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Nucor Corporation: A Study on Evolution Toward Strategic Fit

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Submitted to the Program of Organizational Dynamics In the Graduate Division of the School of Arts and Sciences In Partial Fulfillment of the Requirements for the Degree of Master of Science in Organizational Dynamics at the University of Pennsylvania.

Advisor: Everett Keech

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Abstract
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by

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ABSTRACT

For much of its century long history, Nucor Corporation and its predecessors displayed turbulent financial performance. Several attempts at a strategic realignment proved unsuccessful, and in 1965, the company faced insolvency. Since that time, however, the company has rallied around its steel operations to become the largest steel producer in the United States, with $12.7 billion in net annual sales. This thesis examines Nucor's development from an unprofitable conglomerate to a highly efficient enterprise. Specific focus on the evolution of the activity system underlying the organization lays the groundwork for systematic analysis of why some companies succeed while others fail.

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CHAPTER 1

OVERVIEW AND OBJECTIVES

This thesis uses a case study approach to analyze and understand the developmental processes that lead to organizational fit. Organizational elements such as internal and external activities, structural elements, policies and resources are seen to form complex systems. The notion of consistency, or internal fit, among an organization's elements has long been accepted by academics as a major contributor to long-term success and that which forms the very essence of sustained competitive advantage. However, little research exists about how organizations evolve toward these systems of tightly reinforcing elements. While it may be evident that some elements are more central or core to an organization and others less essential, the ability to distinguish them systematically remains a dilemma.

To better comprehend the nature of core elements and the fundamental developmental processes that lead to true organizational fit, I chose to investigate the developmental route of Nucor Corporation, the largest steel producer in the U.S. Historical data, existing literature, and broader conceptual reasoning about organizational evolution were used to assist in the identification of core elements and their interactions within the organizational system.

Nucor proved to be an excellent candidate for this study. A history rich in complexity, prolific leadership and unique organizational structure all helped generate a plethora of secondary data and press coverage, thus, making it easier

to identify Nucor's organizational system throughout its' existence. The analysis is divided into sections illustrating key inflection points in the Nucor's history (See Table 1 below).

The objective has been to lay the groundwork on which future analysis can be based and provide a greater understanding of evolution toward strategic fit, and, perhaps even more importantly, the origins of misfit.

Table 1. History of Nucor Corporation

Timeline	Description
1954 – 1965	Operations as a mini-conglomerate, beginning with the formation of the Nuclear Corporation of America
1965 – 1966	Streamlining of the business, and strategic realignment around the Vulcraft steel joists division
1966 – 1970	Expansion in steel joists, and the introduction of minimills
1970 - 1986	Rapid growth in steel production and fabrication
1986 – 1996	Expansion of product line
1996 – 2006	Nucor without Iverson, moving forward with new leadership

CHAPTER 2

ACTIVITY SYSTEMS

Along with adding value and setting strategic agendas, creating competitive advantage is one of the most important aspirations of any ambitious firm. Until recently years, many firms have been preoccupied with operational effectives (i.e. restructuring, improving efficiencies, etc.). Though these improvements are certainly necessary, they are simply not enough. All too often, even the greatest improvements begin to approach points of diminishing returns. It is no longer enough to simply be efficient. Firms need to be distinctive in the way in which they compete.

Competitive advantage almost never grows out of a single activity. “Unique” products or services are often easily imitated by competitors. True sustainable advantage comes from systems of activities that are complementary. As such, competitors no longer have to match just one thing, but rather a whole system if they wish to enjoy many of the same benefits. Companies with sustainable competitive advantage integrate lots of activities within the business, all of which are consistent, interconnected and mutually reinforcing. Interaction, or fit, also redoubles the imitation-deterring effects of imitation costs, limits on managerial capacity, and casual ambiguity.

In this thesis, I have used activity systems to help illustrate the value chain propositions throughout Nucor’s history. The schematics categorize the generic value-adding activities for each period in Nucor’s history. The comparison of

activity systems from one period to the next help illustrate the actual development of the interaction of existing activities and the addition and assimilation of new ones.

The analysis describes the main activities that the organization performs and links them to the organization's competitive position. The illustration of core and supporting activities as well as their interaction, assist in the understanding of the evolution of fit, and ultimately the reasons behind some of the failures and the ultimate successes.

CHAPTER 3

CONGLOMERATE OPERATIONS: 1954 – 1965

Historical Overview

Nucor Corporation has its origins in Reo Motor Works (Reo), a Lansing, MI, automobile producer founded by Ransom Olds in 1904. Following sporadic profitability early in the century, the company abandoned automobile production in 1934, instead producing trucks for military contract. Demand waned after World War II, and the company faced serious financial difficulty.[1]

In 1954, Reo liquidated all assets and began to distribute this money to shareholders. A proxy battle ensued, and in 1955, shareholder TelAutograph Corporation won control of the company and forced it to acquire Nuclear Consultants, one of its subsidiaries. The new company was named Nuclear Corporation of America (Nuclear).[2]

Nuclear sought to capitalize on emerging nuclear technology, but lacked clear direction in that endeavor. Divisions varied from consulting operations, to instrument manufacturing, to chemical production. In 1960, the company had not yet turned a profit, and the purchase of substantial stock interests by the Martin Company (later Martin Marietta) and Bear Stearns led to a reorganization of the Nuclear board of directors.[3] The newly elected chairman, David A. Thomas, soon succeeded the company president.

Thomas had a diverse business background, with experience in heavy equipment manufacturing, insulators, steel products, and radios. From 1957 to

1960, he had served as corporate vice president at Radio Corporation of America (RCA). With his broad background, Thomas found the concept of a conglomerate business appealing, and immediately embarked on a series of acquisitions and divestures. Nuclear put its unprofitable Electron Tube and Isotope Specialties divisions up for sale, eventually divesting them at sizeable losses.[4] Subsequent acquisitions were unrelated to the original nuclear technology strategy. In 1961, Nuclear purchased U.S. Semiconductor, later renamed US Semcor. A 1962 acquisition brought Valley Sheet Metal, a diversified steel products company with operations in air conditioning, ventilation, pipefitting, air purification, and sheet metal cutting. In the same year, Nuclear acquired Vulcraft, a leading steel joist manufacturer.

Although the company retained the “Nuclear” name, it did not maintain a focus on nuclear technologies as a guiding vision for the company. In a symbolic move in 1962, Nuclear moved its headquarters from New Jersey, the location of the flagship Nuclear Division, to Phoenix, Arizona, home of the newly purchased US Semcor Division.[5] Later acquisitions introduced yet more lines of business: equipment leasing and office copier equipment.

In 1965, all divisions except Vulcraft were operating at a loss, and in May of that year, the Valley Sheet Metal Division defaulted on two bank loans.[6] The Nuclear Corporation stood on the brink of bankruptcy.

The Vulcraft Acquisition

One bright point of Nuclear's history was the 1962 acquisition of South Carolina-based Vulcraft, a manufacturer of steel joists. Although Vulcraft had virtually no strategic fit with any of Nuclear's other divisions, within a few years it would become the core of the organization. Similarly, many of the activities that Vulcraft adopted during these early years as a subsidiary division would later resonate throughout Nucor Corporation.

When Nuclear purchased Vulcraft in 1962, arguably the only link between the two organizations was Thomas' brief prior experience in steel. Vulcraft was a financially attractive target, however, a market leader in its segment with annual sales in excess of $6 million.[7] Nuclear lacked any management with the experience to run the division, so 35-year-old outsider F. Kenneth Iverson was hired to oversee operations.

Iverson's management style had two primary goals: improving productivity and fostering strong employee relationships. In both endeavors, Iverson seemed driven by a firm belief that all employees should be treated fairly. His first order of business upon arriving in South Carolina was the desegregation of bathrooms and company events at Vulcraft.[8] The decision was unpopular at the time, but set a standard for egalitarian principles that would continue at Nucor for decades.

Iverson also instituted measures to care for his employees. He formed a safety committee and began strict enforcement of safety rules in the plant. Accidents dramatically declined within one month. In addition, late in 1962, he

introduced the Vulcraft Credit Association. This was intended to tie employee well-being to company performance, serving both to enhance feelings of job security and to encourage productivity improvements in the plant.[9]

Aside from the direct productivity improvements associated with fewer injuries and heightened morale, the relationship Iverson fostered with his workforce helped him to combat a much greater threat to overall profitability: unionization. The Teamsters attempted to organize Vulcraft in 1964, a move adamantly opposed by Iverson. He wrote memos to employees emphasizing that job security lay with the company, not the unions, and he circulated anti-Teamster literature. In addition, he threatened to fire any employee organizing a union on the job. Iverson pledged that any worker who went out on strike would immediately and permanently be replaced. Iverson's campaign was successful, and the workers voted down the union.[10]

Late in 1964, Iverson was recalled to headquarters and promoted to vice president. In his two years at Vulcraft, he had installed a set of activities that had tripled earnings at the already profitable operation.[11]

A Fragmented Activity System (Appendix A)

Vulcraft had built a foundation of supporting activities under Iverson's management, but Nuclear Corporation itself had a largely fragmented activity system. This seems almost inevitable considering its 1965 product line: radiation systems and instrumentation, rare earth oxides, semiconductors, equipment leasing, steel joists, air conditioning ducts, aerospace electronics, tin cans, and

plain-paper copiers, to name a few.[12] There were, however, a few core activities serving as weak links in the activity system.

Technological innovation was a key driver of many of Nuclear's business units. The Nuclear Division in particular held some well-publicized technology and process patents during its history.[13] The Research Chemicals, US Semcor, and Electromechanical Divisions also had a technology focus. During this time period, technology played a far lesser role in the steel and equipment leasing divisions. However, a commitment to technology was to remain a lasting part of the Nucor activity system long after the divestiture of the high technology divisions.

Nuclear also dealt largely in highly specialized products. That specialization was often manifested in the form of technological expertise, as discussed above. However, a number of Nuclear's products were also made-to-order, specially tailored to customer needs. Vulcraft manufactured products almost exclusively on a made-to-order basis. The Nuclear Division also custom tailored the majority of its products. Another form of specialization dealt with segmentation, where Nuclear Corp. produced products that appealed only to specific segments. An example here is the Research Chemicals Division, whose rare earth oxides had primary application in high-end color television screens,[14] or US Semcor, who marketed its products directly to the US government.[15]

Finally, a very loose link among the Vulcraft, Southern Leasing, and Valley Sheet Metal is the capital-intensive nature of the businesses. Beyond this,

however, there is little relationship between Southern Leasing, Valley Sheet Metal, and rest of Nuclear.

Aside from these general connections, there were few supporting activities within Nuclear. For example, Vulcraft was highly efficient and cost-sensitive, yet at the corporate level, the board frequently flew around the country in a private plane. The low degree of activity consistency likely contributed to the company's financial difficulties.

CHAPTER 4

STREAMLINING: 1965 – 1966

Historical Overview

Despite the financial distress at Nuclear Corporation, there was no sign that the board intended to change top management. Fears of insolvency led to a massive shareholder sell-off, with Martin Marietta Company selling its 22% stake at $0.05 per share. The stock had been trading at $1.60 per share. Donald Lillis, a director at Bear Stearns and a 2% owner of Nuclear, was the acquirer. Lillis convened a special board meeting, where David Thomas resigned with the unanimous approval of the board. Lillis was elected the new chairman.

Within two months, five additional board members were asked to leave the company. Lillis solved the immediate financial crisis by personally loaning the company $250,000 and establishing a $3.85 million revolving credit line with Southeastern Financial Corporation. $3.2 million of the line was required to pay down existing debts.[16] The board elected Ken Iverson as president in August of 1965, by a majority vote.[17] Iverson quickly promoted three other managers from the Vulcraft divisions to vice president.

After the top-level turnover, the conglomerate strategy of the first half of the decade disappeared. Valley Sheet Metal, the company's biggest cash drain, immediately went up for sale. Within a short time, Nuclear also divested its Electromechanical Division, Southern Leasing, and US Semcor. The reorganized company consisted of four divisions: Vulcraft (South Carolina),

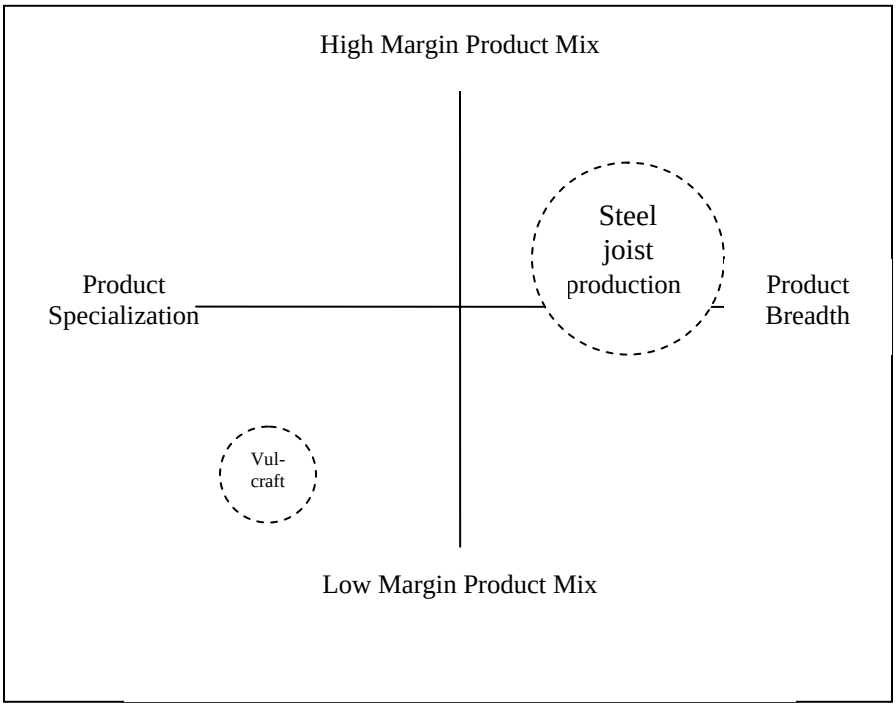
Vulcraft (Nebraska), Nuclear Division, and Research Chemicals. The focus of the company was the profitable steel joist operations.[18]

With only the Research Chemical division remaining in Phoenix, it made little sense to keep the corporate headquarters there. In 1966, Iverson and his Vice President of Finance, Sam Siegel, moved the corporate offices to Charlotte, North Carolina, in order to be closer to the Vulcraft operations.[19]

Positioning in Steel Products

Although significant competition arose from other steel joist specialty shops, the primary source of competitive pressure came from integrated steel mills, such as Bethlehem Steel and US Steel. There are two key differences in product offering between integrated mills and shops such as Vulcraft (Figure 1).

Figure 1. 1966 Vulcraft Competitive Positioning: Steel Products

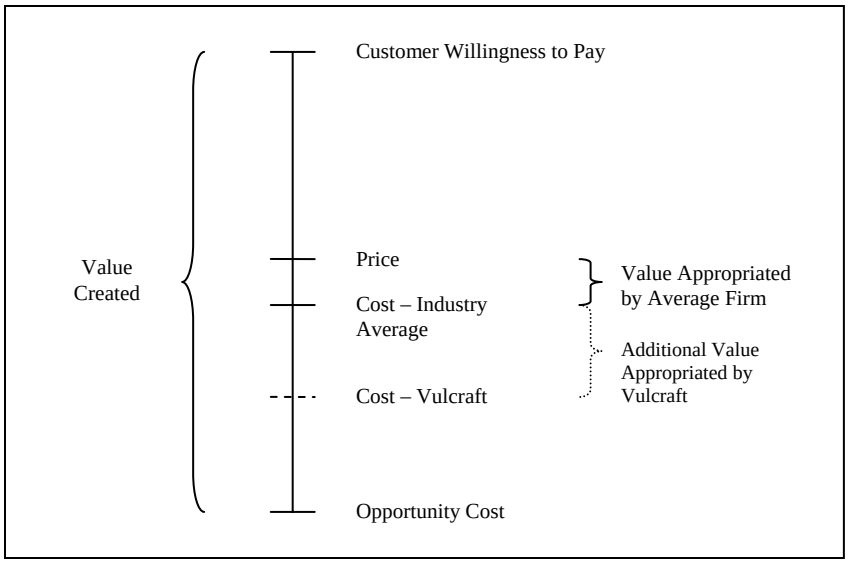


First, while Vulcraft offered only one product (steel joists), integrated mills offered a full line of steel products. Second, different products have different margins, largely dependent on the quality of steel and degree of processing required. Joists were relatively low margin steel items, when compared to top-end products such as steel plate. Integrated mills sold these low margin products, since they serviced all segments of the steel market; however, their primary focus was on higher end steel products.

Value Creation in Steel Joists

Although Vulcraft manufactured joists to customer specifications, steel products remained largely a commodity product, and competitive pricing was critical for success in the industry. The competitive price point was reasonably close to costs, making joists a relatively low margin steel product. With price effectively fixed, a firm needed to push down costs in order to increase appropriated value. Because Vulcraft purchased raw steel rather than producing it, the company had little control over supply costs. However, the company's emphasis on productivity granted Vulcraft some advantages in operational costs (Figure 2).

Figure 2. Vulcraft Value Creation and Appropriation



A sound safety policy and strong employee relationships generated productivity advantages. In addition, in 1965 Iverson initiated an incentive program for senior management based on productivity, entirely eliminating discretionary bonuses. Iverson eventually extended this type of incentive program to all employees. With workers knowing exactly what their efforts would net them, Vulcraft enjoyed worker productivity far above the industry norm. One Nucor executive later said of the practice, "We hire five, work them like ten, and pay them like eight."[20]

Vulcraft's non-union status was critical in implementing this compensation structure. The company's unionized competitors would find this approach to labor difficult or impossible to imitate, giving Vulcraft a sustainable advantage

over its integrated competitors. With its low cost position, Vulcraft was able to gain market share while successfully maintaining profitability.

Thinning and Patching in the Activity System (Appendix B)

Once in control of the company, Iverson applied the Vulcraft management model to the entire Nuclear Corporation. This had a massive impact on the Nuclear's activity system, and dramatically improved strategic fit within the company. With most non-core businesses divested, "Capital Intensive Businesses" no longer appears in the activity system (although Vulcraft is capital intensive, this is not a guiding directive of the organization, and is no longer needed to tie together the loosely related divisions of the 1965 activity system). Three new core activities have been added to the activity system, as the organization begins to more closely resemble Vulcraft: low cost structure, strong employee relations, and high quality in segment.

Low cost focus was a primary feature at Nuclear by 1966. Unlike the somewhat wasteful corporate culture under Thomas, Iverson operated a bare bones corporate office. When the company headquarters moved to Charlotte in January of 1966, the entire corporate staff quit, rather than follow the company cross-country. No staff member was replaced before spring, and even then, the staff was kept to a minimum. The headquarters itself consisted of a rented office of only 2,000 square feet.[21] Nuclear sought not only to reduce staff members, but also to minimize bureaucracy in the organization. The entire company had

only four layers of management.[22] Responsibility was pushed to the lowest level possible, creating a highly flexible organization.

Performance based compensation structures helped to ensure that these managers would make the decisions in the best interests of the company. These incentives were also instrumental in maintaining a high commitment to quality. This emphasis on quality would increase as Nuclear's activity system continued to evolve.

Nuclear also inherited Vulcraft's focus on using egalitarian principles to produce strong relationships with employees. Under Iverson, all employees in the company had the same benefits, from the CEO to steel shop workers. Everyone in the company had the same holidays, the same amount of vacation time, and the same health plan. Iverson sought to remove status symbols from all levels of the organization. He mandated that all workers wear the same color hard hat, with the exception of visitors and safety personnel. This was unusual in the steel industry, as foremen had traditionally worn a different colored hat as a symbol of rank.[23]

The Research Chemical and Nuclear Divisions remained only loosely tied to the company's activity system, and as a result of these operations Nuclear Corporation continued to lose money. However, Iverson's reorganization had greatly improved the strategic fit among Nuclear's activities, and profitability was improving. Nuclear now had a solid base for growth.

CHAPTER 5

EXPANSION: 1966-1967

Historical Overview

1966 marked the beginning of the rebuilding of Nuclear Corporation of America. Ken Iverson's philosophy called for the empowerment of general plant managers, who enjoyed nearly autonomous responsibility. Bi-annual meetings were held in order to allow managers to voice their opinions and concerns, in which Iverson himself acted simply as a participant. The firm hired extensively and set in place the administrative infrastructure that would serve it well for several decades. This was an especially frenetic period in the firm's history, yet was formative due to the fact that "Everybody was just so enthused in getting things going."[24]

Having shed the subsidiaries that were not clearly aligned with long-term strategic goals, Nuclear saw the need to expand its presence in those areas where core lines of business were identified. Through commitment to these units, the firm developed more clarity in its strategy as a whole, allowing it to accentuate the appropriate points in its operations.

Expansion, Value Creation in Steel Joists

Throughout the 1960s, the steel joist business was characterized by fierce competition between a large host of producers for a market composed of a small number of buyers. The bundle of product and services offered by the aforementioned producers was similar and thus, the value added of each

producer was, in essence, zero. The limited number of buyers appropriated the maximum amount of value in such a situation. Nuclear dealt with this predicament on several fronts – by expanding its operations, stringently controlling costs and offering a host of services to increase customer loyalty. By 1967, with its streamlined focus and distinctive production incentive programs, Nuclear was the leading joist manufacturer in the United States, having captured 25% of the market.[25]

The firm's strategy was straightforward – provide a good product, offer the best price, and market aggressively. From its very inception, Nuclear had focused on quality, and emphasized its design flexibility and customer service. Each of the Vulcraft plants maintained their own engineering departments, which were computerized to help generate customized designs for customers' specific demands.

In the interest of controlling costs, the firm introduced its own fleet of trucks to guarantee on-time delivery to all 50 states. By taking control of shipping, Nuclear generated loyalty from its contractors, who did not have to concern themselves with idle workers or long waits for commercial carriers to arrive.[26] Joist plants were also located in rural areas, near the markets they served.

The offering of such services worked to raise customer willingness-to-pay by a small but not insignificant margin, thereby further increasing the value appropriable by Nuclear. By such initiatives, the firm posted net earnings of

$755,440 in 1966, up from $114,777 the year before, while sales dropped from $10.94 million to $10.5 million. Working capital had increased to $43 million, and shareholders' equity tripled to $2.2 million. (Data taken from the company filings.)

Nuclear cemented its strategic plan of being able to "profitably ship joists to every state in the union"[27] by purchasing the M&S Steel Company in April 1967, further increasing its joist production capacity by 25%. Even the less successful divisions posted increased sales.

Porter's 5 Forces Analysis (Appendix B)

Supplier power was significant due to the fact that the firms in the steel industry at the time were largely dependent on imported steel. The foreign firms in question acted more as price setters than price takers. Minimills had not been implemented at this time and thus the steel firms were in a constrictive position. Unions were common at most of the Big Steel firms and represented a powerful community of lobbyists for change. Nuclear would not face significant union-related challenges for a short period of time. Thus, supplier power in the industry at this point was considerable.

Threat of substitutes was not significant due to the fact that there were no viable substitutes for the use of steel in, for example, the automotive industry.

Buyer power remained intense as the concentration of buyers was very limited as compared to that of producers. Furthermore, it was extremely difficult to "lock in" buyers, as they had low switching costs due to the fact that steel was a commodity product. Buyers were in a position to demand prices of the

producers, further contributing to the limitations of the margins within which the steel industry operated.

Barriers to entry were significant due to the fact that a considerable capital investment was needed in order to operate on the requisite scale for profitability and reasonably low costs. The former was already slim in comparison to many other industries and the latter was, logically, necessary to maintain it due to the price sensitivity of buyers. Furthermore, this was a difficult industry to exit, which is another key consideration for any group considering entering a new industry. Differentiation was also difficult and may only have been possible by the building of efficient service infrastructure, another deterrent to entry. Overall, there were significant barriers to entry.

Degree of rivalry within the majority of the industry was considerable due to little differentiation and firms scrambling to appropriate value. However, Nuclear had carved out a niche for itself and did not face significant retaliatory actions by its immediate competitors as it expanded its core businesses. Once again, though, rivalry was most often driven by low product differentiation, low brand identity, low switching costs, and high exit barriers. Thus, rivalry was significant, but manageable in the given situation.

Overall, the industry was not entirely attractive to an outsider, but Nucor's distinctive characteristics that formed the central nodes in its activity system placed it in a position with potential to play a dominant role in the industry.

CHAPTER 6

SUPPLY MANAGEMENT: 1967-1969

Historical Overview

One of the clearest hallmarks of Nuclear's success was that the firm was not prepared to rest on its laurels. Even while it was prospering, Iverson realized that Nuclear could be even more profitable if it would manufacture its own steel. "Iverson, a trained metallurgist, had never gotten the love of steel-making out of his blood, and he believed that the company could save money by supplying its own steel for its joist operations."[28]

In late 1966, Iverson asked the board of directors to consider constructing an electric furnace steel mill similar in design to those that were already in operation in Europe. Known as a minimill, with a capacity of 60,000 tons per year, the facility would be smaller and more economical than the larger mills used by the majority of Nuclear's competitors.[29] The board enthusiastically welcomed the suggestions and approved the plan to establish the Eastern Carolina Steel Division that would make steel angles and rounds to be used at Vulcraft facilities, though it was an enormous gamble for a firm that had just returned to profitability.

The Birth of the Minimill

In 1967, 60% of each revenue dollar Vulcraft earned was spent on materials, primarily steel. Approximately 60% of the steel used by Vulcraft's operations was imported, and since 1963, the price of foreign steel had ranged

from $104.40 to $121.80 per ton. Thus it is clear why Iverson would want Nuclear to minimize its dependency on foreign imports – in the words of Rod Hernandez, his colleague, “They were really at the mercy of foreign steel.”[30] The situation was very constrictive for Nuclear due to the fact that the firm had to buy several months in advance, which led to the market functioning sub-optimally. Prices on finished goods could plummet, causing havoc due to the fact that the firm still had commitments to fulfill on existing orders.

Iverson was confident that Nuclear could take advantage of the cost differential between buying steel on the open market and producing it themselves. The benefits of minimills were clear – they were rather inexpensive to build and operate, were energy-efficient, could operate on scrap alone, could be built to efficiently produce relatively small quantities of metals, could produce high-quality steel in batches, and small batches of specific types.[31] Thus, even with low throughput, these facilities could be efficient. By building the proposed minimill, the joist plants would be assured of a continuing and economical supply of steel for their raw materials needs, and the mill would have a captive market within which it could operate profitably.

In July 1968, Nuclear formally announced the construction of the Darlington minimill amid fanfare and media coverage, thereby signaling its commitment to the operation. Net sales for 1968 exceeded $35.5 million and net earnings $2.3 million.[32]

Grappling with Unions

In the eventful late 60s, Nuclear also faced a resurgence of a predicament that had plagued the steel industry for decades – that of organized labor. In January 1968, employees at Nuclear's M&S Steel Division in Alabama were recruited by members of two local unions – the Ironworkers International Union and Shopmen's Local 539. The General Manager of the plant, H.M. Crapse, wrote to each employee, imploring them to think twice about the detriment to the company as a result of unionization. Nuclear took a hard stance and issued, "No union has the right to run M&S Steel Division and tell us what we have to do. We will never have to bow down to any demand which is unsound and unreasonable."[33]

The situation continued to grow more complex as the National Labor Relations Board was called in to assess the validity of union elections and specific employee terminations carried out by Nuclear. However, by July 1969, the firm emerged as the winner and the issue of unions was eliminated. As Iverson told *The Wall Street Journal* in 1981[34], unionization efforts had proved to be unsuccessful because even the most lucrative basic steel agreement with a union could not match Nuclear's combination of wages and job security.

Another factor in coercing workers to stand by the status quo was Nuclear's egalitarian management structure and policies, and its extensive incentive systems. While the actual work involved at the facilities was difficult and dirty and the pace challenging, once a worker made it through his/her first

year of employment, turnover fell to almost zero. Part of Nuclear's strategy was to actively solicit and implement suggestions from these workers. Even if a concept was unproven, Nuclear would often try it on an experimental basis.

Activity System (Appendix C)

There were no dramatic shifts in the activity system during these periods, but rather an accentuation of the firm's central activities. Nuclear had become more entrenched in Vulcraft operations, had clarified its labor policies and had become even more dedicated to technological leadership.

Nuclear's success was best emphasized by its comparison to the struggles of Big Steel. Iverson attributed the industry's predicament to its reliance on top-heavy management that was reluctant to change and take risks: "The Big Steel companies tend to resist new technologies as long as they can. They only accept a new technology when they need it to survive." Thus, Nuclear was in a strong position to take on Big Steel, its largest competitors.

CHAPTER 7

THE MINIMILL ERA 1970-1986

Historical Overview

Following operational and managerial upheaval in the 1960's, Nuclear embraced the 1970's with the objective of rebuilding the firm around its major profitable operations. Management directed its energies toward two basic businesses - the steel joist business, operated as Vulcraft, and the steel business, operated as Nucor Steel. 1972 was a major inflection point for the evolution of Nucor as a profitable steel business. Management explicitly communicated that the firm's core competencies were progressing towards steel production. Effective on January 1st 1972, the company name changed to Nucor. Iverson stated: "We feel that Nucor Corporation, our new name, not only is simpler but also more accurately reflects the nature of our business today, since the nuclear end of it accounts for less than 5% of our sales[35]." Iverson's words were symbolic of two strategies that he would continue to pursue with: *no-frills* and a focus on *core competencies*. In July that year, Nucor was also listed on the New York Stock Exchange and entered the ranks of the Fortune 1000.[36] This signaled to the market that Nucor was a rapidly growing firm with high earnings potential.

Nucor was certainly an enviable position due to its adoption of minimill technology. It could now produce cost-competitive molten steel from scrap at one-tenth the scale required for an integrated mill. This translated to capital

expenditures which were also about one-tenth of that required for integrated mills such as US Steel and Bethlehem. Furthermore, the average minimill offered an operational cost advantage that was 15% lower than that of integrated steel manufacturers. Internal and external industry developments through the seventies also enabled Nucor to thicken its activity system around its core businesses, thus laying the foundation for its long-term strategic fit.

In the late sixties and early seventies, the steel industry celebrated a brief surge in demand. As a result, integrated companies began expanding their plant operations. Although these new facilities had a greater capacity, their operational costs were high. The integrated companies could only justify such a large investment by incremental investments in blast furnaces, continuous casters and modern rolling mills. The mounting pressure from unions, together with their large capital expenditures, forced large steelmakers to gradually increase their prices. Between 1969 and 1976, listed prices jumped 106% from $165 per ton to $339 per ton.[37] Since Nucor, unlike integrated steelmakers, was sourcing cheap scrap metal for its minimill process, it could focus on its low cost structure to be competitive in such a commoditized industry. Its low-cost emphasis complemented the firm's technological savvy well. Nucor had developed an electric furnace that represented the very latest in steelmaking technology, and Iverson's objective was to replicate the success of Nucor's highly productive Darlington minimill.[38]

Therefore, Nucor's path from 1970 through 1986 was characterized by rapid organic growth and capacity maximization. The backward integration into minimill technology that began in Darlington - to control Vulcraft's supply costs – evolved into an extremely profitable business for Nucor. Nucor was recognized by the press as a pioneer in the specialized steel sector, and Iverson in particular was acknowledged as an authority on issues concerning the U.S. steel industry. Although steel imports posed a threat during this period, Iverson and Nucor proved to the U.S. market that high quality steel could be produced at competitive costs.

New Minimill Ventures 1970-1986 (Table 2)

Soon after Nucor's name change and NYSE listing, Iverson announced his intention to expand the company's steelmaking facilities. In August 1972, the company announced the construction of its second minimill in Norfolk, Nebraska. It was modeled on the Darlington mill, and would produce steel exclusively from scrap metal, except that its capacity was significantly higher at 160,000 tons per year. In 1974, the construction of the third minimill in Texas was underway. Like the other two minimills, the Jewett mill was near Nucor's joist operations, which maximized the efficiency and timeliness of product delivery. The next minimill (400,000 tons/yr) was built in 1981 in Plymouth Texas, which enabled the company to penetrate the western regional market as well as supply its Vulcraft division.

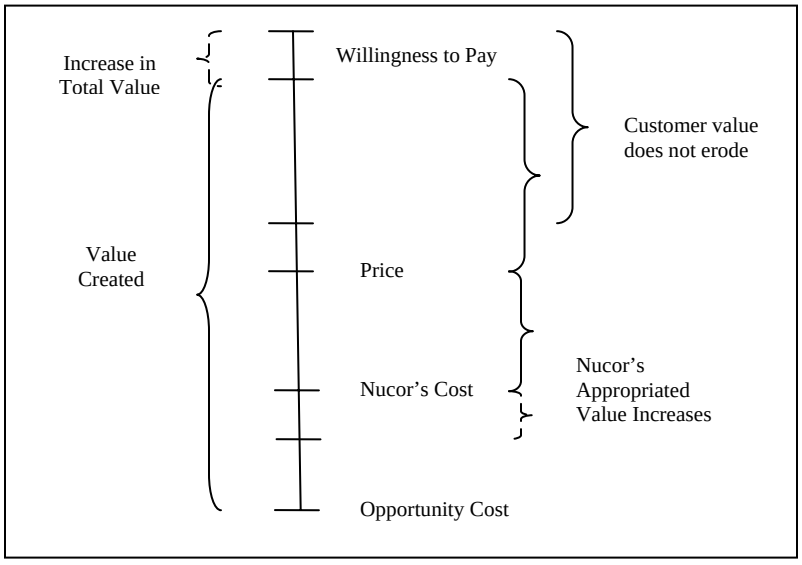
Table 2. Summary of Nucor's New Ventures 1968-1983

Minimills	**Products**	**Year**	**Initial Capacity**	**Nearby Joist Plants**
Darlington, S. Carolina	steel bars	1968	120k/yr	Florence, SC
* Norfolk, Nebraska	steel angles	1972	160k/yr	Stanton, Nebraska
* Jewett, Texas	steel rods, angles	1974	200k/yr	Grapeland, Texas
* Plymouth, Utah	steel shapes	1981	400k/yr	Plymouth, Utah
Other				
* Brigham, Utah	grinding balls	1983		Plymouth, Utah

Nucor was simultaneously expanding its steel joist business, and the fifth joist plant was opened in St. Joe, Indiana in 1972. Nucor emerged as a pioneer in this segment by launching the first of its kind advertising campaign to promote high-quality, reliable and low-cost joists. No other joist manufacturers had advertised in the past. A representative of Price-McNabb (Nucor's advertisement agency) said, "We advertise how Vulcraft has its own trucks, which was unusual at the time. So we advertised about our ability to deliver."[39] Nucor's strategy of rapid organic growth had in fact brought Nucor closer to its customers – the minimills were in close proximity to the Vulcraft operations and Vulcraft in turn was doing everything in its power to ensure speedy delivery of its products. In addition, Nucor had carved a spot in every geographical market in the United States by the early 1982. The Northeast and Southeast regions were supplied by the Darlington plant; the Midwest was covered by Nebraska, the Southwest and

Southeast by Norfolk, and the Western region by Plymouth. Iverson was aware of the price-sensitive nature of the commoditized steel industry. Nucor wanted to ensure that customer value did not decrease in the event of fluctuating prices, so their competent distribution increased the customers' willingness to pay. This enabled Nucor to increase its prices when the price of scrap metal increased, yet still retain its customer base. Nucor did increase the price of its merchant bar products in 1976 from $10 to $20 per ton.[40] Even though Nucor usually priced below domestic and foreign suppliers, their superior delivery encouraged customer loyalty.

Figure 3. 1986 Nucor Value Creation and Appropriation



Nucor also gradually increased its appropriated value by keeping an extremely low cost structure throughout its expansion. The firm gained great benefits due to its emphasis on building mills economically and running them

efficiently. Nucor built its own continuous casters, reheat furnaces and cooling beds. It was often referred to as a "small electric furnace shop.[41] Due to its decentralized organizational structure, regional managers were responsible for the entire life cycle of a minimill. Therefore, the same person who supervised the construction of a plant was responsible for overseeing its expansion and efficient operation. . For example, by 1981, it only took Nucor one year to build and set-up the Plymouth plant, while their competitors ordinarily needed twice that time.[42] Furthermore, obsolescence was not a problem, and facilities were monitored and revamped cost-effectively every four years. In the late seventies, Nucor embarked on a major expansion program of its Florence and Norfolk plants. These actions are indicative of Iverson's preoccupation with the most efficient technologies and processes.

Porter's Five Forces Analysis

The five forces framework underwent significant changes from 1972-1985 as Nucor embarked on its new ventures. Nucor revolutionized the steel industry and was appropriating value through its efficient operational processes. The arrival of disruptive minimill technology has had a significant impact on the players in the industry.

Supplier power decreased after the arrival of minimills, as traditional industry suppliers – ore, energy, transportation – underwent change. Firstly, the majority of ore supply was replaced by a need for large quantities of scrap metal. This was at the very heart of Nucor's cost-efficiency, and initially low scrap prices

allowed it to appropriate more value relative to non-minimill competitors. Secondly, minimills consume far less power than their integrated counterparts, which certainly drove down Nucor's fixed costs. The smaller scale and relatively low output of minimills allowed them to be built much closer to their customer bases, which Nucor did. Therefore, transportation and logistics costs decreased significantly. Since suppliers primarily used trucks (commodities) as opposed to railroads, the supplier power decreased in this area.

Threat of substitutes was still not significant, apart from the emerging trend that the automotive industry (historically the largest consumer of steel) was using lighter plastic parts for cars. These substitutes only affected the peripheral steel segments.

Buyer Power was unchanged on an individual basis. However, due to Nucor's later entry into higher margin products, it successfully increased the quantity and nature of customers it served. This enabled Nucor to diversify the risk of volatile demand. For example, the market for cold-finished steel did not fluctuate as the other markets did. By the early 1980's, Nucor began serving a range of equipment manufacturers, which offered a stable customer base.[43]

Barriers to entry were still quite high due to the large capital expenditures in the industry. For integrated steel mills, the barriers to entry for lower margin products entirely excluded them from the industry. Their cost structure prevented them being able to compete with the minimills. On several occasions in the seventies, they were forced to price particular products below their cost to

compete against foreign steel and local minimills. Minimills were in a far better position to enter specialized markets, however companies such as Nucor were far better poised due to immense economies of scale. Since the government had become stringent with pollution control and safety standards, only companies with enough capital and expertise would enter the industry with ease.

The degree of rivalry mounted due to strong foreign competition. Nucor followed a pricing strategy which matched the market's lowest price. As a result, Nucor never priced below cost and foreign competitors significantly reduced Nucor's margins. Foreign imports increased from 12.4% of domestic supply in 1973, to over 20% of domestic supply in 1977.[44] Foreign competition bypassed expensive investments in basic open furnaces, finding more cost-effective ways to produce steel. The government rarely took an interventionist approach to protecting the steel industry – apart from the *Trigger Pricing* introduced by Carter's administration. Nucor was so cost-efficient and proactive in the industry, that it actually condemned protectionism and accused it of stunting technological innovation.

Therefore, Nucor was able to strengthen itself in the industry due its operational efficiencies and innovative technology. To understand how minimills were disruptive, the following section will elaborate on Nucor's product expansion and repositioning.

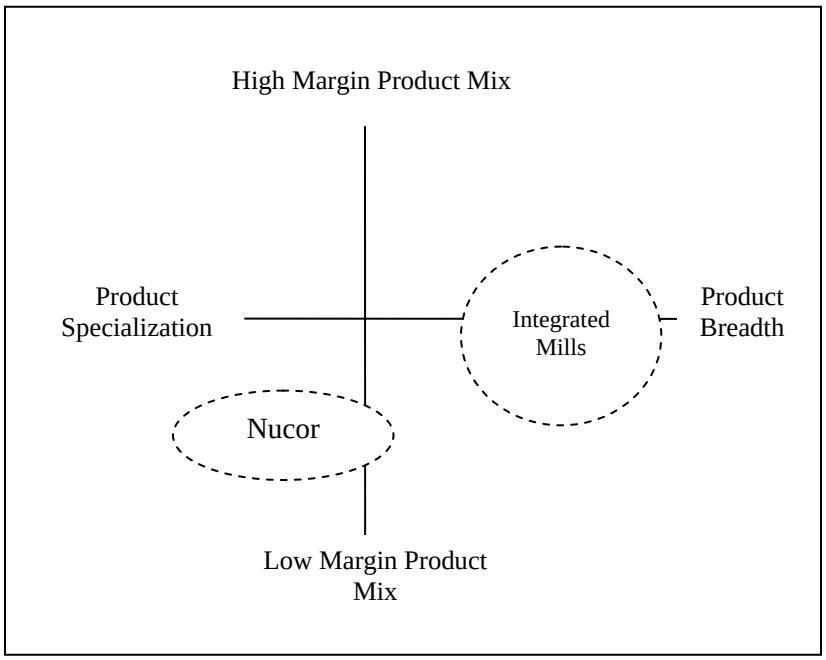
Repositioning: Minimills as Disruptive Technology

Until 1974, Nucor's primary customer was itself – the Vulcraft steel joists business. However in 1974, the Jewett minimill in Texas provided enough capacity to allow Nucor to solicit steel orders from large outside customers. The firm's initial focus on low-margin specialized products (joists) eventually broadened to higher margin markets. As the minimill production process and the quality of steel products improved, Nucor was able to integrate into markets that it initially had no scope of capturing. Minimills were disruptive because they were initially considered as inferior by integrated steel producers, as they failed to meet the demands of mainstream customers.[45]

By 1975, Nucor began increasing its production of merchant-quality bars and small structural pieces, which marked its foray into high margin markets. It was able to match the prices of Japanese, Chinese and South American importers, and took full advantage of the transient surge in demand. Nucor's market penetration had increased its sales by 167% from 1974 to 1979. In 1979, Nucor entered the cold-finish segment (for machine precision parts) by starting two 80,000-ton facilities in Norfolk and Darlington. By 1982, Nucor produced 70% of its steel for outside customers (as opposed to 15% in 1975). The company embarked on an ambitious five-year product expansion, with plans to produce a wider range of grades and sizes of angles, rounds, channels, flats, forging billets and special small shapes. Nucor's acquisition of the grinding balls business in Utah (1983) also increased its product range. Nucor's relative industry positioning in 1986 is illustrated below.

The dynamics of the steel industry are also what enabled Nucor to begin integrating its product range. The domestic steel industry was historically composed of two vertically integrated sectors – raw steel production and finishing mills.

Figure 4. 1986 Nurcor Competitive Positioning: Steel Products



Raw steel products (standard steel shapes) were usually produced from ore and coke and sent to finishing mills which conducted various heat treating and shaping processes to produce structural shapes. These two distinct sectors were usually housed under a single facility, but as two different operations. The onset of continuous casting technologies in the late 1970s has blurred this classical demarcation, as isometric shapes can now be produced in a single

operation. Continuous casting only serves the mid-margin markets, which explains how Nucor succeeded as a disruptive technology.

Nucor's Crown Jewel: Employee Relations

Woven persistently through Nucor's success story is Iverson's unique brain-child: his egalitarian, incentive-based worker-relation philosophy. It comes as no surprise that from 1965 to 1975, the number of Nucor employees had increased from 1,500 to 23,000.[46] Iverson rarely fired his workers, and they seemed to seldom quit their jobs. A number of developments in this domain have thickened this node of the activity system.

Iverson loved to reward all Nucor stakeholders with cash. Whether they were minority shareholders or steel workers, Iverson simply dished out cash when times were good. This was apparent in 1973 when a cash dividend of 5 cents per share was awarded to shareholders, just one year after Nucor's common shares were listed on the NYSE. He rewarded loyal workers tangibly, and in 1978 contributed ten percent of Nucor's earnings towards an employee profit sharing scheme and paid each worker $500.[47]

Consistent with his strong opposition to unions, Iverson did not want high workforce turnover, and implemented systems which encouraged workers to build a career with Nucor. In 1974, *The Nucor Foundation* was formed in response to a fatal accident which killed four men in the Darlington mill. The foundation formed a scholarship fund which aimed to send *all* employee children to university. Unlike other companies, this program was equally available to

management and floor workers. The egalitarianism that characterized Nucor was unheard of in other Steel companies. It was practiced to the extent that workers "shared the pain" during the recession of 1984, and all worked four day workweeks. Not a single worker was fired at Nucor, unlike at integrated mills like Bethlehem and US Steel. Each worker shared in company's losses as opposed to being retrenched.

Iverson's brilliant philosophy defined the most crucial factor in the steel industry: *worker productivity*. Worker productivity is measured by the number of labor hours per ton. During the seventies and eighties, Nucor achieved worker productivity of four labor hours per ton compared with the national average of eight per ton.[48] Even foreign competitors were capable of just six labor hours per ton. Ironically, Nucor was widely known in the industry as one of the highest paying steel employers. It seemed that that the worker incentives, egalitarianism and the non-unionized nature of the workforce were a great strategic fit for Nucor.

Thickening of the Activity System (Appendix D)

Iverson's approach on keeping things simple did wonders for the firm and its stakeholders from 1970 to 1986. Nucor's flat hierarchical, decentralized structure was successful in its autonomous operations. As early as 1972, Iverson said, "We are very confident that it's going to be a very fine business for those people who are efficient, low-cost producers".[49] He continued to thicken the major nodes of Nucor's activity system, using Nucor's early footing in minimill

technology as a ‘trigger’. The disruptive nature of minimills allowed Iverson to pursue an extremely low-cost strategy with respect to the construction, production and operation of these facilities. During this era of maximum capacity and organic growth, Nucor realized incredible economies of learning and scale. It managed to position itself in every geographical market in the United States, bringing its products closer to the customers, thus increasing the total value in the industry.

To some degree, there was some patching and thickening in the activity system with respect to the range of products offered. While Vulcraft was known as a high-quality specialized product, many of the steel shapes that the minimills produced were medium quality lower-margin products. Therefore, medium quality product development also strengthened as a core activity for the mini-minimills. They did, however remain highly specialized, and by the mid-1980’s, broadened their range of specialized products to include a variety of shapes and grades. The integrated steel-makers had already ceded their position in lower margin markets to efficient minimill producers and foreign competitors.

Another primary activity that evolved was Nucor’s worker relations. The founding of the Nucor Foundation and the profit sharing contributions expressed Iverson’s interest in long-term employment and workforce commitment. Nucor’s reputation for providing tangible rewards to the firm’s stakeholders could never have been have been stronger. Nucor issued a cash dividend to shareholders just one year after going public, and paid lump-sum cash bonuses to its

employees at the year-end if times were good. Other firms talked, while Nucor performed. Nucor's investment in cutting-edge technology was of course another activity that flourished. Nucor's new plants were among the most efficient in the world in terms of labor productivity and environmental control. They conserved energy and controlled emission of pollutants and dusts. It really was notable that Nucor could price below foreign imports, while having the best technology in the market and the most stable workforce. It seemed that Nucor was evolving towards a perfect fit by thickening most of its rudimentary activities uniformly during this era.

CHAPTER 8

EXPANSION AND INVESTMENT: 1986-1996

Historical Overview

The next decade was one of continuous growth for Nucor, marked by expansion into different products and the construction of several new mills. The steel industry had rebounded from the slump in the early '80s, and in 1985 sales and net earnings had climbed to $758.4 million and $58.4 million, compared to $486 million and $22.2 million in 1982.[50] Several firms had exited the steel industry during the recession, which caused industry-wide losses of $6 billion and created a one-third unemployment rate among steel workers. Nucor had preserved profitability and managed to retain its entire workforce by using a reduced workweek, and found itself in a position to expand its market share to take up the slack.

However, competition was growing both domestically, in the form of other minimills (by 1985 there were close to 50 in operation, of which Nucor owned four), and from imports, whose volume had grown rapidly. Domestic minimills were using the same basic technology centered on the EAF (Electric Arc Furnace) to achieve similar cost advantages and were competing in the same market segments. In 1984, imports reached 26.2 million tons, a market-share height of 26.4% of the 98.9 million tons consumed in the United States.[51] In August of the same year, Nucor chose to drop its prices by $15 per ton on average in order to offset this trend. Integrated steel no longer considered Nucor

a direct threat at this juncture, choosing to drop out of rebar, rod, and bar production, where gross margins ran from 4% to 12%, and concentrating their efforts on structural and sheet production, whose margins were usually above 20%.[52]

In 1986, with David Aycock newly elected as president and COO to share the burden of leadership with Iverson, Nucor began growth in new directions. In a risky move that committed a large portion of their assets, it announced the decision to invest in thin-slab casting, a form of technology developed by the German company SMS Comcast. The proposed timeline projected a new mill becoming fully operation within three years. Within a few months, Nucor also announced a joint venture with Yamato Kogyo of Japan. In September, the firm entered the import-dominated steel fastener business, and in December Nucor purchased a bearing manufacturing facility, the first major manufacturing concern to be bought, instead of built. At the same time, the price of No. 1 heavy melting steel scrap hit a low of $74.17 a ton, setting the stage for profitable production.

Thin-slab Casting at Crawfordsville

1986 was a critical threshold for Nucor. The company was shifting into a producer for the external market, using only 1/3 of its steel for internal sourcing (mostly to the Vulcraft divisions).[53] At the same time, its product market had nearly reached saturation, thanks to the heavy expansion of the minimills in the late ‘70s and the subsequent decline in demand in steel-intensive industries. Geographic expansion had led to greater competition and lower margins

between minimills, but expansion into product segments outside of rod, bar, and small structural shapes had been relatively limited. Minimills were 16% of the nation's steel capacity in 1986, but their avenues for growth were limited without product diversification. The flat-rolled, higher-margin products had become the bastion of integrated steel producers, making up 82% of their total shipments in 1980 (sheet metal alone was 75%).[54] In 1986, no minimill had the technical ability or means to compete, although several had examined thin-slab casting with the hopes of entering the sheet market.

Thin-slab casting was an emerging science. In 1986, several different methods were being developed, most of which combined the benefits of continuous casting with direct hot-charging to create flat-rolled steel with less capital and lower costs.[55] In terms of strategic fit, the move into thin-slab casting was an example of Nucor's willingness to quickly invest in new technologies that could provide it with a cost advantage. At the same time, it demonstrated management's desire to expand the company into new markets: As other minimills eroded Nucor's cost advantages in the existing segments, industry trends showed customers turning to imports due to their wider range of products and better marketing services. Product differentiation was determined necessary for continued growth.

Nucor estimated that thin-slab casting would allow it to enter the sheet metal industry, at 65% volume and 25% gross margins the largest and most profitable of the steel segments, with a $50-$75 per ton cost advantage.[56] This

cost advantage was generated by the reduction in capital expenditures, labor (from integrated mills' requirements of 50 to 60 workers per shift down to 12 for the same amount of output) [57] and energy (0.6 million BTUs per ton, as opposed to 2.0 million for many other facilities) resulting from the elimination of the machinery used to roll thick-cast slabs into thinner sheets, the method used in integrated mills.[58] Sheet metal served the automotive market, which had grown over the 20th century into the largest industrial consumer of steel. It was Nucor's second largest source of sales, at 15%. Construction, which used steel all across the product spectrum (rebar to sheet) was the largest at 60%.[59] In 1986 the average price for flat-rolled steel was $400 a ton, as compared to $250 per ton in the bar market. [60]

Nucor was not the first to consider this investment. The technology had existed in the early '80s, but been dismissed as a commercial impossibility; one version using Hazelett casters was proving already proving expensive and difficult to implement in the plants where it had been piloted, including Nucor's own plant in Darlington, SC.[61] Nucor had in fact been trying to create its own process, but had also been monitoring SMS' progress carefully since 1984. When the German firm announced a successful prototype based on CSP (Compact Strip Production) on a scale of production roughly one-tenth that of a small minimill in 1985, Nucor executives flew over to investigate. Finding the process viable, they signed a deal to license the technology within a year.

The decision process was an impressive example of Nucor's ability to swiftly make large commitments of resources despite having a decentralized management structure, as well as their willingness to invest in risky new technology. Despite the fact that hundreds of other managers and engineers also examined the SMS plant, no other firms chose to buy the CSP process;[62] in fact, the German firm was so eager to gain orders that it offered Nucor a money-back guarantee in case the equipment failed. The reluctance to buy was understandable, as the cost of the investment was very large and the risks high: the plant construction costs alone were $270 million, and at some points in the process as much was 25% of Nucor's total assets (and if working capital requirements were included, close to their entire net worth) would be tied up in the project.[63] Furthermore, the small scale of the model plant made it difficult to predict the problems that would arise with processing a larger batch. However, being first to sign the license agreement secured Nucor a cost reduction of several million, and allowed them to bargain for performance clauses.[64]

The timeline they set for themselves was also daunting: two years to bring the continuous casters online, and another half year to begin hot rolling, meaning that the plant in Crawfordsville would be fully operational by April of 1989. This was typical of Nucor construction speeds and reduced the cost of capital for their projects, but had never been attempted with a new, untested technology. Start-up costs were an educated guess at best. Integrated steelmakers were confident that the installation would be more difficult than anticipated, or that the steel

produced would never meet standards at the upper end of the market. Externally, failure was not a consideration; internally, the Corporate Controller admitted that, “Thin-slab was a big gamble…It would have been a serious wound had it not worked.”[65]

As it turned out, the gamble paid off with impressive results. In August of 1989, the plant began operations. After some initial adjustments were made, the plant was able to produce high-quality thin sheets that could be used to make automotive parts. Within two years of operation, it was profitably producing 700,000 tons of steel; within four, it was being expanded to a capacity of 2.1 million tons per year. Other minimills began to adopt the process slowly throughout the ‘90s, after thin-slab had proven to be one of the “two biggest leaps in steelmaking productivity in the twentieth century,” reducing man-hours per ton to less than one, and improving production speed to less than four hours required to turn scrap into finished coil.[66]

Capitalizing on their skill in rapid construction and head start on the learning curve, Nucor quickly expanded its Sheet Mill Group. Nucor announced plans in October 1990 to construct a new mill that would produce hot-rolled sheet steel in Mississippi County, Arkansas, using the same technology that was successfully proven at the Crawfordsville, Indiana plant. Construction started on the plant in February 1991, and operations started in 1992.[67] Before 1996, two more mills were built in Arkansas and South Carolina. By 1996, both mills had been expanded to double their original capacity, or 4 million tons per year each;

the 1.8 million tons from the South Carolina mill then in construction would make Nucor the second-largest steel producer in the US. All three plants produced high-grade sheet steel that was adjustable-width and could be cold-rolled or galvanized for further processing; this customizability resulted in strong demand from automotive, construction, and appliance manufacturers. [68]

Nucor's minimill competitors, lacking such nimble management and a high-quality labor force able to take on the complicated tasks and greater responsibility necessitated by the reduced number of men per heat in thin-slab casting, were unable to imitate these investments for several years, by which time Nucor had already established a strong market share. In 1997, five other minimills in America were attempting to follow Nucor's lead using the SMS technology or one of the six competing thin-slab systems that sprung up in its wake; their total capacity was roughly 8.6 million tons per year, less than Nucor's 9.8 million (including the South Carolina plant).

Another investment, similar in structure and principle if not in scale, was made in 1991, when Nucor signed an agreement with Gradic Wire AB of Sweden, making it the first North American producer to use the patented G-casting technique to directly cast wire.[69] Like thin-slab, G-casting was completely revolutionary, required far less capital (the Nucor Wire mill, at one-tenth the size of Nucor's other facilities, was called a "midget mill") and was several times faster than traditional techniques for wire casting. The stainless

steel wire produced was also thinner than that which could be achieved by older methods.

Joint Ventures, Acquisitions, and Internal Growth

Thin-slab was not Nucor's only investment in technology in 1986, although it was the largest. Nucor also signed a letter of intent with Yamato Kogyo detailing a joint venture between the two companies to produce wide-flange beams (I-beams) with a depth of 24 inches. Similar to their approach to thin-slab, Nucor showed a willingness to invest in efficiency and execution. Again, this was a higher gross-margin (18%), major market (24% of total steel demand)[70] product that was being solely by integrated mills, and only the three largest (Bethlehem, US and Inland) at that. (Chaparral, a competing minimill, produced wide-flange beams of a more limited depth.)[71]

Nucor, with no R&D department (one reason why it rarely invented new processes), needed Yamato's technical expertise to complete the structural beam blank casting process, providing the melting and materials-handling technologies in exchange. John Correnti, who had supervised Nucor's Utah minimill during its startup, was placed in charge of the project. The plant's cost was estimated to be $200 million, and time to completion, despite the incredulity of the Japanese partners, was set at 18 months, an impressively short time for what would in the three years be the world's largest structural steel mill. Construction began in 1987; in September of 1988, the plant shipped its first

beam. Within a year it had exceeded its originally planned capacity. In 1996 it was producing 2.3 million tons per year.[72]

Not all Nucor's technological investments focused on innovation; the decision to enter the fastener market was based primarily on the belief that Nucor could produce efficiently enough to match import prices. At the time, imports supplied almost 90% of the market, but using a largely automated, state-of-the-art facility (initially built at a cost of $25 million and upgraded in the early '90s), Nucor was able to make, and to a certain extent, customize various bolts, nuts and screws at a competitive price, internally sourcing its raw material from the Bar Mill Group. The products served a wide variety of industries, ranging from automotive to farm implements. The plant capacity was originally 40,000 tons per year; the upgrade and expansion brought it to 75,000.

Nucor's last entry into a new line of business for 1986 was an outright acquisition. In December, the company purchased a manufacturing outfit from General Bearing Corporation, which evolved into the Bearing Product Division and then Nucor Bearing Products, Inc. The Division was unusual for two reasons: it had been bought, not built, and it was externally sourced. Up until the late '90s, Nucor was not capable of producing the kind of steel needed to make bearings, but it continued to build and sell over a hundred million small parts annually using outside steel. There was no particular cost advantage to producing the bearings and the division never played a significant part in Nucor's bottom line. The acquisition seems to have been purely an effort to broaden

Nucor's product offering, continue its process of providing customization and possibly to diversify its markets. (The division's products were used in GM, Chrysler and Ford cars, as well as a number of other products with moving parts, such as lawn mowers.[73]) The bearings plant did not capitalize on Nucor's core competencies or strengthen the activity system, and Nucor never sought to expand it in later years.

Nucor was more successful in its entrance into the building products industry. If by 1988 there were any doubts that minimills could effectively compete in the highly processed, customized product end of the steel industry, they were eliminated when Nucor began operations at its first Building Systems plant in Indiana. The new division offered custom-built metal buildings and building components to contractors for industrial, commercial, and institutional buildings; the metal for the buildings was largely sourced from Nucor's Bar and Sheet Mill Groups. Construction frequently involved other materials and services, which Nucor subcontracted to a third party. The buildings were sold through a builder distribution network, which allowed better matches of supply and demand and cut lead-time. The convenience of this system led to a higher willingness-to-pay for its customers, and the growth of profits convinced the company to build a second branch in 1995, eventually adding a third. The combined capacity of the three facilities exceeded 140,000 tons per year. Their distinct cost advantage came from being able to internally source most raw materials from Nucor's own minimills.

Other Expansions

Throughout the early ‘90s Nucor continued to expand its existing operations, including the Nucor-Yamato plant in Arkansas. At the same time, it shed its remaining non-steel business, a chemical research concern, at a significant gain. In 1991, Aycock stepped down as president, and was succeeded by Correnti. The same year, Nucor moved its corporate headquarters into a larger, more stylish office space, perhaps in recognition of their new status as one of America’s leading steel producers. Profits in 1993 were $2.25 billion, roughly a hundred times what they had been a decade before. Despite an overall industry slump, all divisions remained profitable, and Nucor continued to add to and expand its mills, particularly in the newer groups. This capacity expansion raised entry barriers for other minimills: by committing to new plants, which were sticky production factors, Nucor made it less profitable for its competitors to expand.

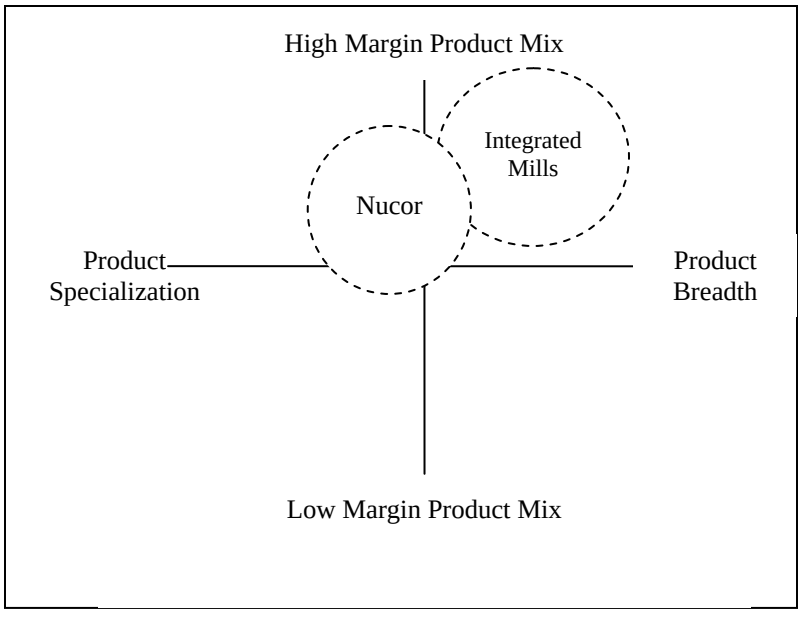
Nucor’s last venture of the early ‘90s was to begin production of iron carbide in Trinidad, hoping to reduce its dependency on scrap. However, this time the revolutionary nature of both the technology and the location served to foil efforts at profitable production, and the plant did not reach profitability for several years. As Iverson often said, Nucor’s managers were not infallible, and their ability to take risks naturally resulted in the occasional loss or failure. However, the tight emphasis on profitability ensured that mistakes were seldom repeated, and risks were generally only taken when the potential gains made

them worthwhile. In the case of iron carbide, Nucor's increasing exposure to rising scrap prices (exacerbated by the new sheet mills) made management eager to look for alternative sources of supply, a goal they retained even after the iron carbide project had been abandoned.

Positioning in Steel Products

In this period of development, Nucor invested heavily in various expansions of its product line. The key to being able to expand into higher margin segments was the development of thin-slab casting, as almost all such segments demanded sheet or strip metal (total demand for these products

Figure 5. Nucor Competitive Positioning: Steel products



comprised 49.7% of total steel demand in 1996)[74], as opposed to bar or rebar. Prior to 1986, this had been one of the last of the product categories still wholly dominated by the integrated steel makers, as the cost of the casters and reducers used in the integrated process had been prohibitive for minimills.

As a result of thin-slab and concerted effort at diversification that pushed into horizontal (sheet, wire, fasteners, I-beams) and vertical (iron carbide, bearings, building systems) integration, Nucor's positioning expanded to overlap and encompass that of the integrated mills.

Coasting and Thickening around the Activity System (Appendix E)

In this period Nucor did precisely what it had been doing all along. Despite its attempt to move into higher-margin markets, it did not compromise its strategic fit: It maintained its decentralized structure, giving new plants autonomy as they were built. It invested heavily in new technologies that allowed it to operate more productively with far less capital than integrated steelmakers, and showed itself to be quick to respond to new opportunities and threats, willing to take risks and capable of long-term commitment. Not surprisingly, this resulted in constant profitability, an achievement that becomes more impressive in light of the rate of growth Nucor was able to sustain for a decade: from 1988 to 1994, Nucor accounted for more than 80 percent of the industry's growth in shipments.[75]

Nucor's tight fit drove its successful expansion. It paid close attention to developing technology both at home and abroad, and had a management structure and team willing to take risks by investing in such technology. The lack of bureaucracy in the company allowed for speedy decision-making, while a competent, independent workforce ensured smooth implementation and operation once decisions had been made. Finally, the efficiency of the operation led to higher quality and lower costs, reinforcing their competitive advantage and increasing the amount of value they were able to appropriate. Without these well-fitting activities, Nucor could not have sustained a rapid rate of development to profitably outpace its competitors. Nucor's leader, Iverson, was well aware that the company's strengths lay in the construction and operation of steel products plants and continued to leverage these skills, while divesting the company's final non-steel related assets.

Although Nucor's decisions to invest in technology were critical to its growth strategy, Nucor's managers did not neglect their people. At the same time as the company relied on the strength of its workforce to operate its new plants, it reinforced excellent labor relations by sharing profits and improving its plant safety. In 1987, Nucor's injury/illness rate for its steelmaking operations was 17.33 cases per 100 workers. That number peaked at 24.76 in 1989. After Nucor instituted the measure of keeping a safety coordinator at every plant, it fell steadily, dropping to 13.62 in 1992 and down to 8.81 through October of 1996.[76] The fatality rate also fell. According to the company, it has not had a fatality at its

steelmaking operations since 1991, when two workers died. Five workers have died since 1987, with one death in 1988, another in 1989 and a third in 1990.[77] When the press (possibly due to union lobbying) drew attention to safety concerns the company responded immediately; its efforts won it a Certificate of Merit from Wausau Insurance Companies in 1995.

CHAPTER 9

AN ERA OF GROWTH AND COMPETITION: 1996-2006

Historical Overview

Nucor experienced changes in leadership as Iverson turned over his CEO duties to company veteran and heir apparent John Correnti in 1996. Nucor's expansion focus continued under this new leadership. Under Correnti, Nucor built a steel beam mill in South Carolina, added a galvanizing facility as well as its first steel plate mill, which became operational in 2000. [78]

Foreign imports put downward pressure on prices as imports entered the market in large numbers. The company slashed prices twice in 1998 to compete against imports from Russia, Japan, and Brazil. Both sales and earnings declined that year due to low metal prices, reduced shipments, and start-up costs for new plants. In an effort to regain price integrity, the company raised its prices in 1999. 1999 was also a year of boardroom musical chairs as Nucor's leadership changed yet again. Correnti resigned amidst disagreement with the board, and chairman David Aycock assumed his duties. In September of 2000 Aycock resigned from the company and Daniel R. DiMicco, an EVP, became CEO of Nucor.[79]

From the very beginning, Dimicco confessed to an international focus and continued with the wave of expansion that was set in motion before him. Under

DiMicco, Nucor cast its reach oversea. Early in 2000, Nucor, along with Australia's Broken Hill Proprietary Corporation and Japan's Ishikawajima-Harima Heavy Industries, began a joint venture called Castrip, LLC for strip casting. Strip casting allowed steel makers to produce in smaller, cheaper plants. In March 2001 Nucor purchased a significant amount of assets of Auburn Steel, a producer of merchant steel bar. Within the United States, Nucor purchased Alabama-based Trico Steel, a steel sheet producer, for approximately $116 million.[80] In late 2002 Nucor bought financially troubled Birmingham Steel for $615 million in cash and debt. Backward integration also continued for Nucor into this period because of the rise in steel input costs. Nucor teamed up with Companhia Vale do Rio Doce (CVRD), a Brazilian producer and exporter of iron-ore pellets, to develop low-cost iron based products in an effort to replace its dependency on steel scrap suppliers.

Nucor also changed its traditionally anti-protectionist position in 2001. In a significant turnaround, Nucor lobbied with fellow steel maker for Bush's Proposition 201, which ultimately imposed a 30% tariff on steel import.[81] Unfortunately, government intervention was unable to significantly boost to Nucor's bottom line because of high cost of expansion. Nucor's results were hurt by a 50% rise in start-up costs. On the positive side, Revenue rose 31% to $1.53 billion as acquisitions of new steel-producing assets boosted total steel shipped.[82]

Steel Industry Environment: Porter's Five Forces

Degree of Rivalry. In many ways, steel makers' profits are determined by their ability to contend with the cyclicality of steel demand. The soft economy, reduced construction demand, and foreign influx of steel products all could and did contributed to downward pressure on steel price in 1996-2005. When firms compete fiercely for customers, who demanded lower prices, the degree to rivalry escalated. Foreign competition was an important factor. For instance, increased imports resulted in lower prices by $30/ton for minimills in 2000.[83] This situation was assuaged to an extent by the President's import tariff and a weak dollar in 2002-2003.[84] However, with Bush's abolishing the tariff in December of 2003, the degree of rivalry increased and the threat of a price war returned to a heightened level.

Despite the public attention on foreign competition, imports were not the only driver for the high degree of rivalry. According to Dimicco, "Imports certainly have a major impact, causing 30 or 40 percent [of the problem]. The other 60 percent is self-inflicted."[85] Triggered by foreign competitors, US steel makers engaged in price wars and gave away value to the customers unnecessarily. Moreover, steel industry continues to be plagued by excess capacity due largely to increasing number of minimills in the US. When combined with the growth of imports and a sluggish economy, the degree of rivalry escalated.

Recognizing the need to reduce the degree of rivalry, steel makers have begun to consolidate amidst bankruptcy and acquisitions. Nucor acquired the

bankrupted Birmingham Steel in 2002, bringing its total US minimill count to 14 mills.[86] The company also considers deeper global expansion. These trends reduce the degree of rivalry as firms recognize their interdependence and restrain their rivalry.[87] This spirit of restraint and cooperation was already apparent as large players lobbied together actively for the 30% tariff.

Barriers to Entry. There were already a significant number of players in the steel industry to make it an extremely competitive market. Moreover, the cost of building a plant has steadily decreased and the cost of entry has been lowered as a consequence. To make the matters worse, Nucor's minimill technology is highly transferable. According to David Stickler, a steel- industry investment banker: ``All you need is iron, cheap electricity, and 300 workers''.[88] The reduced initial investment became an opportunity for other manufacturers to enter the market.

Ironically, Nucor's market success has demonstrated the potential profitability for the steel industry and reduced the barrier to entry by pioneering a disruptive technology. More importantly, the buyers' willingness to switch encouraged the expansion of minimills in this period. As a case in point, Keith Busse, the former Nucor executive, started Steel Dynamic, Inc in 1996.[89] SDI managed to start a plant at a low start-up cost of 600 million and followed a similar expansionary path as Nucor. The Nucor model worked well for the SDI, which recently outbid Nucor for the minimill Qualitech Steel.[90] SDI's success

demonstrated the lowered barrier to entry, and Nucor could easily trace this development back to its own success.

Supplier Power. Nucor's relationship with the scrap-metal suppliers mirrored its downstream relationship with the steel buyers. Because of the competitive profit margin and the commodity nature of scrap, supplier power is usually low when the prices of steel are low. As a supplier described: "(Cost cutting nature of the industry) drives pricing lower and lower to a point where there's no money left for research and development...It's very difficult to counteract".[91] Nucor's source of power stems from large number of suppliers as well as low switching cost of changing suppliers. According to Dan DiMicco, "You'd be remiss to your shareholders and employees if you did not work to get the best price. Once the suppliers have won the contract, then how well you work together to bring that project to completion, that's where the partnership is. Up until that point, they're competing against five or six other guys, and we're competing against 20 different steel companies for the product we're going to be producing."[92]

In 2005, supplier power has been boosted by the increased demand for scraps of global market. In particular, Asian steel makers bought scrap metal to feed the expansion in Asia. Specifically, Nucor experienced a sharp increase in input cost as China's demand for raw material shot up due to its heightened construction activity.[93] It is partially because of this increase in supplier power that Nucor saw its profits drop by 59% in 2003.[94]

Buyer Power. On the demand side, minimal product differentiation and low switching cost allow buyers to switch between steel producers with ease. The proliferation of minimills and high amount of imports of recent years meant there are increasing numbers of steel producers for steel buyers to choose from. As a result, buyer power in the steel industry is extremely high.

Strategic Positioning of Competitors

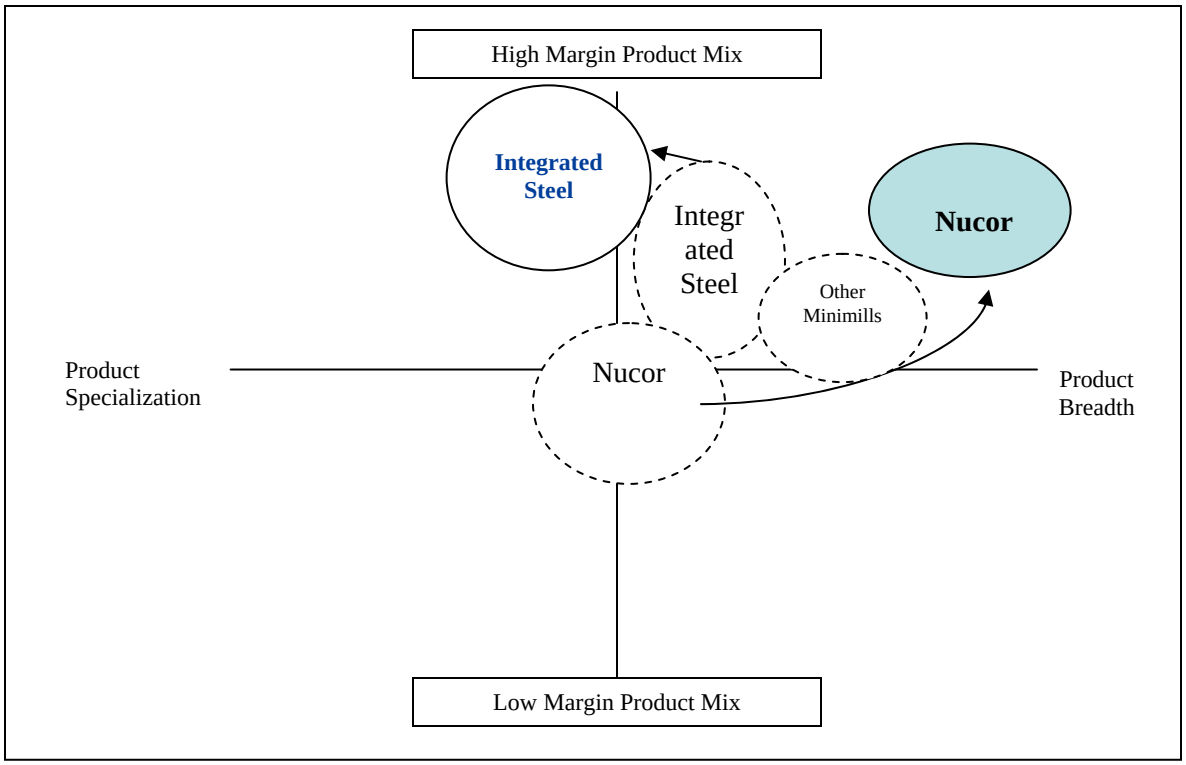
As minimills' operational expertise disseminated throughout the industry, operational efficiency increased across the board and the gradual competitive convergence intensified. In basic steel production, one can observe the Red Queen effect as both the integrated steel makers and minimills, such as Nucor and SDI, consolidated in order to increase operation efficiency and lower production cost. Fortunately, Nucor has simultaneously expanded into higher margin, more complex product lines to avoid competing on similar competitive competencies. As of 2003, Nucor's main product lines include: carbon and alloy steel bars, beam, sheet, plates, cold finished steel, steel joists and joists girders, steel deck, metal building systems, light gauge steel framing.[95]

As a result of this broadening of product focus (See Figure 6), Nucor's overall position moves up and to the right in the strategic positioning chart into a cost leadership focus.[96] Interestingly, integrated steel makers took the opposite track and trimmed their product lines to retain only the most profitable operations - narrowing to a cost base focus in order to achieve solvency for many troubled operations. This resulted in moving up (higher margin product) and to the left

(reduction of product breadth) for the integrated steel makers. Overall, Nucor faces leaner and meaner competitors in the domestic market from the traditional steel makers. Minimills such as SDI have increased the level of competition by closely following Nucor's expansion model. This is apparent in minimills' proximity to Nucor on the strategic positioning graph as well as other minimills' acquisition activities.

Nucor's ability to broaden its product line profitably is due to the high quality of its labor resources. The high production discipline of its labor resources can be utilized across different product lines of steel making. For instance, Nucor transfers its managers across different product lines to capitalize on their expertise. Therefore, Nucor is able to occupy the position of broad product breadth, a space originally occupied by integrated steel makers, more successfully than the traditional steel makers. In short, Nucor's superior resource and stronger industry position potentially allow it to operate more profitably than traditional steel makers in the wide product scope position.

Figure 6. 2006 Strategic Positioning of Steel Industry



Activity System: Thickening & Coasting around Core Elements (Appendix F)

Nucor chose not to engage in significant trimming of its activity system in 1996-2006. Instead, Nucor's activity system demonstrated thickening around the original core elements of low cost structure, strong labor relation, technology focus, specialized product, and focus on high margin products through a set of new activities. Overall, Nucor has consolidated its position in the steel industry through elaboration of previously created core elements. This reinforcement of complementary activities is especially important during this period since Nucor's competitors, such as SDI, have copied Nucor's operating model with a high degree of success. Indeed, Nucor has not only expanded activity around the core elements of low cost and technology focus to improve operation efficiency, but also remained committed to its main factor of strong labor management as a key source of its competitive advantage.

Domestic and International Expansion

Reinforcing the notion of Low Cost Structure and Strong Labor Relation

For Nucor, increasing capacity strengthened the firm's operational efficiency and lower production cost through economy of scale and learning experiences. Besides increased operation efficiency, international expansions into Latin America also translated into lower labor cost and government subsidies, which reinforced the low cost core element. During this period, Nucor also expanded domestically through the purchase of Birmingham steel and

through the potential addition of micro-mills, a form of strip casting mills even smaller than those of regular minimills.

On the supply side, Nucor backward-integrated abroad by building raw material processing in an effort to reduce input costs. As Nucor moved more aggressively into flat-rolled steel, its need for higher-quality scraps increased.[97] Since January 1993, prices of low-residual scraps have jumped from $15 to $20 a ton higher than regular grades of scrap.[98] In response, Nucor teamed up with Companhia Vale do Rio Doce (CVRD), a Brazilian producer and exporter of iron-ore pellets, to develop low-cost iron based products to reduce its dependency on scrap.

Nucor continued to thicken its element of strong labor quality through its international expansion. When considering expansion into Latin America, Nucor was drawn by the hard working nature of the South American workers. Nucor also elaborated around its core element of strong labor management practice by strengthening its sophisticated knowledge management system through the transfer of key managers. At its new plate plants in the US, executives with years of steel making experience worked to transfer steel-making know-how to new ventures**.** When hiring for its first plate mill in North Carolina, Nucor took care to choose experienced steel workers from its own plants along with outside workers.[99] This practice of utilizing the company's reservoir of experience reduced the overall start up costs for Nucor and complemented the low cost

structure by reducing startup costs. Nucor also continued to coast along its highly competitive hiring process; the management chose only 190 out of the 5400 workers who applied for positions.[100] This consistency in maintaining Nucor's exceptional people factor allowed the company to sustain its competitive advantage by reinforcing key elements of its activity systems. However, the company also began to hire outside management, rather than promoting experienced workers into the boardroom, one of the issues which was a source of strife between Iverson and Aycock.

Nucor also reinforced its element of higher quality for its customers through its expansion. This strong customer focus added to the uniqueness of Nucor's activity system and builds relationship with key customers. For example, Nucor's expansion into strip casting micro-mills allowed it to locate closer to customers' base of operation, which meant transportation cost savings of up to $20/ton for key customers.[101] Overall, Nucor's international growth focus reflected a growing willingness to meet customers' needs. Many manufacturers had emphasized that they wanted their Chinese plants to be supplied by mills in Asia.[102] "If U.S. companies want a piece of the action, they won't be able to do it from a U.S. base".[103] Thus, through better services and extra cost savings, Nucor effectively increases switching cost for its core customers, who would have to forfeit Nucor's reliability and superior logistics cost if they decide to switch to one of Nucor's many competitors.

Continual Focus on Technology

Kenneth Iverson said it best when he commented on Nucor's success factors: "70% of it has to do with culture and 30% has to do with technology".[104] Nucor has always been an innovator with technology. Strip casting technology, which casts molten steel directly into thin sheets, allows steelmakers to switch among multiple steel grades quickly.[105] By thickening around the element of technology focus with strip casting technology, Nucor reinforced technology's complementarities to the core element of low cost. Indeed, strip casting only requires around 10% of a new integrated mill's capital investment but will turn out steel 20 times as fast.[106] Even more encouraging is the fact that micro-mill technology can produce cold-rolled sheet for $200/ton, which costs $300-310/ton to make today.[107]

Besides reinforcing its low cost structure, investment in technology allows Nucor to thicken around the core element of high quality. Nucor installed Parsytec automatic surface-detection systems in its plants; Parsytec scans steel for cracks.[108] By harnessing technology to assure better quality, Nucor created value by fulfilling customers' needs for reliable products and complements its customer focus element.

Broadening into Specialized Product Lines: Complementing Customer Focus

One of Nucor's specialized product lines is new plate production. Responding to customer needs, Nucor began to produce a series of basic plate grades and moved up the value chain by expanding into different ranges of better

quality plates. This thickening around specialized product lines diversifies the company's products and stabilizes cash flow when the prices of basic steel products drop in response to macroeconomic pressures. In addition, this specialization into higher margin product has improved Nucor's profitability and reinforced the customer focus by fulfilling the needs for high quality steel product.

Commitment and Evolution towards a Better Fit

By consistently thickening around its core elements, Nucor has evolved toward a strong strategic fit through a unique and consistent activity system. One element that Nucor has taken care to cultivate is its strong worker relationships. As a sticky factor, this worker relation was durable, specialized, and scarce. By providing generous compensation, Nucor's workers remain loyal to the company. Furthermore, Nucor has invested continuously in a work force that possessed specialized steel making knowledge - a work force that could be transferred amongst steel making operations. This flexibility allowed Nucor to transfer the expertise of its workers across different product lines, which translated into lower startup costs for Nucor as a whole. It will be difficult for competitors to access or imitate Nucor's labor relations in a short time. By committing to this sticky factor of strong labor relations on a continuous basis, Nucor has a strong chance of sustaining its competitive advantage into the future.

Another key feature of Nucor's activity system is the complementarities amongst its elements. A strong technology focus reinforces low cost structure

and higher quality products. The core element of high quality is also complementary with a strong customer focus. Nucor is able to retain key customers by providing superior quality products.

Value Creation

High Incentive for Supplier (See Figure 7)

Nucor's strategy of high incentive structure reduces the suppliers' opportunity cost for doing business with Nucor. By maintaining good supplier relationships and offering bonuses for timely delivery, Nucor is able to open its plants at lower cost and create higher value for itself. Suppliers are installing equipment that allows them to better integrate with Nucor.[109] This superior coordination reduces probability of plant failures, lowers cost, and creates value.

Appropriating Value from Suppliers

Backward Integration through iron pellet production

With the rising cost for scrap metal, Nucor attempts to stabilize its cost lines through the process of backward integration into iron pellet production. By gradually reducing its dependence on suppliers, Nucor is appropriating value away from the scrap producers.

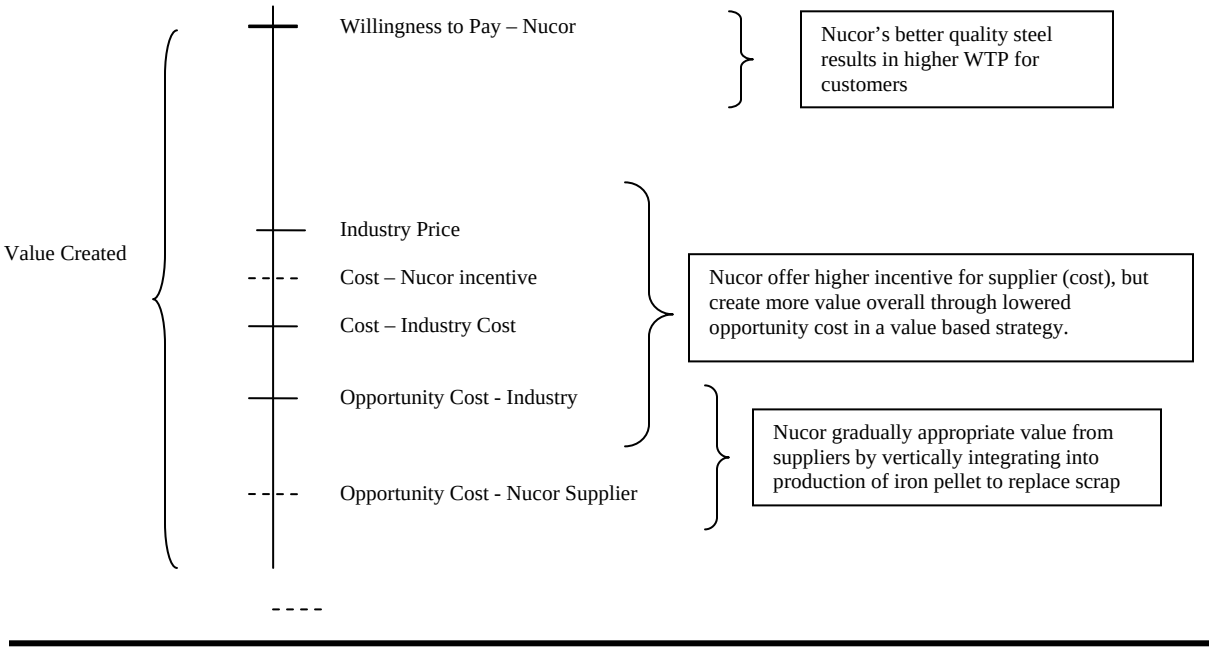
Creating Value for Customers

New Steel Technology for Higher Quality

Nucor's focus on new technology such as Parsytec automatic surface-detection system produces superior quality steel and increase customer's willingness to

pay. Furthermore, the strip-cast technology allows the plant to be located close to the customer. This in turn allows customers to cut costs and increase their willingness to pay for the firm's products.

Figure 7 Nucor Value Creation and Appropriation



CHAPTER 10

CONCLUSIONS

Nucor's story is one of growth towards a strategic fit against the competitive backdrop of the ultimate commodity market. Over the years and largely through the vision of one man, Nucor has evolved towards a strong strategic fit with a consistent activity system. By strengthening around its core elements in its activity system, the company has shown a strong commitment to its strategy. Even though competitors might attempt to imitate Nucor's management system, the mini mill's main sticky factor of an extraordinarily strong worker relations as well as the complex host of interrelated activities made the firm's success difficult to replicate. Thus, despite economic swings and tough competition, Nucor continues to grow steadily.

There are three main takeaways from the Nucor story that can apply to any industry:

(1) Advantages of intangible sticky factors: Management theory has described the importance of developing organizational sticky factors in building sustainable advantages in business.[110] While much attention in the subject is focused on tangible sticky factors, such as capital expenditures, Nucor serves as an example of how intangible sticky factors can provide even greater benefits. Integrated mills are one of the greatest examples of commitment in modern times, requiring massive capital

expenditures to build and operate. As theory would predict, such signals of commitment preserved an oligopoly in the steel industry for many decades. However, commitment to such a large tangible sticky factor has a downside. When technology advanced in the 1960s, the trade-off between commitment and flexibility became readily apparent. The same sticky factor that had been such a great source of commitment and sustained advantage became a primary reason that integrated mills did not experiment with the disruptive minimill technology, a decision that eventually led to their downfall.

Meanwhile, Nucor's greatest sticky factor was intangible: extraordinary labor management practices. This was a key factor in their rapid, successful growth, and in their ability to produce steel at margins that could compete with imports. Intangible sticky factors share or exceed the inimitability of tangible sticky factors in commitment, while being more inherently flexible than the tangible commitments made by integrated mills. Nucor has shown in joint-ventures and in the unusually rapid adoption of new technologies that its labor practices can be applied in a variety of steel applications. This makes Nucor less likely to be caught in the trap of the integrated mills, should a successor to minimill technology arise.

Every organization should seek to identify and develop intangible sticky factors that can both add value to present operations, and increase the flexibility of the organization to adapt to a changing environment.

(2) Dependence vs. continuity: As the future of Nucor unfolds, it may prove to be a cautionary tale of the tradeoff between dependence and continuity. The low-level responsibility in the Nucor organization did produce superior results, but such a model of autonomy within a defined framework relies heavily on aligned visions of managers at all levels. The charismatic leadership of Ken Iverson accomplished this purpose during Nucor's rapid growth, but Nucor has yet to prove that his successors can do the same. After 30 years of a profitability focus, the company's newfound capacity focus may provide managers with the wrong incentives for Nucor's long-term health. The next decade will likely be a telling one for Nucor.

Regardless of whether or not Iverson's replacement is ultimately successful, the company's difficulty in replacing him illustrates the problematic conflict between dependence and continuity. Since Iverson's retirement eight years ago, there have been three CEOs. If a leader has a successful vision, as Iverson did, an organization dependent on that one person can achieve outstanding results. However, every great leader will eventually leave, and there is no guarantee that a carefully selected successor can achieve the same results. A potential way to smooth this

transition is to clearly and credibly inculcate the leader's vision into the firm's internal structure and governance. Otherwise, best practices may prove to be transient and limited to the leader's tenure.

(3) Controlled growth: Even in a rapidly growing firm, it is important to control the pace and direction of that growth. Profitability consistently remained the core consideration in new project evaluations. Nucor carefully monitored growth during its expansion period, selecting only projects where its sticky factors could be successfully leveraged.

An equally important aspect to growth management applies to the point when a company begins to reach maturity. Rate of growth will inevitably slow. The absolute scale implications of a fixed growth rate are radically different for a $500 million company and a $4 billion company. While every executive would readily admit that 25% annual growth cannot be indefinite, many companies are reluctant to accept that fact when the time comes. Nucor is at this stage now, and may be making this exact mistake. This would explain why a company that used to reject with disdain the idea of "growth for the sake of growth" would adopt a policy of rapidly increasing its capacity through acquisitions. Moving forward, Nucor must examine its current growth projects, as must every company, and determine whether growth plans are due to the sufficient presence of

profitable, applicable project opportunities, or whether projects are being taken on simply to meet growth expectations based on prior growth rates.

To maintain its lucrative stance within an increasingly competitive industry, the firm needs to learn from and continue its evolution towards fit. It has surpassed the expectations of the industry and its investors before, and it is a widely held belief that it possesses the potential to do so again.

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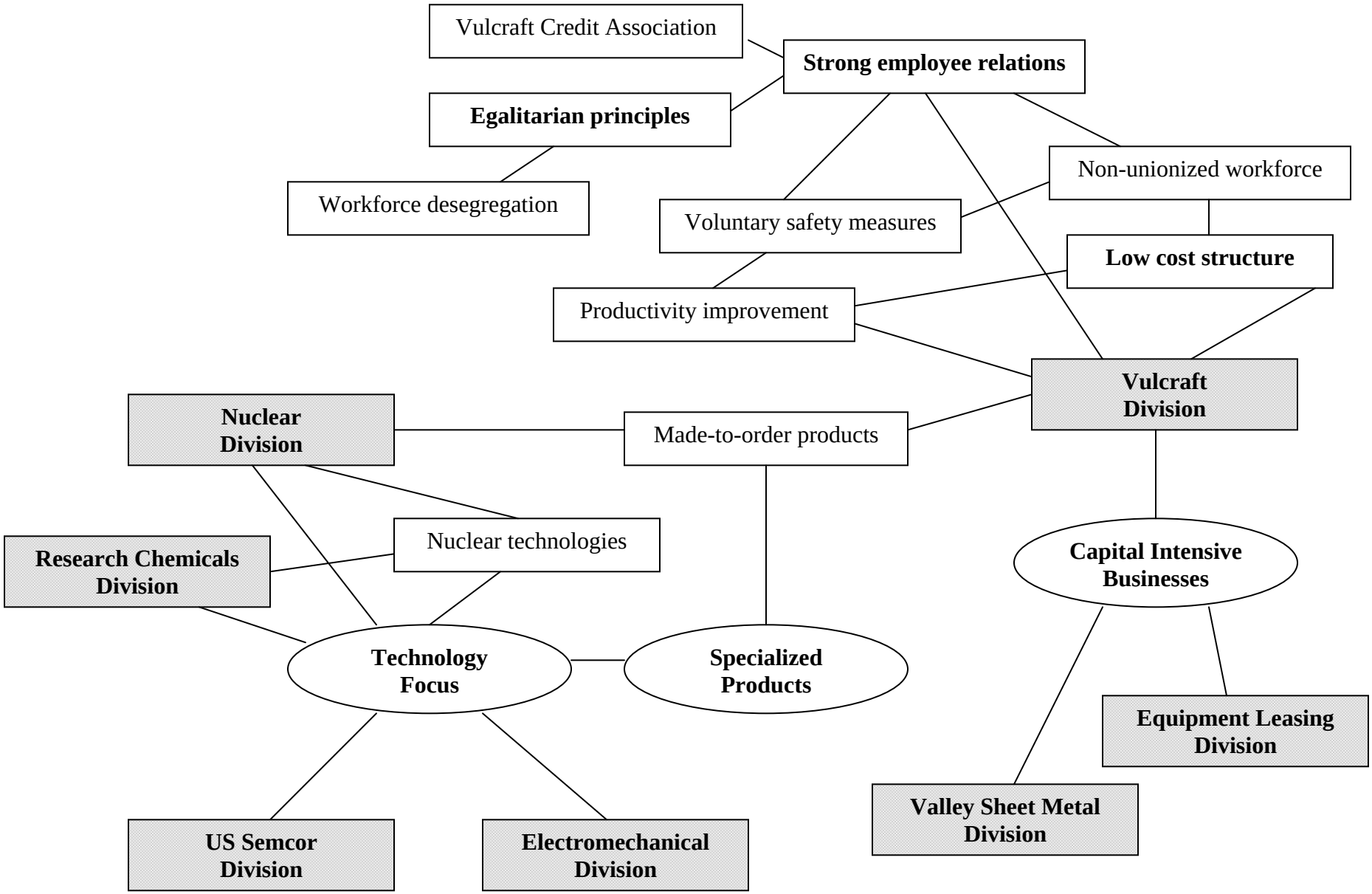
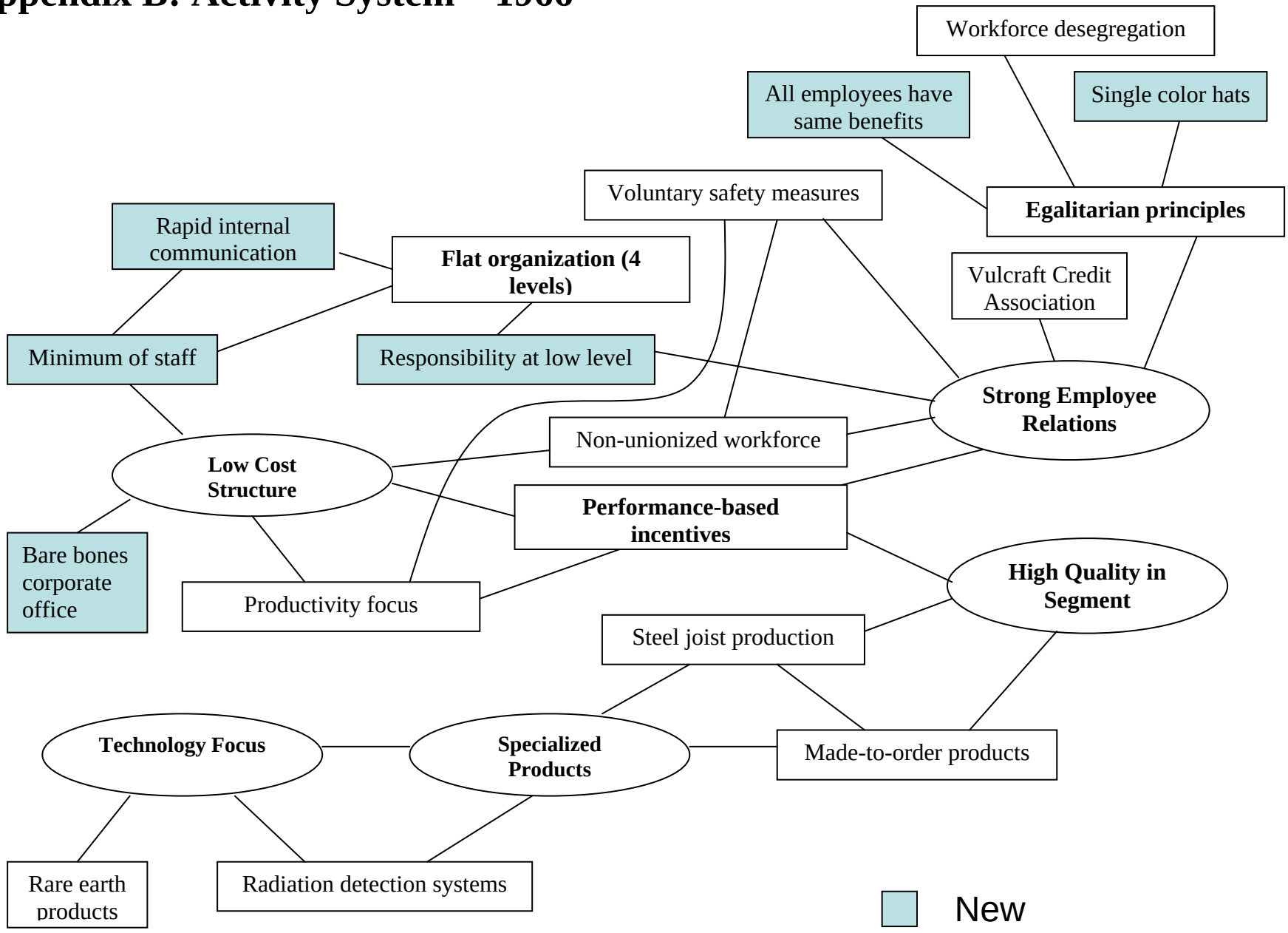
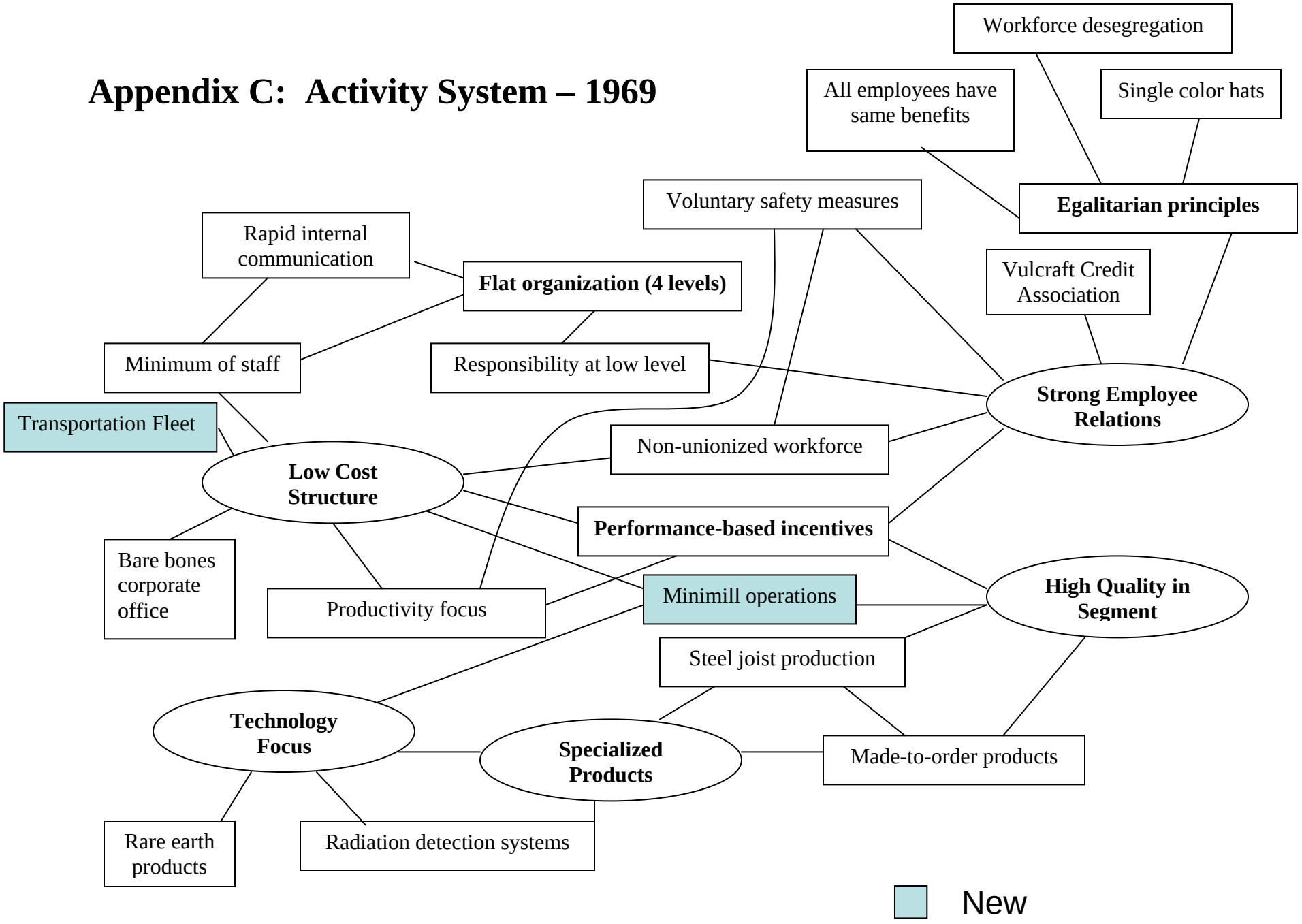
Appendix A: Activity System – 1965



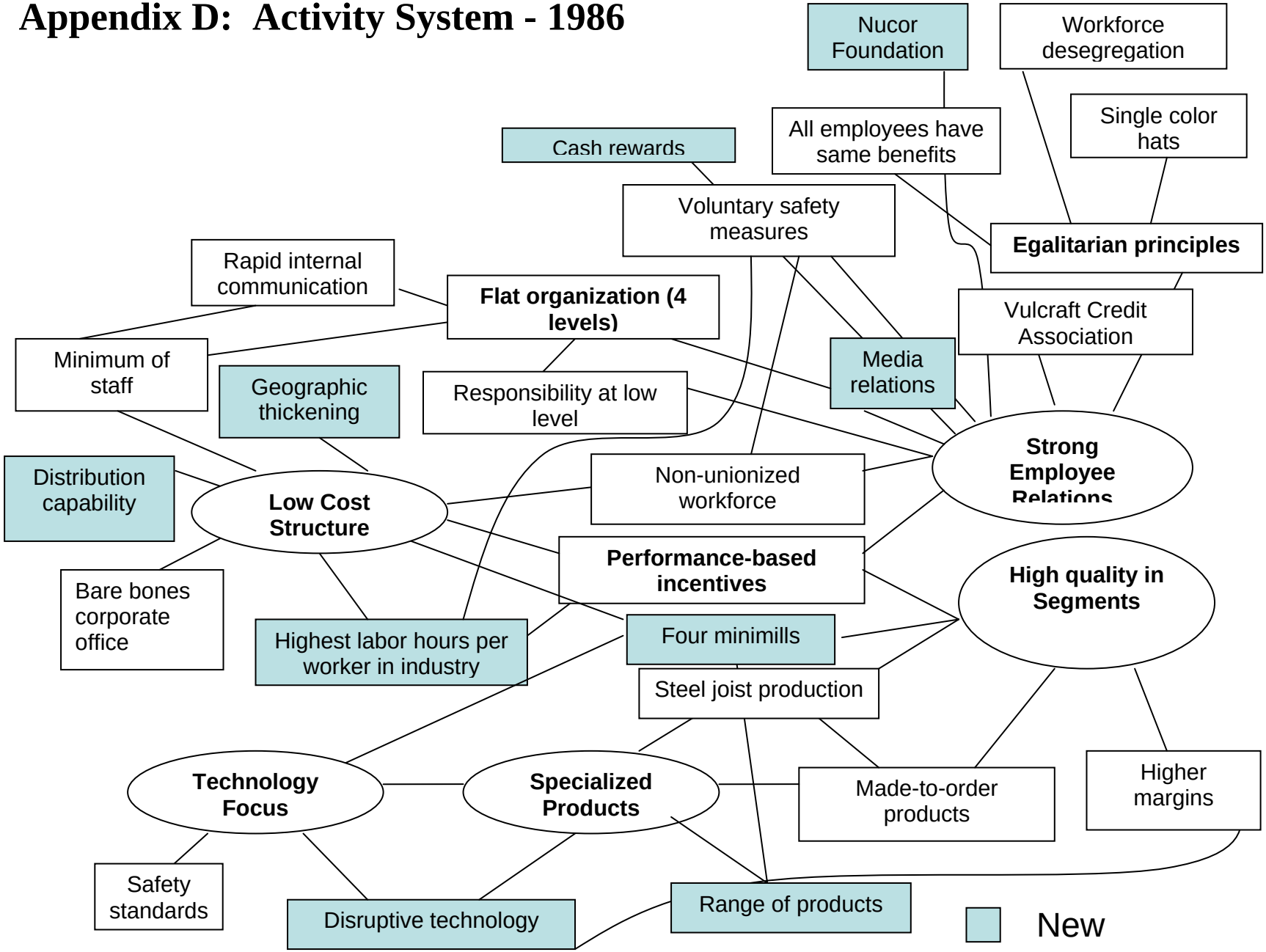
Appendix B: Activity System – 1966



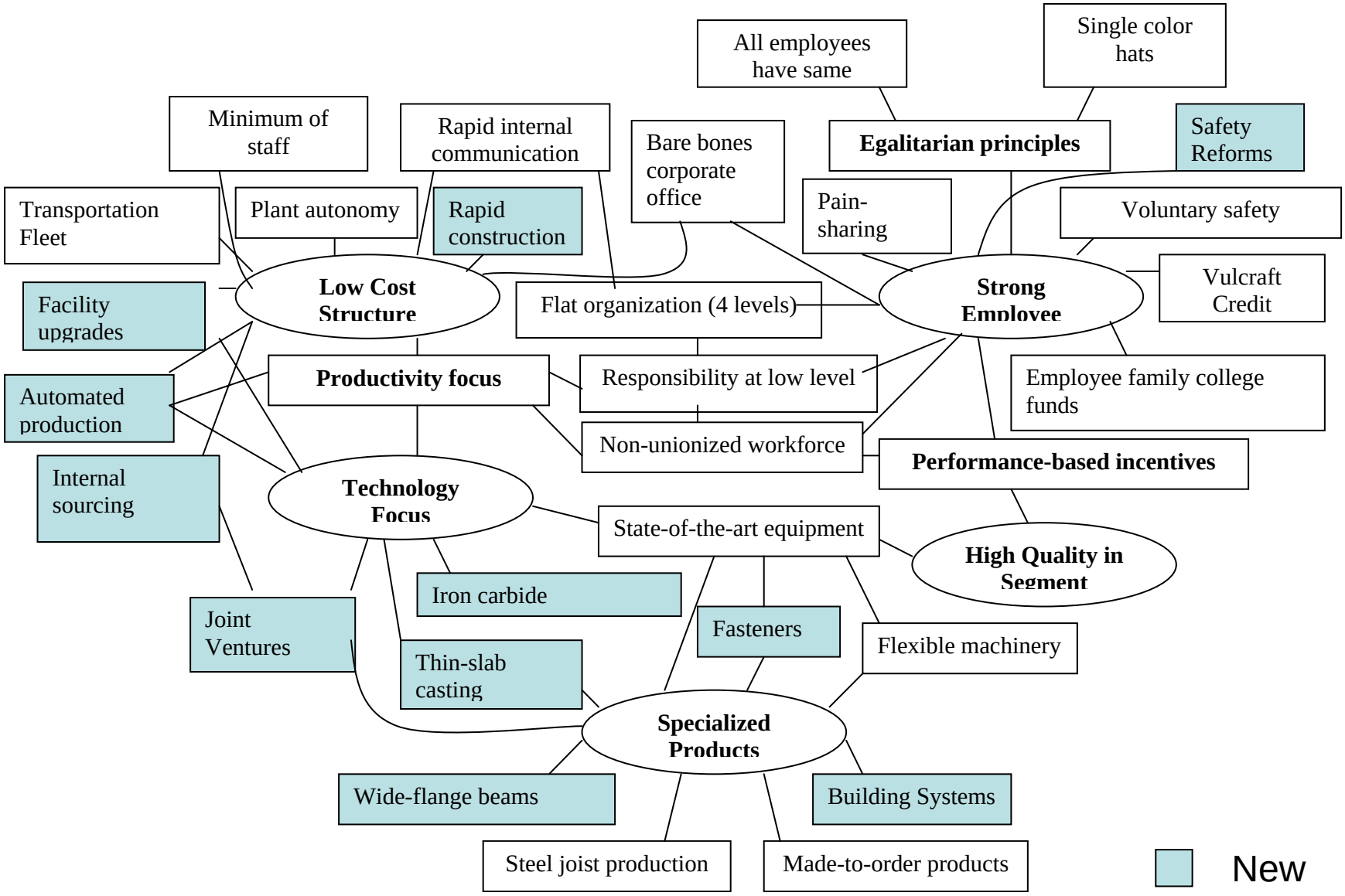
Appendix C: Activity System – 1969



Appendix D: Activity System - 1986



Appendix E: Activity System - 1996



Appendix F: Activity System – 2006