothschild, *GE’s Success*, 2007, 127-142.

<sup>145</sup> Sakamoto, *GE*, 1997, 147-148.

<sup>146</sup> For instance Sakamoto regards the new organization as a positive contributor to financial standing compared to the previous decade while O’Sullivan seems to be less positive regarding the performance impact of the new organization by considering the cost of introduction and relatively flat of sales and profits afterward. See Sakamoto, *GE*, 1997, 148 and O’Sullivan, “Innovation,” 1996, 243-244.

<sup>147</sup> According to Ghemawat and McGahan, the original data of Sultan’s books are currently very difficult to obtain, because (1) Sultan had already discarded them and (2) they were unsuccessful to track down the data in GE’s archives and through court records. Therefore Sultan’s books contain rare data regarding the court trial. See Ghemawat and McGahan, “Order Backlogs and Strategic Pricing,” 262; Ghemawat, *Games Businesses Play*, 47.

<sup>148</sup> The author would like to thank Professor Akitake Taniguchi at the Faculty of Commerce, Chuo University for generously sharing his part of research materials on GE.

<sup>149</sup> Schatz, *The Electrical Workers*, 237-238.

<sup>150</sup> Chandler, “The Competitive Performance,” 16-19.

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<sup>151</sup> Backman, *Electrical Machinery Industry*, xvii.

<sup>152</sup> Ibid, 45. Also see, chart II-2, 44.

<sup>153</sup> Ibid, 19.

<sup>154</sup> Ibid, 1.

<sup>155</sup> This category is based on Backman, *Electrical Machinery Industry*, 2 and 325. Electrical apparatus includes steam engines and turbines. Electrical appliances includes household items and refrigeration and air conditioning units used by industry. Radio and television includes radio and television receiving sets and communication equipment. All other includes electronic tubes and miscellaneous electronic components.

<sup>156</sup> Ibid, 60 and 87.

<sup>157</sup> Ibid, 87.

<sup>158</sup> Backman, *Electrical Machinery Industry*, 88.

<sup>159</sup> The industrial concentration in steam turbine business also tends to occur in other countries. For instance, according to W. Geoffrey Shepherd analysis, U.K prime movers (other), which is equivalent to 3,511 steam engines & turbines, was also highly concentrated. See Shepherd, "a Comparison of Industrial Concentration," 74.

<sup>160</sup> Crawford, "Oral History," 9; Fuller, *The Gentlemen Conspirators*, 22.

<sup>161</sup> "Allis-Chalmers to Stop Making Generators," *Wall Street Journal* (December 21, 1962). However, Allis decided to reenter the business with Kraftwerk Union which was a joint venture between Siemens and AEG Telefunken in 1969 and set up Allis-Chalmers Power Systems in 1970. See "Out of the Shadow of 'Big Allis'," *Business Week*, no. 2186 (July 24, 1971)

<sup>162</sup> Chandler, *Scale and Scope*, 213.

<sup>163</sup> Backman, *Electrical Machinery Industry*, 29.

<sup>164</sup> Hirsh, *Technology and Transformation*, 56.

<sup>165</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 168.

<sup>166</sup> Ibid, 175; Hirsh, *Technology and Transformation*, 56.

<sup>167</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 174.

<sup>168</sup> Ibid, 168.

<sup>169</sup> Ibid, 168-169.

<sup>170</sup> Hirsh, *Technology and Transformation*, 63.

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<sup>171</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 166.

<sup>172</sup> Ibid.

<sup>173</sup> Ibid, 169.

<sup>174</sup> Ibid, 174.

<sup>175</sup> Ibid, 173; Westinghouse Electric Corporation, *Annual Reports, 1947*, 2.

<sup>176</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 174.

<sup>177</sup> Ibid.

<sup>178</sup> Ibid.

<sup>179</sup> Ibid.

<sup>180</sup> Ibid, 1975

<sup>181</sup> Ibid.

<sup>182</sup> Ibid. Testimony of John R. Carlson, division engineering manager at Lester for Westinghouse, Ohio Valley Electric v. General Electric, 2971-2972.

<sup>183</sup> Ibid, 175-176.

<sup>184</sup> Schatz, *The Electrical Workers*, 167.

<sup>185</sup> Ibid, 238; Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 176. For the detail of differences in labor relation between GE and WH, see Schatz, *The Electrical Workers*, especially chapter 7 to 9. For the detail of the development of Lemuel Boulware's labor policy, later called "Boulwarism," also see Wise, *General Electric's Century*, chapter 7.

<sup>186</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 176.

<sup>187</sup> Ibid, 175.

<sup>188</sup> Ibid, 166.

<sup>189</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 1, 198.

<sup>190</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 174.

<sup>191</sup> Ibid, 232-233.

<sup>192</sup> Ibid, 169.

<sup>193</sup> GE started its expansion from 1948, but WH did around 1950; Ibid, 179.

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- <sup>194</sup> One of factors that WH maintained its market share was the brand loyalties; Sultan, *Pricing in the Electrical Oligopoly*, Vol. 1, 290-295.
- <sup>195</sup> DeGrasse, *Military Expansion*, 2.
- <sup>196</sup> Haynes, *The Awesome Power*, 151-152.
- <sup>197</sup> Ibid; DeGrasse, *Military Expansion*, 3; U.S. Department of State, Office of the Historian, "NSC-68, 1950."
- <sup>198</sup> DeGrasse, *Military Expansion*, 3
- <sup>199</sup> National Security Council, "United States Objectives and Programs for National Security," 28.
- <sup>200</sup> National Security Council, "United States Objectives and Programs for National Security," 58.
- <sup>201</sup> Haynes, *The Awesome Power*, 153.
- <sup>202</sup> Wise, *General Electric's Century*, chapter 8, 44.
- <sup>203</sup> Ibid, 44-45.
- <sup>204</sup> Ralph J. Cordiner, GE president, "New Frontiers for Professional Managers (1): New Corporate Dimensions," 1956 McKinsey Foundation Lectures Presented at Graduate School of Business Columbia University, New York City, April 19, 1956, 10.
- <sup>205</sup> Wise, *General Electric's Century*, chapter 8, 45.
- <sup>206</sup> Ralph J. Cordiner, GE Chairman of the Board, "Social Responsibilities of the Businessman," Harvard Business School Could of New York, Harvard Club, New York, City, May 18, 1959, 6.
- <sup>207</sup> Wise, *General Electric's Century*, chapter 8, 44-45; J.S. Parke, GE vice president and general manager of aircraft gas turbine division, "Let's Conduct Defense as a Business," Harvard Business Review, May-June, 1957, 7.
- <sup>208</sup> Guy Suits, Vice president and Director of Research, "Large Business as a Source of Technical Assistance for Small Business" a talk extracted from a paper on "Industrial Research in a Free Society" submitted to the President's Conference on Technical and Distribution Research for the Benefit of Small Business, Washington, D.C., September 24, 1957, 7
- <sup>209</sup> J.S. Parke, GE vice president and general manager of aircraft gas turbine division, "Let's Conduct Defense as a Business," Harvard Business Review, May-June, 1957, 7.
- <sup>210</sup> Ibid, 6. Aircraft industry held major subcontractors. The structure of subcontracting in postwar aircraft industry as a whole, see Nishikawa, *Amerika Koku-Uchu Sangyo*, chapter 5.
- <sup>211</sup> Ibid.

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<sup>212</sup> Robert Paxton, the president of GE, "Social Responsibilities of the Businessman" To Harvard Business School Club of New York, Harvard Club, New York City, May 18, 1959, 6-7.

<sup>213</sup> Ibid.

<sup>214</sup> Leyes and Fleming, *The History of North American Small Gas Turbine Aircraft Engines*, 33; Virginia P. Dawson, *Engines and Innovation*, 45. Before they were chosen as the contractor, at least WH's engineers studied gas turbine for land and industrial application in 1939 and 1940. See Leyes and Fleming, *The History of North American Small Gas Turbine Aircraft Engines*, 35

<sup>215</sup> Misa, *Leonardo to the Internet*, 155.

<sup>216</sup> For instance, GE provided B-29 Gunfire System which was based on electrical analog computer between 1941 and 1945. See Uda, "GE-sha," 385 and 387.

<sup>217</sup> Uda, "GE-sha," 385-86 and 394-95; Aspray, "Edwin L. Harder," 35. Regarding GE's Computer department, OARCA did not directly link to the establishment of 1956. See Uda, "GE-sha," 396.

<sup>218</sup> Bergin, *50 years of Army Computing*, 75-76.

<sup>219</sup> "Management –Comparison with G.E., Part II, (1949-1960)," box13, folder 1, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>220</sup> Westinghouse Electric Corporation, *Annual Report*, 1960, 7.

<sup>221</sup> "Mr. Expansion," *Time*, October 8, 1951.

<sup>222</sup> "Employee: O-Ro" box58, folder 5, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>223</sup> Ibid; Westinghouse Electric Corporation, *Annual Report*, 1946-48.

<sup>224</sup> Ibid.

<sup>225</sup> "Employee: O-Ro" box58, folder 5, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center; Westinghouse Electric Corporation, *Annual Report*, 1951-55.

<sup>226</sup> Ibid.

<sup>227</sup> "Employee: O-Ro" box58, folder 5, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>228</sup> "Employee: O-Ro" box58, folder 5 and "Histories: Chronologies and List (1906-1986)" box 79, Folder 1, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>229</sup> Ibid.



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- <sup>230</sup> “Histories: Chronologies and List (1906-1986)” box 79, Folder 1, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.
- <sup>231</sup> Scherer, *The Weapons Acquisition Process*, 77; Lagasse, “The Westinghouse Aviation,” 21.
- <sup>232</sup> Lagasse, “The Westinghouse Aviation,” 29.
- <sup>233</sup> Scherer, *The Weapons Acquisition Process*, 77.
- <sup>234</sup> U.S. Department of the Air Force, “(U) B-47 with Westinghouse J-54 Engine,” 1956.
- <sup>235</sup> Leyes and Fleming, *The History of North American*, 45: Original source was Lewis F. Smith, “History of Westinghouse Aviation Gas Turbines,” unpublished paper, undated (circa 1990), National Air and Space Museum Archives, Washington, D.C., 7-8.
- <sup>236</sup> Lagasse, “The Westinghouse Aviation,” 20.
- <sup>237</sup> “Histories: Chronologies and List (1906-1986)” box 79, Folder 1, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.
- <sup>238</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 2, 175.
- <sup>239</sup> Ibid.
- <sup>240</sup> Fleck, “The Dynamics of Corporate Growth,” 251 and 282.
- <sup>241</sup> Richard A Smith, “The Incredible Electrical Conspiracy, Part 1,” 133.
- <sup>242</sup> Walton and Cleveland, *Corporations on Trial*, 33; Herling, *The Great Price Conspiracy*, 190.
- <sup>243</sup> Lean, Ogur, and Rogers, *Competition and Collusion*, 1; Richard A Smith, “The Incredible Electrical Conspiracy, Part 1,” 134; Richard A Smith, “The Incredible Electrical Conspiracy, Part 2,” 222.
- <sup>244</sup> Mr. Holifield, speaking on HR6134, on July 20, 1959, 86th Cong., 1st sess., *Congressional Record* 105, pt. 11: 13728.
- <sup>245</sup> Porter, *Cases in Competitive Strategy*, 107. In addition, Brown Boveri had won 3.8% in 1961.
- <sup>246</sup> Crawford, “Oral History of the Tennessee Valley Authority,” 9.
- <sup>247</sup> Mr. Holifield, speaking on HR6134, on July 20, 1959, 86th Cong., 1st sess., *Congressional Record* 105, pt. 11: 13728.
- <sup>248</sup> Sultan, *Pricing in the Electrical Oligopoly*, Vol. 1, 17.
- <sup>249</sup> Walton and Cleveland, *Corporations on Trial*, 29.
- <sup>250</sup> Ibid, 30; Mr. Holifield, speaking on HR6134, on July 20, 1959, 86th Cong., 1st sess., *Congressional Record* 105, pt. 11: 13729.
- <sup>251</sup> Walton and Cleveland, *Corporations on Trial*, 30.

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<sup>252</sup> Ibid, 32.

<sup>253</sup> Ibid.

<sup>254</sup> Ibid, 35-37.

<sup>255</sup> Foreign firms took orders before the TVA contract. For instance, Brown Boveri had already sold turbo-generators to private industries, municipal and privately owned public utilities. See Mr. Holifield, speaking on HR6134, on July 20, 1959, 86th Cong., 1st sess., *Congressional Record* 105, pt. 11: 13729.

<sup>256</sup> For instance, on a current dollar basis, average dollars per kilowatt of turbine generator orders sold by GE was declining from \$22.6 in 1955, \$21.2 in 1960, to \$17.0 in 1965. See Sultan, *Pricing in the Electrical Oligopoly*, Vol. 1, 195.

<sup>257</sup> Allen, "Tacit Collusion," 51.

<sup>258</sup> Hordeski, *Emergency and Backup Power Sources*, 6.

<sup>259</sup> Hirsh, *Technology and Transformation*, 56.

<sup>260</sup> Federal Power Commission, *Gas Turbine Electric Plant*, VII.

<sup>261</sup> Somerscales and Hendrickson, "America's First Power Generating Gas Turbine," 4.

<sup>262</sup> Unger and Herzog, "Comparative Study on Energy R&D Performance," 13.

<sup>263</sup> Ibid, 5.

<sup>264</sup> Hirsh, *Technology and Transformation*, 57.

<sup>265</sup> Ibid, 57-58.

<sup>266</sup> Allen, "Tacit Collusion," 51.

<sup>267</sup> Porter, *Cases in Competitive Strategy*, 108.

<sup>268</sup> Ibid, 102.

<sup>269</sup> Allen, "Tacit Collusion," 51.

<sup>270</sup> Ghemawat, *Games Businesses Play*, 54-55.

<sup>271</sup> Allen, "Tacit Collusion," 51.

<sup>272</sup> Ghemawat, *Games Businesses Play*, 55-56.

<sup>273</sup> McInnes, "Aggressive Swiss," 9; Scherer, An Oral History, Dealing with GE & Westinghouse.

<sup>274</sup> Loft, "Gas Turbine Development at General Electric"; Unger and Herzog, "Comparative Study," 5.

<sup>275</sup> Ibid.

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<sup>276</sup> Hirsh, *Technology and Transformation*, 106, 108.

<sup>277</sup> Ibid, 105-106; Scherer, *An Oral History, Dealing with GE & Westinghouse*; Gordon, *Productivity Growth*, 210; *Business Week*, "The Turbine Troubles that Plague Westinghouse," 54-55.

<sup>278</sup> Gordon, *Productivity Growth*, 210

<sup>279</sup> *Business Week*, "The Turbine Troubles that Plague Westinghouse," 55.

<sup>280</sup> Ibid.

<sup>281</sup> Sultan, *Pricing in the Electrical Oligopoly, Vol. 2*, 223-224.

<sup>282</sup> Sultan, *Pricing in the Electrical Oligopoly, Vol. 1*, 198.

<sup>283</sup> Sultan, *Pricing in the Electrical Oligopoly, Vol. 2*, 224.

<sup>284</sup> Ralph J. Cordine, GE president, "New Frontiers for Professional Managers (1): New Corporate Dimensions," 1956 McKinsey Foundation Lectures Presented at Graduate School of Business Columbia University, New York City, April 19, 1956, 7-8.

<sup>285</sup> Hirsh, *Technology and Transformation*, 51.

<sup>286</sup> Ibid.

<sup>287</sup> Ibid.

<sup>288</sup> Ibid, 51-52.

<sup>289</sup> Sultan, *Pricing in the Electrical Oligopoly, Vol. 2*, 69.

<sup>290</sup> Ibid, 168-172.

<sup>291</sup> WH, *Annual Reports 1958*, 23 and GE, *Annual Reports 1959*, 17.

<sup>292</sup> GE, *Annual Reports 1959*, 17.

<sup>293</sup> Ibid.

<sup>294</sup> GE, *Annual Reports 1959*, 5 and WH, *Annual Reports 1960*, 25.

<sup>295</sup> Ralph J. Cordine, GE president, "The Shape of Things to Come," Before the Edison Electric Institute, Boston, Massachusetts, June 9, 1958, 5.

<sup>296</sup> WH, *Annual Reports 1961*, 21.

<sup>297</sup> Galambos and Pratt, *The Rise of Corporate Commonwealth*, 136-139.

<sup>298</sup> Ibid, 137.

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<sup>299</sup> Gerald L. Phillippe, GE president, "Managerial Strategies for the Nineteen-Sixties," An address before the 30th Annual Conference Southeastern Electric Exchange, March 25, 1963, 5.

<sup>300</sup> Ibid, 6.

<sup>301</sup> Ibid, 10.

<sup>302</sup> Ibid, 5, 19.

<sup>303</sup> WH, *Annual Reports 1964*, 2.

<sup>304</sup> J. Stanford Smith, GE vice president, "Electricity for an Age of Cities," Los Angeles Electric Club, April 22, 1963, 3-4. According to Smith, the word "rurban" indicated the half-rural, half-urban character of areas on the fringe of metropolitan districts.

<sup>305</sup> WH, *Annual Reports 1961*, 5.

<sup>306</sup> Gerald L. Phillippe, GE president, "Managerial Strategies for the Nineteen-Sixties," An address before the 30th Annual Conference Southeastern Electric Exchange, March 25, 1963, 5-6, 10

<sup>307</sup> GE, *Annual Reports 1963*, 12; WH, *Annual Reports 1964*, 19.

<sup>308</sup> GE, *Annual Reports 1958*, 18-19.

<sup>309</sup> Gerald L. Phillippe, GE president, "Managerial Strategies for the Nineteen-Sixties," An address before the 30th Annual Conference Southeastern Electric Exchange, March 25, 1963, 7.

<sup>310</sup> Ibid, 5-10; a word "system" increasingly appears in their annual report. For instance, GE uses "system-oriented" in GE, *Annual Reports 1964*, 8. WH describes that system as a problem-solving in WH, *Annual Reports 1964*, 15.

<sup>311</sup> Galambos and Pratt, *The Rise of Corporate Commonwealth*, 136.

<sup>312</sup> Rothschild, *The Secret*, 127-128.

<sup>313</sup> Ibid, 129.

<sup>314</sup> Fruhan, *Financial Strategy*, 155.

<sup>315</sup> Ibid, 157; Sakamoto, *GE*, 114.

<sup>316</sup> J. Stanford Smith, GE vice president, "The New World of the Entrepreneur," Conference on Education for Business Crotonville, New York, July 29, 1963, 6.

<sup>317</sup> Virgil B. Day, GE vice president, "Labor-Management Relations and Economic Growth: the Role of Industry," an address before the Congress of American Industry National Association of Manufacturers, New York, December 5, 1963, 4.

<sup>318</sup> Rothschild, *The Secret*, 138.; GE, *Annual Reports 1968*, 9.

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<sup>319</sup> Sakamoto, *GE*, 150.

<sup>320</sup> Fruhan, *Financial Strategy*, 159.

<sup>321</sup> Ibid.

<sup>322</sup> Rothschild, *The Secret*, 143.

<sup>323</sup> WH, *Annual Reports 1966*, 3.

<sup>324</sup> Ibid, 9.

<sup>325</sup> WH, *Annual Reports 1961*, 17.

<sup>326</sup> WH, *Annual Reports 1961*, 19.

<sup>327</sup> Harrington, "The Social-Industrial Complex," 2.

<sup>328</sup> Rothschild, *The Secret*, 143.

<sup>329</sup> Factors for the economic decline often refer to the Vietnam War, the oil crisis, government regulations, and tax and monetary policies at the time. It depends on the researcher as to which factor caused the situation that resulted.

<sup>330</sup> Otto Eckstein, *The Great Recession: with a Postscript on Stagflation* (Amsterdam; North-Holland, 1978).

<sup>331</sup> Robert H. Hayes and William J. Abernathy, "Managing Our Way to Economic Decline," *Harvard Business Review* 58, no. 4 (1980): 67-68. Hayes and Abernathy point out there is a failure to explain, for instance, why the rate of productivity growth in America has declined in both absolute and relative terms to that of Europe and Japan, and why America lost its leadership position in many high-technology and mature industries.

<sup>332</sup> Louis Galambos and Joseph Pratt, *The Rise of Corporate Commonwealth: United States Business and Public Policy in the 20th Century* (New York: Basic Books, 1988), chap 9 and 10.

<sup>333</sup> Louis Galambos, "The U.S. Corporate Economy in the Twentieth Century," in *The Cambridge Economic History of the United States*, vol. 3, ed. Stanley L. Engerman and Robert E. Gallman (Cambridge: Cambridge University Press, 2000), 957. It notes the antitrust policy influence on American company behavior and the M&A movement of the 1960s, after the Second World War. For more detail see Neil Fligstein, *The Transformation of Corporate Control* (Cambridge: Harvard University Press, 1990)

<sup>334</sup> Alfred D. Chandler Jr., "The Enduring Logic of Industrial Success," *Harvard Business Review* 90, no. 2 (1990): 132-133.

<sup>335</sup> Nitin Nohria, Davis Dyer and Frederick Dalzell, *Changing Fortunes: Remaking the Industrial Corporation* (New York: John Wiley & Sons, 2002), 58.

<sup>336</sup> General Electric Co., *1967 Annual Report*, 25.

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<sup>337</sup> Westinghouse Electric Corp., *1968 Annual Report*, 1.

<sup>338</sup> Westinghouse Electric Corp., *1969 Annual Report*, 1.

<sup>339</sup> Nitin Nohria, Davis Dyer and Frederick Dalzell, *Changing Fortunes: Remaking the Industrial Corporation* (New York: John Wiley & Sons, 2002), 15-16.

<sup>340</sup> Kazuichi Sakamoto, *GE no Soshiki Kakushin: 21seiki-gata-sosiki he no Chosen* (Kyoto: Horitubunkasya, 1997), 155-191. William E. Rothschild, *The Secret to GE's Success* (New York: McGraw-Hill, 2007) 167-186.

<sup>341</sup> Sakamoto, *GE no Soshiki Kakushin*, 191. Rothschild, *The Secret to GE's Success*, 170.

<sup>342</sup> Rothschild, *The Secret to GE's Success*, 170. Although some scholars contend SBU was introduced to GE in 1972, the language had already been introduced previously. In 1972, Reginald Jones defined the rules by which specific strategic actions were taken with respect to the SBU. For more detail, see Robert G. Eccles and Nitin Nohria with James D. Berkley, *Beyond the Hype: Rediscovering the Essence of Management* (Washington, D.C.: Beard Books, 2003) 95.

<sup>343</sup> Nohria et al., *Changing Fortunes*, 16; originally quoted from "General Electric Company: Quality of Earnings Analysis," 5: Reginald Jones who took the helm of GE announced that "with our new strategic planning process, we are learning how to allocate our resources to the right places, at the right time, for optimum growth and profitability—and at the same time, contain our risk," and added "many companies claim they do strategic planning, but the process may or may not be anything more than intuitive wheeling-and-dealing by the top man."

<sup>344</sup> Mary A. O'Sullivan, "Living with the U.S. Financial System: The Experiences of General Electric and Westinghouse Electric in the Last Century," *Business History Review* 80, no. 4 (2006): 629.

<sup>345</sup> *Ibid*, 652-653.

<sup>346</sup> Denise L. Fleck, "The Dynamics of Corporate Growth," (PhD diss., McGill University, 2001), 172-174. To confirm the more clear divergent tendency of both firms on corporate growth, also see Denise L. Fleck, "Building up Capabilities for Sustained Corporate Growth," (2005), 9.

<sup>347</sup> *Ibid*, 236. She also provides the seven factors of the different paths between GE and WH, from observing both histories over a hundred years: (1), organizing approach, GE's integration or WH's fragmentation, (2) resource allocation approach, strong or weak top coordination, (3) problem solving approach, systematic or piecemeal, (4) managerial hierarchy approach, early or poorly developed, (5) enterprising approach, ambitious or satisfying goals, (6) growth motives approach, hybrid or defensive, (7) change approach, change handling or complying. Her conclusion addresses the gap of managerial capabilities. For the more detail, see Fleck, "*The Dynamics of Corporate Growth*," 276-288.

<sup>348</sup> The author would like to thank Professor Akitake Taniguchi at the Faculty of Commerce, Chuo University for generously providing him copies of GE's annual reports and Executive Speeches and Reports to Share Owners.

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<sup>349</sup> Neil, "The Corporate," 742.

<sup>350</sup> Fleck, "The Dynamic," 226.

<sup>351</sup> It should be noted that the disposal of the computer business was a major turning point in GE history, but GE did not fully dispose of its computer business as it held its time-sharing services business. This is one aspect that has not been emphasized in GE history. In fact it is seen as one of the key factors that led to the development of the personal computing industry. On this point, this will be described further in another paper which is presently being developed.

<sup>352</sup> Sakamoto, *GE*, 162.

<sup>353</sup> Rothschild, *the Secret*, 169.

<sup>354</sup> *Ibid*, 170.

<sup>355</sup> Sakamoto, *GE*, 190-191.

<sup>356</sup> Westinghouse, *1975 Annual Report*, 33.

<sup>357</sup> Smith, "Uranium," 31.

<sup>358</sup> *Free Lance–Star*, "Testimony Shows Uranium," 27.

<sup>359</sup> Feder, "Is Westinghouse."

<sup>360</sup> Smith, "Uranium," 31.

<sup>361</sup> Greider, "Uranium," First Section; A1.

<sup>362</sup> WH, *Annual Report 1976*, 34.

<sup>363</sup> WH, *Annual Report 1979*, 47.

<sup>364</sup> WH, *Annual Report 1980*, 36.

<sup>365</sup> Walker, *Three Mile Island*, 3.

<sup>366</sup> See chapter 2 for the detail.

<sup>367</sup> WH, *Annual Report 1980*, 41.

<sup>368</sup> *Ibid*, 41.

<sup>369</sup> *Ibid*, 41.

<sup>370</sup> *Ibid*, 33.

<sup>371</sup> GE, *Annual Report 1971*, 27; GE, *Annual Report 1980*, 34.

<sup>372</sup> WH, *Annual Report 1971*, 28; WH, *Annual Report 1980*, 26.

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<sup>373</sup> Due to not consolidating the financial service subsidiaries during the decade, the net income was included as other income.

<sup>374</sup> GE, *Annual Report 1980*, 6.

<sup>375</sup> Reginald Jones, Title: New Directions for the U. S. Economy, Traffic Club of Pittsburgh, January 24, 1974.

<sup>376</sup> Thomas Paine, Title: Testimony on National Energy Policy, Testimony before Joint Committee on Atomic Energy, February 6, 1974.

<sup>377</sup> Reginald Jones, Title: Financial Management in an Era of Inflation, Annual Conference Financial Executives Institute, October 7, 1974.

<sup>378</sup> Reginald Jones, Title: The General Electric – Utah International Merger, General Electric Investor, December 16, 1976. According to Rothschild, this merger was to provide a steady income-generator, but it was a mistake. More careful consideration is required on how much benefit was gained by GE from Utah's earnings and losses, against the cost of conflict that was generated by different corporate cultures, while still taking into account the inflationary environment. For more detail see Rothschild, *The Secret to GE's Success*, 169-170.

<sup>379</sup> Reginald Jones, Title: Can We Afford The Future?, Annual Distinguished Lecture: The Economic Club of Pittsburgh, May 28, 1975.

<sup>380</sup> Reginald Jones, Title: Capital Requirements of Business, 1974-85, Testimony to Subcommittee on Economic Growth Joint Economic Committee of Congress, May 8, 1974.

<sup>381</sup> Ibid.

<sup>382</sup> Thomas Paine, Title: Testimony on National Energy Policy, Testimony before Joint Committee on Atomic Energy, February 5, 1974.

<sup>383</sup> E.E. Hood, Jr., Title: New Perspectives on the Future of the Electric Utility Industry, the 91th meeting of the Association of Edison Illuminating Companies, November 13, 1975.

<sup>384</sup> As it suggests, a senior vice president of technology planning and development said "Our [GE's] position with respect to breeder reactors is much less satisfactory. Both the Russians and the Europeans are ahead of us in reducing breeder technology to practice (Thomas Paine, Title: Testimony on National Energy Policy, Testimony before Joint Committee on Atomic Energy, February 6, 1974.)."

<sup>385</sup> E. E. Hood, Jr., Title: Energy Technology in Perspective, the Fourth Energy Technology Conference, March 14, 1977.

<sup>386</sup> Thomas Vanderslice, Title: The Energy Equation: Current Perspectives, the Economic Club of Detroit, February 13, 1978.

<sup>387</sup> D. J. Povejsil, Title: Energy Crisis: The Challenge, the Solution, IBEW (The International Brotherhood of Electrical Workers) District 3 Progress Meeting, June 8, 1974.



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<sup>388</sup> *ibid*

<sup>389</sup> *ibid*

<sup>390</sup> *Ibid.*

<sup>391</sup> Charles Ruch, Title: Whatever It Takes, Veteran Employees' Association, March 4, 1975.

<sup>392</sup> D. J. Povejsil, Title: Some Views from Personnel, Atlantic Region Meeting, November 8, 1974.

<sup>393</sup> It is the circle which "more electric products created a demand for more generating capacity. More generating capacity in turn made power available for still more electrical products."

<sup>394</sup> Robert Kirby, Title: Remark, Commerce Department Briefing, October 20, 1975.

<sup>395</sup> *ibid*

<sup>396</sup> Robert Kirby, Title: Remark, Westinghouse Communications Meeting, March 25, 1976.

<sup>397</sup> E. V. Clarke, Jr., Title: Sharon Talk, Sharon Veteran Employees Banquet, October 9, 1976.

<sup>398</sup> Douglas Danforth, Title: Remarks, Financial Analysis Meeting, November 16, 1976.

<sup>399</sup> George Wilcox, Title: A Report from Westinghouse, Meeting with Mitsubishi Representatives, September 29, 1974.

<sup>400</sup> The perception is considered to be future-oriented to some extent. Future action is based on current perceptions, and a verification of certain perceptions can be achieved by looking into the actions taken in the future. The R&D plan or investments can be regarded as indicators of behaviors expected for the future; therefore it is an appropriate subject to examine.

<sup>401</sup> CRD Strategic Plan Session F, October 20, 1971

<sup>402</sup> *ibid*

<sup>403</sup> CRD Corporate Staff - Session I, February 27, 1970

<sup>404</sup> CRD Corporate Staff - Session IV, October 8, 1970

<sup>405</sup> Records of the Westinghouse Electric Corporation, Series XIII R&D, Box168 Folder 13.

<sup>406</sup> Records of the Westinghouse Electric Corporation, Series XIII R&D, Box169 Folder 1.

<sup>407</sup> GE, *Annual Report 1979*, 24; Loomis, "How GE Manages Inflation," 121.

<sup>408</sup> Loomis, "How GE Manages Inflation," 121.

<sup>409</sup> *Ibid*, 123.

<sup>410</sup> Jones, *Multinationals*, 35; Nohria, Dyer and Dalzell, *Changing Fortunes*, 51-52.

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<sup>411</sup> Ibid, 34; Ibid, 57.

<sup>412</sup> Ibid, 37; Ibid, 55.

<sup>413</sup> Ibid, 35; Ibid, 53-54.

<sup>414</sup> Ministry of Economy, Trade and Industry, *White Paper on International Trade*, 1.

<sup>415</sup> Prahalad and Hamel, "The Core Competence," 79.

<sup>416</sup> Markides, *Diversification*, 66.

<sup>417</sup> Galambos, "The U.S. Corporate Economy," 959-960.

<sup>418</sup> Matsui and Okumura, *Beikoku*, 4.

<sup>419</sup> Ibid, 58-64; Sato, *20 seikimatsu*, 188-189, 200-202; Galambos, "The U.S. Corporate Economy," 961.

<sup>420</sup> Hall, "Corporate Restructuring," 115-116. Low-tech industries include food, textiles, lumber and wood products, and misc; the part of stable tech industries indicate the stable-tech (short-horizon) which consist of rubber and plastics, stone, clay, and glass, fabricated metals, soap and toiletries, motor vehicle parts. For the detail, see Hall, "Corporate Restructuring," 123.

<sup>421</sup> Chandler, "Competitiveness and Capital Investment," xiii; Chandler, "The Competitive Performance," 57-58. High-tech industries include pharmaceuticals (except soap and toiletries), electrical equipment, electronics, computing equipment, aircraft and aerospace, instruments; the other part of stable tech industries indicate the stable-tech (long-horizon) which consist of chemical, petroleum, primary metals, machinery, autos and transport equipment (except parts), and engine. For the detail, see Hall, "Corporate Restructuring," 123.

<sup>422</sup> Hikino, "Managerial Control," 490-491.

<sup>423</sup> GE, *Annual Report*, 1982, 3; GE, *Annual Report*, 1983, 4; GE, *Annual Report*, 1984, 4; "Restructuring (acquisitions and divestitures), 1982-1995," 1982, box 27, folder 18, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center. GE's total obtained businesses from 1981 to 1984 was 232, made-up as follows: from 1981 to 1982 through acquisitions, joint ventures and formations of new companies, 62 in 1983 and 52 in 1984 through acquisitions, joint ventures and other equity investments.

<sup>424</sup> Fleck, "The Dynamic," 168, 274.

<sup>425</sup> Ibid, 274, 276-282.

<sup>426</sup> Ibid, 283-287.

<sup>427</sup> Ibid, 236.

<sup>428</sup> Ibid, 233, 287, 293.

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<sup>429</sup> Nohria, Dyer and Dalzell, *Changing Fortunes*, 6, 8, 15, 19.

<sup>430</sup> Ibid, ix, 24.

<sup>431</sup> Ibid, 14.

<sup>432</sup> Ibid, 3.

<sup>433</sup> O'Sullivan, "Living with the U.S. Financial System," 651.

<sup>434</sup> O'Sullivan, "Living with the U.S. Financial System," 652-653.

<sup>435</sup> Aguilar, General Managers, 407-462; Chandler, "The Functions of the HQ Unit," 42-45.

<sup>436</sup> Sakamoto, *GE*, 197-255; Natsume, *Gendai amerika*, 51-73; Tichy and Sherman, *Control Your Destiny*, 80-117; Rothschild, *The Secret to GE's Success*, 189-218.

<sup>437</sup> Taniguchi and Hasegawa, "Sentaku to shuchu'," 182; Kazusa, "Sogoteki Seihin Seisaku," 109.

<sup>438</sup> John Joseph and William Ocasio, "Architecture, Attention, and Adaptation in the Multi-business Firm," *Strategic Management Journal* 33, no. 6 (2012): 633-660; William Ocasio and John Joseph, "Rise and Fall, or Transformation?," *Long Range Planning* 41, no. 3 (2008): 248-272; Ocasio, William and John Joseph, "Governance Channels and Organizational Design at General Electric," in *Organization Design* (Boston: Springer Publishers, 2006) 267-284.

<sup>439</sup> Ocasio and Joseph, "Rise and Fall," 262.

<sup>440</sup> This section of descriptions regarding GE and WH is based on Kenichi Miyata, "1970-nendai kara 1990-nendai niokeru GE no senryaku tenkan: Jonzu no seizougyo sinka kara ueruchi no sabisugyoka," *Studies in Business Administration*, no.32 (2010): 91-110 and Kenichi Miyata, "Westinghouse Electric Corporation in the Late 20th Century: A View from an Investment Trajectory Analysis Perspective," *Studies in Business Administration*, no.34 (2011a):115-130.

<sup>441</sup> WH contracted some of its utility customers for the delivery of approximately 80 million pounds of uranium over 20 years at an average price of \$9.50 per pound. Although WH had approximately 15 million pounds of uranium in inventory or under firm contract, this left a shortfall of approximately 65 million pounds, because the market price quotations for uranium had increased to approximately \$40 per pound. For more detail see WH, *Annual Reports 1975*, 33-34. This increasing price was behind the Uranium Cartel among 29 domestic and foreign uranium producers. See WH, *Annual Reports 1976*, 34.

<sup>442</sup> Sakamoto, *GE*, 162-191.

<sup>443</sup> WH financial subsidiary, Westinghouse Credit Corporation "poured money into high-risk, high-return ventures like hotels, shopping centers, junk bonds, and leveraged buyouts.(Nulty, "Behind the Mess at Westinghouse," 93.)" This year the financial business racked up 844 million dollar as its losses.

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<sup>444</sup> GE, *Annual Reports 1982*, 3. and GE, *Annual Reports 1983, 4., 1984*, p.4. Total obtained businesses from 1981 to 1984 was 232, made-up as follows: 118 from '81 to '82 through acquisitions, joint ventures and formations of new companies, 62 in '83 and 52 in '84 through acquisitions, joint ventures and other equity investments.

<sup>445</sup> Both GE and WH financial services business entered into multiple financial businesses. Although GE had already operated broadcasting and cablevision business, such as television and radio stations prior to the 1980s, GE entered the full field of broadcasting business with its acquisition of NBC.

<sup>446</sup> Nulty, "Westinghouse What an Outsider has to Tackle," 102.

<sup>447</sup> Since generally it is considered that investment as an actual behavior is derived from strategy e.g. a conceptual plan; in other words, investment serves as one proxy of organizational response. This approach, Investment Trajectory Analysis, is useful for tracking both companies' responses during the periods, even though impacted to certain degrees by the macro-economic environment. See Addendum A on this approach.

<sup>448</sup> *New York Times*, 1976.

<sup>449</sup> GE, *Annual Reports 1979*, 4.

<sup>450</sup> WH, *Annual Reports 1980*, 3.

<sup>451</sup> Rothschild[2006], p.167.

<sup>452</sup> GE, *Annual Reports 1981*, 2.

<sup>453</sup> WH, *Annual Reports 1983*, 45.

<sup>454</sup> Bergek, Tell, Berggren and Watson, "Technological Capabilities," 336; Bauer, *Atoms, Bytes and Genes*, 12, 54-55; *Business Week*. "Nuclear Dilemma," 54.

<sup>455</sup> Bergek, Tell, Berggren and Watson, "Technological Capabilities," 336.

<sup>456</sup> Unger and Herzog, "Comparative Study on Energy R&D Performance," 38.

<sup>457</sup> Watson, "The 'Success' of the Combined Cycle Gas Turbine," 88.

<sup>458</sup> Ibid.

<sup>459</sup> Ibid; Arne, "Gas Turbine Development," 3-4.

<sup>460</sup> Arne, "Gas Turbine Development," 3.

<sup>461</sup> Unger and Herzog, "Comparative Study on Energy R&D Performance," 21-23; Watson, "The 'Success' of the Combined Cycle Gas Turbine," 89.

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<sup>462</sup> Wilcox, an oral history. Wilcox, who was WH's former executive vice president and retired in 1975, said that he "was a troubleshooter for gas turbine problems, and we had lots of them" between 1976 and 1980.

<sup>463</sup> Unger and Herzog, "Comparative Study on Energy R&D Performance," 5, 23.

<sup>464</sup> Watson, "Constructing Success in the Electric Power Industry," 13-14.

<sup>465</sup> Bergek, Tell, Berggren and Watson, "Technological Capabilities," 351.

<sup>466</sup> Ibid, 351-352.

<sup>467</sup> Ibid, 372.

<sup>468</sup> Ibid, 363; Watson, "The 'Success' of the Combined Cycle Gas Turbine," 89; WH, *Nuclear Energy Digest*, 9-10; Curtis, "The Innovation of Energy Technologies," 26.

<sup>469</sup> "Administrative: Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>470</sup> Unger and Herzog, "Comparative Study on Energy R&D Performance," 37-38.

<sup>471</sup> "Administrative: Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>472</sup> Unger and Herzog, "Comparative Study on Energy R&D Performance," 38.

<sup>473</sup> GE, *Annual Reports 1981*, 5; WH, *Annual Reports 1981*, 4.

<sup>474</sup> GE, *Annual Reports 1982*, 3.

<sup>475</sup> Steward, "Westinghouse Gets Respect," 93.

<sup>476</sup> "Administrative: Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>477</sup> Morone, *Winning in High-tech Markets*, 28; Janssen and Medford, *Envision*, 72-73.

<sup>478</sup> "Administrative: Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>479</sup> Aguilar, *General Managers in Action*, 452.

<sup>480</sup> "Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>481</sup> "Restructuring (Acquisitions & Divestitures), (1982-1995)" box 27, Folder 18, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

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<sup>482</sup> Welch, *Jack*, 102-103.

<sup>483</sup> *Ibid.*, 102.

<sup>484</sup> "Financial Article (1989-1993)" box 6, Folder 3, Records of the Westinghouse Electric Corporation, Historical Society of Western Pennsylvania Senator John Heinz History Center.

<sup>485</sup> *Ibid.*

<sup>486</sup> *Ibid.*

<sup>487</sup> Fleck, "The Dynamic," 274, 276-282; Chandler, "The Functions of the HQ Unit," 42-45.

<sup>488</sup> John Joseph and William Ocasio, "Architecture, Attention, and Adaptation in the Multi-business Firm," *Strategic Management Journal* 33, no. 6 (2012): 633-660; William Ocasio and John Joseph, "Rise and Fall, or Transformation?," *Long Range Planning* 41, no. 3 (2008): 248-272; Ocasio, William and John Joseph, "Governance Channels and Organizational Design at General Electric," in *Organization Design* (Boston: Springer Publishers, 2006) 267-284.

<sup>489</sup> Nohria, Dyer and Dalzell, *Changing Fortunes*, 2.

<sup>490</sup> Nohria, Dyer, and Dalzell, *Changing Fortunes*, 270-276.

<sup>491</sup> Cole, "Entrepreneurship and Entrepreneurial History," 94; Penrose, *The Theory of the Growth*, 40-49; Johnson, "Agenda for the 1970's," 113-114; Shackle, *Imagination and the Nature of Choice*, 39-43; Okochi, *Keiei-koso-ryoku*, 37-38; Witt, "Imagination and Leadership," 162-163; Chandler, *Shaping the Industrial Century*, 7; Kor, Mahoney and Michael. "Resources, Capabilities and Entrepreneurial Perceptions," 1195; Teece, *Dynamic Capabilities*, 4-5.

<sup>492</sup> The word visaction is derived from vision with action, where vision is regarded as a product derived from perceiving the external environment and conceiving the future.

<sup>493</sup> Loomis, "How GE," 121.

<sup>494</sup> Miles and Snow, *Organizational Strategy*, 28-29. They describe the general characteristics of each type as follow: 1. Defenders are organizations which have narrow product-market domains. Top managers in this type of organization are highly expert in their organization's limited area of operation but do not tend to search outside of their domains for new opportunities. As a result of this narrow focus, these organizations seldom need to make major adjustments in their technology, structure, or methods of operation. Instead, they devote primary attention to improving the efficiency of their existing operations.

2. Prospectors are organizations which almost continually search for market opportunities, and they regularly experiment with potential responses to emerging environmental trends. Thus, these organizations often are the creators of change and uncertainty to which their competitors must respond. However, because of their strong concern for product and market innovation, these organizations usually are not completely efficient.

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3. Analyzers are organizations which operate in two types of product-market domains, one relatively stable, the other changing. In their stable areas, these organizations operate routinely and efficiently through use of formalized structures and processes. In their more turbulent areas, top managers watch their competitors closely for new ideas, and then they rapidly adopt those which appear to be the most promising.

4. Reactors are organizations in which top managers frequently perceive change and uncertainty occurring in their organizational environments but are unable to respond effectively. Because this type of organization lacks a consistent strategy-structure relationship, it seldom makes adjustment of any sort until forced to do so by environmental pressures.

<sup>495</sup> Ibid, 131-132.

<sup>496</sup> According to Sakamoto's classification, GE transformed from Analyzer to Prospector (see Sakamoto, *GE*, 229-230.). The different categorization occurs because of the use of different criteria.

<sup>497</sup> Fleck, "The Dynamics of Corporate Growth," 226.

<sup>498</sup> Chandler, "The Enduring Logic," 131-132.

<sup>499</sup> Welch, *Jack*, 106, 108-109, 114.

<sup>500</sup> For instance, see William Ocasio and John Joseph, "Rise and Fall, or Transformation? The Evolution of Strategic Planning at the General Electric Company, 1940-2006," *Long Range Planning* 41, no. 3 (2008): 248-272.; John Joseph and William Ocasio, "Architecture, Attention, and Adaptation in the Multi-business Firm: General Electric from 1951 to 2001," *Strategic Management Journal* 33, no. 6 (2012): 633-660.

<sup>501</sup> Tichy and Sherman, *Control Your Destiny*, 90, 192; Ocasio and Joseph, "Rise and Fall," 262.

<sup>502</sup> Tichy and Sherman, *Control Your Destiny*, 90; GE, *Annual Report 1989*, 3.

<sup>503</sup> Tichy and Sherman, *Control Your Destiny*, 195, 246-248.

<sup>504</sup> Welch, *Jack*, 192-195; Joseph and Ocasio, "Architecture, Attention, and Adaptation", 643-644.

<sup>505</sup> Chandler, "The Enduring Logic," 133. Certainly, firms can grow horizontally by combining with competitors, such as a merger of Thomson-Houston Electric Company and Edison General Electric Company in 1892. However, horizontal integration is not considered in this framework in order to simplify the discussion.

<sup>506</sup> Ibid.

<sup>507</sup> Ibid.

<sup>508</sup> Chandler points out that geographic expansion was generally based on economies of scale while the related product market rested under economies of scope. See Chandler, "The Enduring Logic," 133.

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Since I focused on diversification of product markets and managerial perceptions in this framework, geographical expansion is not considered at this time.

<sup>509</sup> Teece, "Economies of Scope" 226-228; Panzar and Willing "Economies of Scope," 272; Bailey and Friedlaender "Market Structure," 1037.

<sup>510</sup> Chandler, "The Enduring Logic," 132. The requirement for the establishment of managerial enterprise is under dispute in Japan, so the concept and logic of managerial enterprise does not have theoretical clarity. See Morikawa, "Naze," 2-5; Abe, "Chandora moderu," 56-61; Morikawa, "Kabushiki," 108-117; Morikawa, *A History of Top Management*, 3-17.

<sup>511</sup> Chandler, *Scale and Scope*, 43.

<sup>512</sup> Penrose, *The Theory of the Growth*, 44-46.

<sup>513</sup> Chandler, "The Enduring Logic," 139.

<sup>514</sup> Ibid.

<sup>515</sup> Chandler, *Scale and Scope*, 623-624.

<sup>516</sup> Although Edward Sherwood Meade employed the phrase economies of combination to describe the advantages of trust or industrial combinations (see Meade, "The Economies of Combination," 365-366.), it is used here to indicate the advantages of operating unrelated businesses within one company. Although the distinction between 'related' or 'unrelated' is ambiguous, it is used here as a sense of Chandler or Rumelt works (i.e. Standard Industrial Classification code). (see, for instance, Chandler, "The Competitive Performance," 1994 and Rumelt, *Strategy, Structure and Economic Performance*, 1974)

<sup>517</sup> Slywotzky and Morrison, *The Profit Zone*, 81-82.

<sup>518</sup> Penrose, *The Theory of the Growth*, 44.

<sup>519</sup> Aupperle, Acar, and Mukherjee, "Revisiting the Fit-performance Thesis," 343.

<sup>520</sup> Chandler, "The Functions of the HQ Unit," 40, 44.

<sup>521</sup> For instance, see Chandler, "The Competitive Performance of U.S. Industrial Enterprise since the Second World War," *Business History Review* 68, no. 1 (1994).

<sup>522</sup> Joseph and Ocasio, "Architecture, Attention, and Adaptation," 636.

<sup>523</sup> Chandler, "The Enduring Logic," 132.

<sup>524</sup> Chandler, *Shaping the Industrial Century*, 7.

<sup>525</sup> Langlois, "The Vanishing Hand," 374; Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies," 426 and 429.



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<sup>526</sup> Jones, *Multinationals*, 34-40.

<sup>527</sup> Lazonick, "Alfred Chandler's," 376-377.

<sup>528</sup> Ibid.

<sup>529</sup> See Fleck, "The Dynamics," Helfat et al., *Dynamic Capabilities*, and Teece, *Dynamic Capabilities*.

<sup>530</sup> Chandler, *Shaping the Industrial Century*, 7.

<sup>531</sup> Fredrik Tell, "Organizational Capabilities: A Study of Electrical Power Transmission Equipment Manufacturers, 1878-1990," PhD diss., Linköpings Universitet, 2000.

<sup>532</sup> For instance, see Kahneman, *Thinking, Fast and Slow*, especially Part II.

<sup>533</sup> Araoka, "Seizogyo."

<sup>534</sup> Kodama, *Analyzing*, 17.

<sup>535</sup> Araoka, "Seizogyo."

<sup>536</sup> Araoka, "Seizogyo." According to Araoka (2004), Murakami (1999) provides the foremost research on the declining efficiency of R&D investment in Japanese manufacturing enterprises. In Sakakibara and Tsujimoto (2003) and Sakakibara (2005), they relate notable previous research results in economics and management, including Kodama (1991), Murakami (1999) and American enterprise analysis. They conclude that (1) Japanese manufacturing could confront more serious problems in the efficiency of R&D investment than can American firms, (2) Japanese firms could over-invest in R&D, even though there is space on how to interpret the efficiency of R&D investment. Through analyzing the time series macro data of capital investment and R&D expense from 1976 to 2006 along with questionnaire data from 544 publicly traded companies, Nagano, Kamei and Kondo (2008) verify that there has been dilution in the relation of R&D to capital investment in Japan, although the research also confirms that it is not necessarily true at the micro level.

<sup>537</sup> Araoka, "Seizogyo." His conclusion is Japanese firms should research and develop not only technology but also the business model itself, in order to maximize the fruits of R&D.

<sup>538</sup> Kodama (2007) mentions that the word used, "Senryaku Tenkan (strategic change)," specifically means "Strategic Inflection Point", which ex-CEO of Intel Andrew Grove used in the strategic change of Intel from a memory to a microprocessor business. Kodaira and Kodama (2007) then translate the word to "strategic change" in English. To simplify understanding, this thesis uses "strategic change" as per the translation of "Senryaku Tenkan."

<sup>539</sup> According to Kodaira and Kodama (2007), it is difficult to make major changes in capital investment to improve corporate profitability within a single fiscal year because (1) capital investment is basically determined under a long-term plan and (2) it does not immediately affect depreciation expense.

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<sup>540</sup> In examining a sample of financial statements of Japanese manufacturing enterprises, approximately 75% were sales-related expenses in FY2005 and 94% in FY1990 for Fujitsu, 79% and 76% for Toshiba, 86% and 89% for Sharp. See Kodaira and Kodama, "Saiko-keiei-sekininsha," 45.

<sup>541</sup> Kodama (2007) uses an alternate financial database for R&D expense.

<sup>542</sup> This is due to the wild fluctuations in data from year to year. However, in Kodama (2007), only capital investment takes a five-year moving average and this results in a slight difference between Kodaira and Kodama (2007), and Kodama (2007) in terms of data processing. Kodaira and Kodama (2005) and Kodama, Kodaira, and Okada (2009) are not clear on which data take a five-year moving average. The model is based on Kodaira and Kodama (2007), considered as the original KK model, and does not lead to much difference in results between data processing methods.

<sup>543</sup> Kodaira and Kodama, "Erectoronikusu," 30.

<sup>544</sup> A knowledge creation company can suggest various meanings. For Kodama (2013), a knowledge creation company ("Souzougyo" in Japanese) refers to a "thinking organization", as cited by Kodama (1991).

<sup>545</sup> Kodaira and Kodama, "Erectoronikusu," 29.

<sup>546</sup> The line for knowledge creation should be a straight line starting at 0% for both capital investment / sales and R&D expense / sales and then to 5% for both, recognizing that the criterion of knowledge creation is  $R\&D \text{ expense} / \text{capital investment} = 1$ . In the same manner, two additional lines are drawn, one by which the criterion of knowledge creation is 2 and the other 0.5. The line of commercializing investment starts at 10% and again passes through the 5% point, the intersect for the R&D expense ratio and the capital investment ratio. Two additional lines are drawn, one starting at 12% and the other 8%. See Fumio Kodama, *Gijutsu keiei senryaku* (Tokyo, Japan: Ohm-sha, 2007) for more details.

<sup>547</sup> However, this part (called "positioning business model") is not mentioned in their other papers besides Kodaira and Kodama (2005). The reason is unclear and makes it difficult to gain an understanding of the appropriate attribution of the business model.

<sup>548</sup> Kodaira and Kodama, "Erectoronikusu," 29.

<sup>549</sup> Ibid.

<sup>550</sup> Ibid.

<sup>551</sup> Ibid.

<sup>552</sup> Kodama, *Gijutsu*, 8-9.

<sup>553</sup> Kodaira and Kodama, "Erectoronikusu," 29.

<sup>554</sup> Kodaira and Kodama, "Erectoronikusu," 30.

<sup>555</sup> Kodama, *Gijutsu*, 9-10.

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<sup>556</sup> Kodama, *Gijutsu*, 10.

<sup>557</sup> Kodaira and Kodama, "Erectoronikusu," 30.

<sup>558</sup> ESAC is not explained as much as BMAC in any of their articles, although Kodama (2007) shows analyzed results of ESAC.

<sup>559</sup> The models used in Miyata (2010, 2011a, 2011b, 2012) differ slightly. This is because the model was in the process of development and introduced feedback provided on prior works. The model in this Addendum A is the latest and likely final version.

<sup>560</sup> Gras mentions that economic determinism in economic history leaves no important place for free choice, decision, or management, and reveals itself as essentially economic libertarianism in business history. Nakagawa describes that Gras' research approach to examine the defined aspects of business activity that are developed by specific process and decision-making, he acknowledges that senior management have sufficient latitude for some decision-making even though social and economic conditions determine decisions to a certain extent. It fine to understand that business history has considered the decision-making aspect from its early history. For more detail, see N. S. B. Gras, "Why Study Business History?" *Canadian Journal of Economics and Political Science* 4, no3, (1938): 331; Keiichiro Nakagawa, *Hikaku Keieishi Josetsu* (Tokyo, Japan: the University of Tokyo Press, 1981), 49.

<sup>561</sup> Fridenson, "Business History," 12. He also mentioned that "The analysis of decision and of strategy by business historians brought nothing new to historians in terms of the different dimensions and scales of time" (Fridenson, "Business History," 13). Although there is some truth to his statement, I contend there was still a constructive impact on business management studies.

<sup>562</sup> Fridenson (2007) also describes the concept of strategy as well as the decision, which has been even more influential.

<sup>563</sup> Whittington, "Alfred Chandler," 267; Abe, "Kigyo no kyokai," 73.

<sup>564</sup> Suzuki, "Gendai no kigyo," 9-10. However, Suzuki (2007) also indicates that it is simply the same in different words. That is, the investment in production and distribution is equal to vertical integration, the investment in management is the formation of an hierarchical organization. In addition, organizational capabilities are nothing but the accumulation of resources that are acquired within an organization through vertical integration. In my opinion, although Suzuki's interpretation is accurate on a macro perspective, Chandler aims to deepen each key concept of his framework, Strategy and Structure. Therefore, in the micro perspective, they are not exactly similar concepts.

<sup>565</sup> At the end of his framework, investment is part of the virtuous strategy, a new key concept, as "continuous investment in the new learning," see Chandler, "How High Technology Industries," 1. Although it places less emphasis on investment itself, it remains a basic and essential point in his framework.

<sup>566</sup> Mowery, "Alfred Chandler," 499.

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<sup>567</sup> Hikino, "Alfred Chandler," 65. While pointing out the differences between Alfred D. Chandler's and Michael C. Jensen's view, Hikino (2009) indicates a commonality as their fundamental problem that they lack of the logic to specify the condition: under what kind of condition top managements apply their controllable knowledge to investment which is effective for corporate growth and profitability, or to maximization of their interest which is obstructive factor for stakeholder or organization. This problem is left as subject for analysis of the growth of the firm. In other word, analysis of investment is to provide clues to solve the subject.

<sup>568</sup> For instance, if expenses on sales-related activities are very high and capital expenditures are very low, it indicates that the firm is a service company or at least not mainly in the manufacturing business. Kodama, Kodaira, and Okada (2009) mentions that the analysis was unable to interpret an understanding of this combination of variables for strategic change. However, it provides some insights in terms of the research purpose.

<sup>569</sup> Miyata (2011b) uses increases in the rate of total investment instead of the total investment / revenue ratio. After all is considered, ITA uses the total investment / revenue ratio because of the ease in understanding corporate behavior, although increases in the rate of total investments demonstrate similar results for gauging corporate changes and other interesting tendencies.

<sup>570</sup> As mentioned above, there is a difference in the data processing method for the KK model, Kodaira and Kodama (2005), and Kodama (2007). Because Kodaira and Kodama (2005, 2007) is the base for the ITA model, all data is on a five-year moving average.

<sup>571</sup> However, it is flexible to change how long the data are taken an average for, e.g. every three-years, ten-years for each research object.

<sup>572</sup> Itami (2006) reviews the previous researches on profitability between Japanese and the U.S. firm, and also reveals the insightful fact of that topic with useful evidences and multifaceted approach.

<sup>573</sup> For instance, the US electric enterprises' annual report has started the R&D expense since the early 1970s and Japanese enterprises since the later 1980s.

<sup>574</sup> To understand the more historical context and detail analysis of these companies, see Kenichi Miyata, "1970-nendai kara 1990-nendai niokeru GE no senryaku tenkan: Jonzu no seizougyo sinka kara ueruchi no sabisugyoka," *Studies in Business Administration* 32, (2010): 91-110; Kenichi Miyata, "Westinghouse Electric Corporation in the Late 20th Century: A View from an Investment Trajectory Analysis Perspective," *Studies in Business Administration* 34, (2011a): 115-130; Kenichi Miyata, "Corporate Transformation and Conglomerates in the U.S.: A Comparison of General Electric Company V.S. Westinghouse Electric Corporation, c. 1970 – c. 1999," *Studies in Business Administration* 35, (2011b): 1-17; Kenichi Miyata, "A Comparative Study of Toshiba and Hitachi in 'the Lost Decades': Corporate Investments and Strategic Attributes," *Studies in Business Administration* 36, (2012): 165-182.

<sup>575</sup> Although TC and HL also have small financial service divisions, the data is not separated, unlike GE and WH. However, because of the relatively much smaller revenue than that of GE and WH, it does not materially affect the results of ITA.

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<sup>576</sup> In GE it is called “Additions to property, plant and equipment”, in WH “expenditures for new and improved facilities” and later changed to “capital expenditures,” and in TC and HL “Yukei Kotei Shisan no Shutoku (acquisition of tangible fixed assets).”

<sup>577</sup> In WH it is called “marketing, administration and general expenses, and in TC and HL “Hanbaihi and Ippankanrihi (selling, general and administrative expenses).”

<sup>578</sup> For more detail of historical context, see Miyata, “1970-nendai,” (2010); Miyata, “Westinghouse,” (2011a); Miyata, “Corporate Transformation,” (2011b); Miyata, “A Comparative Study,” (2012).

<sup>579</sup> Mishina, *Senryaku*, 48-49.

<sup>580</sup> Itami, *Nichi bei kigyo*, 196.

<sup>581</sup> Miyata, “Corporate Transformation,” 13.

<sup>582</sup> Miyata, “A Comparative Study,” 171-173.

<sup>583</sup> Taniguchi and Hasegawa (2008) conclude that the differentiation clearly started in the 1980s between GE and TC and was more advanced in the 1990s. GE seems to resemble the different business model that Alfred Chandler Jr. proposes, while TC continues to hold the characteristics of the Chandlerian model.