Cognitive Theory of the Firm:

A Historical Analysis of Ford and GM

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Abstract

A theory of the firm not only needs to explain firm boundaries and their existence but also explain differences in performance and structure. A knowledge or cognitive theory of the firm can explain differences in firm performance and structure by identifying the knowledge of the entrepreneur and the coordinated knowledge of the firm members to develop capabilities. We have applied this theory to Ford Motors Company (FMC) and General Motors Corporation (GM) from time of inception until World War II (WWII) to explain differences in performance, structure, technological innovation and responses to changing markets. Our analysis begins with the early development of capabilities and then continues to explain the dynamic capabilities each had developed. The limitations of each capability set are analyzed by comparing responses of each to external events, in our case the Financial Crisis of 1920/21 and the Great Depression.

Keywords: Theory of the Firm, Ford Motor Company (FMC), General Motors Corporation (GM), Entrepreneurship, Knowledge, Capabilities, Cognitive Distances

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1. Introduction

A complete theory of the firm must answer why firms exist, how their boundaries are determined and why do firm structures and performance vary. Most theories however only address a couple of these questions (Hawkins, 1973). Transaction cost theory for example, developed by Coase and Williamson, addresses the existence and boundaries of the firm but has very little to say about differences in performance and structures (Coase, 1937; Williamson, 2002). On the other hand, economists who have focused on cognitive and knowledge limitations of entrepreneurs have gone to incredible lengths to explain the differences in performance and structure while glossing over existence and boundaries (Morroni, 2006). Difference in firm structures and performance may be explained by external factors such as institutions, environment and access to capital and labor markets, but by itself cannot explain all such differences. To explain all differences in structure and performance we must also include internal factors such as entrepreneurial knowledge, firm capabilities, technical and processing knowledge cognitive capacity and distances (Spender, 1996). Our will focus will be exclusively dedicated to the internal factors mentioned above that cause differences in firm structure and performance.

Ford Motor Company (FMC) and *General Motors* (GM) started their operations at roughly the same time and place, and, therefore, experienced similar external constraints that shaped their organizations. However, each firm has taken different evolutionary paths. We will focus on the internal factors that caused each firm to take a different evolutionary path and discuss their responses to external events and product innovation to satisfy consumer demands.

Sections 2 to 6 are dedicated to explaining a knowledge or cognitive theory of the firm to carry-out our analysis while sections 7 to 11 are an application of that theory. Section 2 defines the firm and the individuals involved in the firm and section 3 defines the relationship between information and knowledge and classifies knowledge into appropriate categories. Sections 4 and 5 explain the build of firm capabilities from coordinated knowledge and the role of cognitive distances in firm structure and performance while section 6 deals with firm development. Section 7 reviews the early development of GM and FMC to explain the capabilities each developed and the limitations each faced. Section 9 continues the review but after the early development stage, in particular, it deals with each firm's dynamic capabilities. Sections 8 and 10 use the capabilities and dynamic capabilities framework to compare the responses and explain the difference in performance of FMC and GM during the 1920/21 financial crisis and the Great Depression. Section 11 is dedicated to explaining FMC's third development phase and the results it brought about and section 12 is our conclusion. Our analysis of FMC and GM is

primarily focused on the time period starting from the time of inception, around 1908, till the end of World War II (WWII).

2. Firms and Individual Roles

A firm is " … a social organization and an autonomous legal entity that produces and sells goods or services by means of a set of human, physical and financial resources that are coordinated, combined and monitored under an administrative structure." (Morroni, 2006, p. 1) Nooteboom's definition is that a firm is "Myopically goal-directed, socially constructed, more or less focused systems of coordinated activities and capabilities." (Nooteboom, 2009, p. 72) Schumpeter's argument is that a firm is a mechanism to shelter novel ideas and combinations not accepted by the market and to establish a cognitive focus to implement the entrepreneurial vision (Schumpeter, 1950). These theories are in stark contrast to the traditional neoclassical economics that treats firms as a black box that transforms inputs into outputs. The Coasian theory describes a firm as a "…supersession of the price mechanism" and "When the direction of resources (within the limits of the contract) becomes dependent on the buyer in this way, that relationship which I term a 'firm' may be obtained." (Coase, 1937, pp. 389,392)

Morroni, Notteboom and Schumpeter agree that a firm is a device that focuses on coordination of knowledge and physical resources to provide a product or service by innovation either through product creation or efficiency gains (Crew, 1975; Hawkins, 1973). The only condition that should be added to distinguish it from other organizations is the profit motive (Spulber, 2009). We add this condition to abstract from other organizations such as cooperatives, societal associations and governments agencies whose mechanics are less sensitive to market changes and consumer demands (Mises, 1949).

In all of the definitions of the firm given above, the entrepreneur plays a critical role and much attention is given to entrepreneurs as the individuals shaping the firm's innovative and technical capacity (Schumpeter, 1950; Kirzner, 1978; Morroni, 2006; Nooteboom, 2009; Spender, 1996). The Schumpeterian definition of the entrepreneurial function is "… to reform or revolutionize the pattern of productivity by exploiting an invention or, more generally, an untried technological possibility for producing …." (Schumpeter, 1950, p. 132) Ludwig von Mises described the entrepreneur as the individual who pierced the cloud of ignorance to see an opportunity (Mises, 1949). Other economists have similar definitions; however, the Schumpeterian definition is the most comprehensive since he focused on the role of innovation on the creative destruction process. Israel Kirzner, one of the most prolific writers on entrepreneurship and the market process, uses a definition based on the

Schumpeterian idea with a slight difference in that Kirzner focuses on the entrepreneur as an individual who corrects errors in the market "arbitrage entrepreneur" while Schumpeter's primary focus is on the entrepreneur who creates a new market and therefore destroys another "creative entrepreneur" (Kirzner, 1978; Schumpeter, 1950).

That being said, the entrepreneurial function always takes place under conditions of uncertainty, and, therefore, entrepreneurship is a process of discovery of firms attempting to achieve profits and avoid losses (Rothbard, 1962). In our analysis it would be helpful to think of the entrepreneur as the ultimate decision maker of the firm who has to take into consideration technical, financial and marketing issues. The entrepreneur is the person who undertakes a great deal of risk and uncertainty to transform their vision into reality and his returns depend entirely on profits (Rothbard, 1962).

We will briefly discus the role of the capitalist. The capitalist is the one who "… advances present goods to owners of factors in return for future goods; then, later they sell the goods which have matured to become present or less distantly future goods in exchange for present goods (money)." (Rothbard, 1962, p. 374). The capitalist is able to provide the resources monetarily (as is usually the case) or even in kind to bridge the gap between procuring inputs, transforming them into outputs and receiving the proceeds of sale. With this role his return is primarily in interest with profit sharing only playing a secondary role. We can also see given the above definition that suppliers and customers often play the role of capitalists in a firm. Suppliers often finance a firm by advancing inputs prior to payment; in business language this is often referred to as terms of payment and it is one of several important items discussed when negotiating with suppliers. The same can be said of customers who make advance payments that are often practiced in larger transactions or products that are custom built. In a world where there is perfect foresight the role of the entrepreneur will vanish, while the role of the capitalist will remain, but in such circumstances his return will be entirely interest since profits will disappear completely (Rothbard, 1962).

Lastly we turn our attention to employees who are individuals involved in the transformation process directly or indirectly under the direction of the entrepreneur. Employees are for the most part just like any other input except for two distinctions. First, employees, unlike physical goods, have objectives of their own and as utility maximizing agents may wish to act in ways that are different from what the entrepreneur would like. Thus, whenever we speak of employees we should also speak about governance and competence costs that go with their employment (Williamson, 2002; Spulber, 2009). Second, employees may exhibit the entrepreneurial function in a limited scope, also having a vision to improve a production process or create new markets (Smith, 1776). In this case, the employee is also an

undertaker of risk and uncertainty with payoffs in terms of profit sharing. A brief review of history will show that some of the most significant technological developments of our times were made by employees who have created significant efficiency gains (Smith, 1776). Adam Smith in *The Wealth of Nations* points this out as "A great part of the machines made use of in those manufactures in which labor is most subdivided, were originally the invention of common workmen, who, being each of the employed in some very simple operation, naturally turned their thoughts towards finding out easier and readier methods of performing it." (Smith, 1776, p. 15)

Employees play a significant role in the coordination of knowledge and the cognitive focus of the firm and will be one of the determinants explaining the innovative development of new products or the exploitive nature of the firm (e.g. increase in production efficiency) (Nooteboom, 2009; Morroni, 2006). A large part of our literature will focus on the relationships between the entrepreneur and employees, their knowledge and cognitive focus will develop into the capabilities of the firm.

3. Information and Knowledge

The idea of knowledge is intricately interwoven in economic theory and dates back to some of the earliest economists. In fact one of the fundamental principles of praxelogoy, purposeful human behavior, is that not only the individual must feel some uneasiness that can be relieved through action but also must have the relevant knowledge to carry-out the action to come to a more satisfactory state (Rothbard, 1962; Mises, 1949). When we speak about knowledge we must separate it from the terms "information" and "data" even though these terms are used in everyday speech interchangeably. Data is the smallest set used to describe a particular setting of the world (Morroni, 2006). When data is combined together in an organized manner it becomes information (Spender, 1996). Information consists of reports, databases, datasets and any other communications.

The elements inside that cannot be subdivided into smaller segments without losing their meaning are data (Nooteboom, 2009). Data and information are not self-interpreting and therefore by themselves carry no importance (Hayek, 1952). It is when data and information are interpreted by an individual that they become knowledge (Hayek, 1952). Knowledge can be analyzed, categorized and incorporated as part of the cognitive structure and therefore only exists within each individual's subjective realm, while data and information exist only in the physical realm (Hayek, 1952). Knowledge gives us the ability to correlate and interpret information, data and events and allows us to connect seemingly unrelated phenomena (Spender, 1996). Knowledge is then based not only on the information and data presented but also on beliefs, skills, emotions, experiences and all previous information and

data that was previously interpreted into knowledge which now makes up an individual's cognitive structure (Hayek, 1952).

To clarify the distinctions between the three think of the contact list that any firm will have. The individual items such as names, telephone and fax numbers and email addresses each are a piece of data, however the bits of data, when combined and organized in such a way as any Client Relationship Management module does by classifying them according to customers and suppliers and the roles of different individuals inside an entity, those bits when combined and organized become information. Knowledge is then required to know the significance of suppliers and the services they provide and the importance of the classification between customers and suppliers. As we can see knowledge is highly subjective and will vary considerably from one individual to the next as well as respective trajectories (Hayek, 1952). Information and data in today's age can be easily acquired by any firm, and by themselves cannot account for differences in firm performance and structure. However, the cognitive structure of entrepreneurs will lead to vast differences in interpreting information and responses taken by them to market changes (Spulber, 2009).

Due to the specific nature of knowledge its transmittability will largely depend if it is contextual, tacit and on the use of a common code or language that individuals use for their exchange (Hayek, 1952). Various factors will dictate how knowledge is communicated to others within a firm or to others in the market and its ability to be traded (Morroni, 2006). In general when knowledge is least contextual and tacit firms will attempt to codify it into policies, procedures and training materials for employees or communicate it through reports or requirements to market participants (Spender, 1996). When knowledge is more tacit and contextual codifying it becomes more difficult, and its transmissions are either through hands-on training, or a simple accumulation of experience (Nooteboom, 2009). The ability to receive knowledge successfully not only depends on the various traits mentioned above, but also on the absorptive capacity of the receiver (Nooteboom, 2009). The absorptive capacity will depend on the receiver of information to interpret, analyze, appraise and incorporate that knowledge into the existing cognitive structure (Morroni, 2006).

Absorptive capacities can be increased by learning specific skills to process information that can be converted into knowledge quicker; a large part of it depends on the receiver's existing cognitive structure (Morroni, 2006). In addition to the issues of absorptive capacity it is difficult to ascertain the value of the knowledge to the receiver until they have received it. This problem was most notably addressed by Arrow, the value of information is not known until it has been acquired but once it is acquired the information was effectively given away for free (Arrow, 1971). The most common way to

overcome the issues concerning the tradability of knowledge and indeed almost all market exchange is the building of trust (Nooteboom, 2009). Trust can be calculative, meaning the trust is built on previous experience and the reputation of the party and their standing in a family, community or firm (Nooteboom, 2009). Non-calculative trust is a belief that the opposing party will act in an honest way on the basis that any other action will be against their best interest (Spender, 1996). Needless to say, when knowledge is less transmittable it is more difficult to trade. Trust will play a role to counter this effect, but it cannot completely offset it (Morroni, 2006).

The accumulation of knowledge is heavily influenced by environmental factors, education, community and personal experience. The whole of accumulated knowledge is the cognitive structure of the individual and it is one of the main determinants of individual ability (Hayek, 1952). Due to similarities in environmental and educational factors within a region individual abilities may share common traits that will be shared throughout the workforce (Crew, 1975). The ability of the labor workforce influences the structure, performance and competitiveness of firms (Spender, 1996). When combined into a coordinated activity of the firm it becomes the firm's capabilities (Lachman, 1978). We should note that individual abilities and firm capabilities are a dynamic process where firms may carry-out internal and external training to improve individual abilities for employees and or improve coordination with its suppliers and customers (Spender, 1996). The dynamic process may also work with new employees who exhibit slightly different abilities that influence firm capabilities (Spender, 1996). In this manner individual knowledge is in a constant state of change that influences firm capabilities and other external factors and is also being influenced by them (Nooteboom, 2009).

Individual ability can be classified into theoretical knowledge, practical knowledge and information processing ability (Crew, 1975). Theoretical knowledge deals with a cognitive representation of the world (Spender, 1996). It is developed by a learning process that interprets information and categorizes it into mental categories. It may be as simple as correctly interpreting various stimuli or be more complex to deal with states of nature, their respective outcomes, and awareness to rules and the ability to construct mental models that are meant to simplify real world relations to further analyze them. Practical knowledge, on the other hand, deals with the know-how ability and the various skills required for making and implementing a decision. It is largely developed through routinized application of problem solving procedures that are derived either from experience or socially accepted practices (Morroni, 2006).

Practical knowledge develops gradually from locally accepted methods and its advancement is often a series of small steps each of which can be considered part of the norm (Ricketts, 2002). Due to

its nature practical knowledge has a large tacit and contextual component which is difficult to transmit and will vary greatly between different communities and, to a lesser extent between individuals within the same community (Morroni, 2006). Lastly, information processing abilities refer to, as the name implies, the ability to handle information and integrate it into the larger existing cognitive structure (Hayek, 1952). It includes abilities such as classifying, ordering, problem framing and determination of probabilities (Nooteboom, 2009). It involves the problem solving mechanism that begins with identifying and understanding the nature of the problem to the selection of a possible solution (Crew, 1975). Information processing abilities are closely related to theoretical knowledge in that to process information an existing cognitive structure is required which includes logical consistency, a mental model and an awareness of rules (Morroni, 2006). The information processing ability is in direct relation to the adequacy of the solutions taken (Morroni, 2006).

To understand the difference between the three take for example software than needs to be chosen for a firm. Theoretical knowledge will help the individual understand that there are different softwares available to choose from, while practical knowledge involves the ability to use each of the softwares. The information processing ability involves the individual to take in the information such as features, requirements, processing capacity, etc… to evaluate and make an informed decision based on the alternatives.

4. Firm Capabilities

When the different types of abilities have been incorporated into a firm under the direction of the entrepreneur it becomes the firm's capabilities; therefore, the capabilities of the firm depend on the abilities of the individuals present in the firm and the ability of the entrepreneur to coordinate the different abilities into a cohesive cognitive focus (Ricketts, 2002). The capabilities become part of the assets of the firm much like the physical assets such as plant, property and financial capital, and can be divided into knowledge, organizational and relational assets, collectively the intangible assets (Morroni, 2006). Knowledge asset concerns itself with knowledge of organization, process and relationships and often evolves from the learning process between members of the firms and external participants (suppliers and customers) (Morroni, 2006). It is often the core of the firm which gives its unique competitive advantage.

The organizational aspect of knowledge assets deals with social and technical interaction that matches personnel to tasks and employees to create work teams (Spender, 1996). Due to their highly tacit component, organizational aspects exist in the inter-personal relationships among firm members

that create a part of the "firm culture" (Nooteboom, 2009). Lesser tacit components are often documented in a set of rules, routines and department policies and procedures (Ricketts, 2002). It is specific knowledge on how to coordinate activities between individuals (Hawkins, 1973). It does not deal with technical aspects which are specific practical knowledge to carry-out activities such as administration, R&D, marketing and operational activities (Spender, 1996). Relational knowledge is the theoretical knowledge to handle contracts with suppliers and customers and to conduct transactions (Morroni, 2006).

An organizational asset on the other hand, is the organization of knowledge to effectively create a production process (Morroni, 2006). It deals with the organizational relationships between firm members to distribute tasks according to the existing skill set and the development of new skills through internal learning processes. It depends on the policies designed to promote motivation, innovation, coordination and integration among firm members (Lachman, 1978). It covers a technical component with the coordination of practical knowledge from the various departments such as administration, R&D, marketing, legal, finance and operations, to successfully provide the product and service. There is a relational component that organizes the interactions between the firm and its customers and suppliers (Spender, 1996). When we refer to firm capabilities we are in fact talking about the organizational asset, that can coordinate suppliers, production chains, administrative tasks, marketing and customer and supplier relationships to ensure a successful operation (Lachman, 1978).

Lastly, relational assets consist of managing agreements within members of the firm and upstream and downstream parties, customers and suppliers. Relational assets are the main determinant in deciding between internal production and external procurement (Morroni, 2006; Ricketts, 2002). To sum up, knowledge assets is the accumulation of knowledge of all members of that firm that covers knowledge on how to organize, practical knowledge on how to carry-out production activities and theoretical knowledge of customers and suppliers (Nooteboom, 2009). Organizational assets are the constructed process to effectively coordinate the knowledge and relationships to have a successful operation while relational asset is the practical knowledge to deal with either members of the firms or external parties (Spulber, 2009).

When the knowledge of different individuals inside a firm is combined into a coherent focus that creates a successful production of a service or product it becomes the firm's capabilities giving it a competitive edge (Lachman, 1978). Firm capabilities develop over time in a learning process that includes the building of the various intangible assets mentioned above that allow the growth of productive and transactional capacities of the firm (Spender, 1996). It should be clear the firm

capabilities are not just the mere sum of individual abilities and skills, but instead are an accumulation of knowledge and abilities that is organized and coordinated in such a way to create an entity whose value is greater than the sum of its parts with an entirely new firm ability or capability. For example, Adam Smith discussed the benefits of the division of labor in his example of the pin factory (Smith, 1776). When the pin factory divided up labor into manageable smaller operations its production far exceeded the sum of production if each individual produced pins separately (Smith, 1776). Likewise firm capabilities will in almost all cases produce more than the sum of employees working individually, and even more important in many cases, the service or product could not be produced unless it is developed into a firm capability (Marx, 1867). In essence, firms face the requirements of coordination and the division of labor to pool, coordinate and organize different activities that are technically related to profits from economies of scale, scope and time (Nooteboom, 2009).

The developed capabilities arise due to the specialization of each firm in the market place, giving it a competitive advantage that can explain differences in firm structures and performances (Spender, 1996). The extent to which capabilities cannot be replicated will give the firm market power (Nooteboom, 2009). Firm capabilities do not extend to natural resources since "… the origin of all tangible resources lies outside the firm, it follows that competitive advantage is more likely to arise from the intangible firm-specific knowledge which enables it [to] add value to the inputs in a relatively unique manner." (Spender, 1996, p. 46). When capabilities are non-contestable they are the core capabilities which form a set of specialized activities, routines and organization skills that cannot be replaced by the market (Morroni, 2006). Core capabilities arise from entrepreneur's specific knowledge, strategy and vision; capabilities will vary considerably between firms because of heterogeneous abilities and knowledge and asymmetric information among other tangible differences (Lachman, 1978). As markets and technologies develop there is increasing pressure to further refine and preserve the core capabilities of the firm in order to maintain its competitive advantage (Nooteboom, 2009). Specialization of activities essentially economizes the knowledge build-up required to conduct an activity and favor an internal learning process which brings about the innovative activity (Spender, 1996). Of course the degree of specialization for either a firm or an individual will be constrained by the extent of the market (Smith, 1776).

5. Dynamic Capabilities and Cognitive Distances

This ability to learn new capabilities is termed dynamic capabilities which heavily depend on the entrepreneur's ability to learn new skills, spot opportunities and either develop the required skills

internally or acquire them from outside the firm to address constant market changes (Spender, 1996). Dynamic capabilities are just one aspect of the core capabilities that is part of the firm's intangible assets that we have discussed above, giving the firm its competitive edge which dictates the ability of firms to adopt new technologies (Lachman, 1978). The adoption of a new technology might cause systemic changes in the entire production process that may require a reconstruction of the existing structure, processes and even the cognitive focus of a firm (Nooteboom, 2009). Differences in research, innovation with the strategies chosen will show up in differences in firm performance and structure.

The limitations of firm capabilities is a product of the cognitive cohesiveness of the members of the firm which will limit the firm's goals, activities, products, markets and technology of physical and intangible assets alike (Nooteboom, 2009). The main benefit besides the ability to adapt to market changes is the ability to differentiate themselves and their products from competitors to achieve higher levels of profits, since it is more difficult to compete on aspects other than price (Ricketts, 2002). A cognitive focus may constrain a firm's potential activities; however, it brings about greater flexibility and wider scope to apply capabilities to a number of products and processes, allowing for more configuration possibilities (Montella, 1991). The constrained cognitive focus, since it economizes on the knowledge required, will increase the speed of innovation which is critical to the longevity of a firm (Montella, 1991). In an environment that faces increasing competition, an increase in cognitive diversity between firms will allow for their collaboration to increase possible novel combinations and innovation (Montella, 1991).

The alignment of collaboration is the organizational asset that we have described above that is central to the organizational capabilities (Crew, 1975). The ideas that vary between a firm's individuals can be measured as the cognitive distance (Montella, 1991). In general a larger cognitive distance will bring about a more novel combination that yields product innovation or exploration, while a smaller cognitive distance will bring about process innovation or exploitation (Ricketts, 2002). A larger cognitive distance is beneficial to idea generation since it gives a larger degree of autonomy and motivation but, the firm will have larger governance cost (Nooteboom, 2009). A more heterogeneous cognitive structure among firm members will give rise to an increase in interpretations of meanings and that unfortunately could lead to more misunderstandings and unsuccessful coordination; therefore, a variety of cognition is desirable up to the point that collaboration is feasible and effective (Montella, 1991). It would also increase governance costs as more diverse cognitive sets usually bring about more autonomy, making the willingness to collaborate more difficult (Morroni, 2006). On the other hand, a smaller cognitive

distance lowers both competence and governance costs, yielding higher productive efficiency but costs the firm lost opportunities of explorative innovation (Hawkins, 1973).

When deeper levels of cognition are farther apart surface level distances will also be larger apart and routines will be developed to coordinate the surface level distances while keeping deeper cognitive structure intact (Montella, 1991). The downside to such a solution would be that routines would need to be developed for each problem and the routines may sometimes be inadequate in complex problems (Spulber, 2009). A smaller cognitive distance on a deeper level will spare competence and governance costs and speed up coordination, but it requires indoctrination of firm members (Crew, 1975). Reducing cognitive distance on deeper levels is more invasive, costly and time consuming as it requires more socialization of firm members, but the main cost will be less cognitive variety, hence less capability to explore novel combinations (Nooteboom, 2009). In general firms will focus on increasing cognitive cohesiveness on a deeper level to enjoy the benefits of exploitative innovation, ability of firm members to understand each other and a reduction of time and effort to build competence and governance structure, while surface level routines will be developed for intra-firm transactions to benefit from novel combinations for explorative innovation (Spulber, 2009).

6. Firm Development

Schumpeter identified two types of entrepreneurs that occur at different stages in the development of a capitalist economy as mark I and mark II entrepreneurs (Schumpeter, 1950). In the early stages of capitalism mark I entrepreneurs exist as outsiders, setting up their own enterprises and comprising the role of capitalist, entrepreneur and manager (Schumpeter, 1950). Mark I entrepreneurs use their limited capital in untried technologies to create novel products and services that often create new markets and just as often destroy existing ones (Schumpeter, 1950). In later stages of capitalism mark II entrepreneurs require larger teams of specialists that can only be afforded by pooling more capital together which may require the formation of partnerships or corporations (Schumpeter, 1950). In the same manner as Schumpeter described the different types of entrepreneurs as the capitalist system evolved, Rothwell used it to describe the growth of firms (Rothwell, 1985). Mark I entrepreneurship manages small firms that have behavioral advantages and flexibility over large firms (Rothwell, 1985). As this stage the entrepreneur accepts higher levels of risk and lower incomes; they are also in constant contact with customers, suppliers and employees and often are on the shop floor on a continual basis (Rothwell, 1985). Relationships at this point are interpersonal and have not hardened into accepted practices, giving the entrepreneur the flexibility to respond to customer demands and

other market changes (Rothwell, 1985). At this stage routines and a general method of conducting business have not been established and corporate culture exists only with firm members; whatever procedures do exist will largely not be codified (Morroni, 2006). Organizational structure is malleable, waiting to be shaped into the organization of tomorrow (Rothwell, 1985).

When firms grow they enter into mark II entrepreneurial phase; at this phase firms are larger in terms of capital and employees, and the entrepreneur needs to separate himself from operating activities (Rothwell, 1985). Policies, procedures and routines have been codified and relationships with customers, suppliers and between employees are impersonal (Morroni, 2006). Divisions are formed to support specialized labor; staff functions are designated and formal procedures to coordinate activities spatially and functionally are developed (Hawkins, 1973). The firm has the advantage of steady revenue streams and more resources to fund innovation, has built distribution channels and political and social capital, operates more activities, and has a greater ability to spread risk and bring specialized knowledge to develop its capabilities (Lachman, 1978). The disadvantages are less flexibility and higher governance and competence costs to cope with larger cognitive distances (Rothwell, 1985). The success of a firm will ultimately depend on the entrepreneur to transition from mark I to mark II, meaning the delegation of roles and responsibilities and surrendering partial control of certain aspects of the firm (Crew, 1975).

7. Development of Capabilities

7.1 Ford: Early History

Henry Ford was born in 1863 on a farm in Dearborn, Michigan. At a young age he resented being a farmer and avoided manual labor but realized how machinery and automation could make farm life easier. Mechanical engineering interested him at a young age and he often spent spare time repairing toys, watches and domestic appliances. At the age of 15 he left the family farm and headed to Detroit to take on his first job at the *Michigan Car Company Works*, a maker of street cars. He only lasted six days with them and took on his second job at the *James Flower and Brother Machine Shop*, a manufacturer of machine parts. During his time there he learned a great deal about machinery and attempted to build a steam engine of his own. Nearly a year later Ford joined *Westinghouse* and was in charge to maintain and repair steam engines in Michigan and Ohio. After work he often spent time understanding the construction of steam engines and taking night classes in accounting, typing, mechanical drawing and business administration. During his time there he saw one of the first internal combustible engines ever made by *Ottow Company*. Inspired by this creation Ford attempted to make a farm locomotive which

ultimately did not work out, but a by-product of that invention was steam-powered sawmills (Brinkley, 2003).

After *Westinghouse* he moved to *Woodward and Wills Avenue Substation* (WWAS) as a mechanical engineer responsible for the supervision of the steam powered electric generators (Nevins, 1954). At WWAS he adopted new methods that lowered generator downtime and implemented methods to have them operate with little human interference. His innovations caused him to be promoted to Chief Engineer (Ford, 2005). It was during this time that he started to apply the knowledge gained from steam engines to gasoline powered engines (Nevins, 1954). In December 1893 he attempted to build his first gasoline engine to no avail. Early in the following year he rented the basement from *Edison Illuminating Company* to use a storage and experimental facility to bring the steam engine idea to life (Brinkley, 2003). In 1896 he reached a milestone when he successfully built and operated a quad bike; an accomplishment only few had reached at the time (Ford, 2005). He eventually made two other gas powered quad bikes in 1898 and 1899 (Nevins, 1954).

Encouraged by his success he established the *Detroit Automobile Company* in 1899 with a capital of $15,000 and left his employer and mentor, Alva Edison. Although Ford was the man behind the idea and the knowledge to build a gas powered quad bike, the financial backers gave him no ownership interest, no profit sharing incentive and he was paid a salary only. Ford proved to be an unsuccessful manager and could not delegate tasks. It was most apparent in low production volumes, only seven cars a year, a trifle when compared to Ohio Packard Motors which produced 160 cars a year of much better quality. The company survived only till 1901 when the financial backers lost confidence in Ford's management abilities and filed for dissolution. Despite the apparent failure of the company it gave Ford and one of his employees, Spider Huff, the opportunity to resolve many of the electrical issues. In addition Ford was able to build a racing car which completed first in the race against Winton, owner of *Winton Motors* (Ford, 2005).

A year later Ford went to establish the *Henry Ford Co.* with a capital of $30,500 and again there was no profit sharing incentive. The financial backers wanted the company to produce cars for the mass market, while Ford on the other hand wanted to make another racing car. They brought in Henry Leland to look after the operations of the company while Ford was left to experiment and design. Their relationship only lasted until 1902 when Ford resigned from his position and Leyland was to take over managing the entire company (Ford Motor Company, 1953).

In 1903 Henry Ford established the *Ford Motor Company* (FMC) that we all know today with a capital of $28,000 and 50%-50% profit sharing agreement (Brinkley, 2003). This time Henry Ford and the

financial backers had the same objective, to build a car for the mass market, and to help him Gray, Malcomson, Couzen and Wills where appointed president, treasurer, secretary and vice CEO respectively by the financial backers (Ford Motor Company, 1927). Couzen was brought in because of his modern management methods and his knowledge in double-booking accounting (Nevins, 1954). It was thanks to him that FMC built a network of dealerships with the highest standards of the time. Before Couzen, individuals sold cars part time and may have had dealerships to multiple automakers (Nevins, 1954). It was common practice at the time that an automaker would grant a dealership with the purchase of any car but all that changed with Couzen (Chandler, 1964). First, he split up the dealerships into territories and each territory was large enough for the dealer to conduct door-to-door sales (Brinkley, 2003). If door-to-door sales could not be conducted the territory was considered too large (Brinkley, 2003). Second, all dealerships had to be full-time and they were not allowed to be the dealers of several automakers (Ford Motor Company, 1927). Thirdly, Couzen demanded a 50% upfront payment from the dealerships, the only automaker to do so (Nevins, 1954). Lastly he drafted a handbook for dealerships which ensured they had the proper equipment and training to repair any malfunctions and become future service stations (Brinkley, 2003). Wills, unlike Ford, was able to read and create blueprints. He was responsible for creating the company logo and coordinated with the suppliers to ensure that parts where made according to specifications (Ford Motor Company, 1927).

FMC, like many at the time, depended both on in-house manufacturing and external suppliers. *Dodge Brothers* provided the engine and many of the spare parts while the rear-axle bearing was provided by *Roller Bearing Company* and the tires from *Columbia Buggy*, which later turned into *Firestone Tires*. FMC was left to design the body and factory layout to assemble the components; a layout that could only produce 15 cars a day. With $3,000 over budget the prototype to Model A was born; a small 2 cylinder, 7 horsepower engine with a top speed of 30 mph. It was launched in 1903, selling for $750, and although it did have technical problems it sold well and alleviated many of the financial problems the company was facing. A year later Model B was launched; a much larger 4 cylinder engine from the Racer 999, the racer Henry Ford built while at *Detroit Automobile Company*. The car wasn't as appealing to the public and sold less than Model A. In 1904 the company moved to a facility ten times larger and launched the AC and C models (Ford Motor Company, 1927).

In 1905 Model C went into full production, a 2 cylinder car that was designed to be between Models A and B. With over 300 employees and a new facility they produced 25 cars a day and posted a profit of $200,000. In that same year Ford incorporated the *Ford Manufacturing Co.* to start to make components internally rather than rely on external suppliers. In 1906 Model N was launched, a 4

cylinder speedster costing $500 with an extremely uncomfortable ride that shared the fate of Model B and was eventually discontinued. Also that year Gray passed away and Henry Ford took on his position as president (Ford, 2005).

7.2 GM: Early History

Before William Durant began to work for *Buick* he was president of a leading carriage company, the *Durant-Dort Carriage Company* (Sloan, 1963). In 1904 he joined *Buick*, a small and troubled automaker but by 1908 it became the industry leader for a brief period before the launch of Model T (Sloan, 1963). In 1906, *Buick* reported revenues of $2 million which jumped to $4.2 million the following year and jumped again to $7.5 million by 1908 (Chandler, 1964). Profits lead a similar trend starting from only $400,000 in 1906 but by 1908 reached $1.7 million (Chandler, 1964). *Buick* was unusual compared to others in the industry in that it produced nearly all the components of its production (Chandler, 1964). In 1908 Durant incorporated the *General Motors Company* (GM) and first acquired *Buick Motors* then later in that same year *Olds* (General Motors Corporation, 1949). In 1909 GM bought *Oakland* and *Cadillac* (Dassbach, 1989). By 1910 GM had acquired 25 companies, 11 in the automakers and the other mainly in related industries (General Motors Corporation, 1949).

Buick was the top performer of the group with a 20% market share (Sloan, 1963). Durant had hoped that bringing these companies under a single umbrella would allow for a variety of cars to meet the differing tastes and incomes of consumers, diversify investments and achieve economies of scale and scope by integrating the production of shared components (Barabba, 2004). Unfortunately none of his ideas would materialize for at least another ten years and by 1910 GM was overextended on credit (General Motors Corporation, 1949). A group of New York and Boston bankers agreed to extend a five year loan of $15 million on the condition to take over its operations (Sloan, 1963). Durant was still majority shareholder but was asked not to influence the management of the company (General Motors Corporation, 1983).

From 1910 till 1915 the banks ran GM efficiently and conservatively and a number of acquisitions had to be written off (Barabba, 2004). During this period the banks hired individuals that would become the industry leaders such as Nash, who worked with Durant in *Durant-Dort Carriage Company* and later became president of *Buick* then GM. Eventually he started off his own company, *Nash Motors* (Rupert, 1995). Chrysler was hired at the same time as Nash and like Nash created the *Chrysler Corporation* that exists till today (General Motors Corporation, 1949). In 1911 the *GM Export Company* was formed to access overseas markets (Chandler, 1964). GM did not have a low priced

vehicle to compete with FMC but by 1915 GM had increased its market share to 30%, selling over 100,000 units compared with only 40,000 units five years earlier (Sloan, 1963).

During this period, Durant met with Louis Chevrolet and established the *Chevrolet Motor Company* in 1911 (General Motors Corporation, 1983). In four years *Chevrolet* became a national organization and was successful to such an extent that Durant used the profits to regain control of GM (General Motors Corporation, 1949). By 1916 Durant had regained control of GM and took Nash's place as president (General Motors Corporation, 1949). By 1917 GM was transformed from a holding company to an operating company and officially became the *General Motors Corporation* (GM) and increased its capital from $60 million to $100 million (Sloan, 1963). Durant brought in *du Pont Group* as the financial backers of his newly acquired company and to control the financial aspects of the firm (Cheape, 1995). Raskob was assigned as chairman of the Finance Committee with Durant and Haskell on the Executive and Operations Committees (Bradley, 1959). In 1917 *du Pont* had invested $25 million in the company and had ownership interest of slightly less than 20%. By 1918 *du Pont's* ownership increased to 24% and by 1919 their ownership exceeded 28% (Cheape, 1995).

All the while Durant had again started an aggressive acquisition campaign starting in 1916 with the acquisition of *Hyatt Roller Bearing Company* and a handful of other component suppliers such as *AC Delco* to create the *United Motors Corporation* (Sloan, 1963). In 1917 GM acquired *Samson Sieve Grip Tractor* along with *Janesville Machine* and *Doyelstown Agricultural Co.* to create the GM Tractor Division. In 1918 Durant acquired *Guardian Frigerator Co.* to be renamed later to Frigidaire Division and then in 1919 acquired 60% of *Fisher Body* (General Motors Corporation, 1949). In 1920 GM purchased *Sheridan Cars* giving GM seven lines of cars with *Cadillac* being the most expensive to *Chevrolet* as the only automaker that could compete with FMC (Bradley, 1959).

7.3 Ford: Exploitive Capability

In 1907 FMC merged with *Ford Manufacturing Company* and Hawkins was brought on board to manage the logistical issues and improve production efficiency, while Couzen focused on the sale departments and further fine tuned the dealership network (Brinkley, 2003). A Wall Street panic that year hit most companies hard but FMC endured and their best product was being developed, the Model T (Dassbach, 1989). In 1908 the Model T was introduced to the market and thanks to the innovation of Spider Huff, Joe Galamb, Wandersee and John Dodge, it left a permanent impression on the world. It was one of the first cars to use vanadium steel to make it lighter and stronger; the 4 cylinder engine was from a single block of steel for the same reason (Ford, 2005). It was the first car to have a removable top

head for easier maintenance and single enclosure for the transmission and flywheel and it cost only $850, as compared to competitors' prices which ranged from $1,250 to $2,500 (Ford Motor Company, 1927). It was built with a 3 point chassis and sat high off the ground to handle the largely unpaved roads at that time (Brinkley, 2003).

FMC also switched the Model T to be left hand drive and driven on the right hand side of the road, the common practice today, but at the time most vehicles were right hand drive and driven on the right, for the driver to see any incoming ditches and gullies that could get the car stuck (Brinkley, 2003). The public loved the new innovative design and it allowed FMC to run at full capacity for the next 15 years. In its first year they produced 10,000 cars, in 1910 after Highland Park was opened production soared to 34,000 and in 1911 78,000 cars (Ford Motor Company, 1927).

In 1910 production was moved to the much larger Highland Park where automated car production started to make its first appearance. New specialized machinery was brought in nearly every day and the machines were placed side by side to take advantage of assembly lines to speed up production. The upper floors of the facility were used to manufacture many of the parts needed by Model T. Vertical integration continued with the purchase of timber fields and ore mines and dedicated railway to transport raw materials. In 1913 FMC purchased *Keim Steel Mill* and with that purchase came William Knudsen, Alex Lumsden and John R. Lee, each of them will prove critical to FMC's success. Knudsen adopted the idea of moving assembly lines used at the steel mill to FMC's facility; we should point out that it was initially first thought of by *Samuel Colt Firearms*. In conjunction Klann studied the methods used by *Swift Meat Packing Company* to adopt faster production techniques. Magnetic coils was the first part to be manufactured by a moving assembly line, then crankcases, camshafts, pistons and transmission parts. Then conveyors belts where installed to move the heaviest parts such as the radiator and engines (Ford Motor Company, 1927).

After proving successful in Highland Park Knudsen was responsible for replicating the process for 14 out of the 25 assembly plants that FMC would eventually open. By 1913 FMC has spent over $210 million in machinery and had increased productivity by 60%. The end result was that production time for a Model T car decreased from 12 hours to 1:30 hours. In 1914 Ford implemented yet another process to improve efficiency - all Model Ts were only in black as opposed to a range of colors that was previously available. The logic behind it was rather simple, black paint dried faster than color paints and so the time to paint a car dropped from 2 weeks to only 1.5 days. The upshot is that the price of Model T steady declined from $850 when it was first launched to only $500 in 1914 (Chandler, 1964).

Although the mechanization of production increased efficiency and with vertical integration lowered unit costs, it had an unintended side effect on the workforce. Factories once employed skilled mechanics to build cars but the introduction of machinery meant that low skilled workers could be trained to perform a single task in the automotive production. This method of working dehumanized the workforce and had them treated like machines. The result was that workers didn't realize their full productive capacity; absenteeism ran as high as 10% on a single day and yearly employee turnover reached 380%. Ford's solution to the problem was the introduction of the $5 a day wage and an 8 hour work shift. A Sociological Department was created to assess individuals that would qualify. To qualify individuals would have to be above 22 years of age, the men had to be the supporter of the household and all had to be spendthrift and sober. The result of this policy was an increase in productivity in some departments by over 50%, while overall productivity increased between 15% and 20%. Absenteeism dropped to only 0.5% a day and the employee turnover rates dropped to less than 20% (Meyer, 1981).

The successful adoption of the moving assembly line combined with 30,000 workforce and over 8,000 machines meant that FMC was the largest automaker of the day, producing 300,000 cars a year (Brinkley, 2003). *Willys-Overland*, the next largest automakers, only made 48,000 cars a year (Chandler, 1964). Later on in 1914 *Dodge Brothers* left the company to make a car of their own, a slightly more luxurious Model T with 35 horsepower as opposed to the standard 25 horsepower of Model T (Dodge, Dodge, & Stevenson, 1918). The car also had more elegant styling, a smoother ride and quieter transmission, but despite all the positive qualities it never gained popularity like the Model T, but *Dodge Brothers* did earn a reputation for building quality cars (Ford Motor Company, 1927). FMC's response to the *Dodge Brothers* starting a competitor car company was to stop paying dividends under the pretense the funds were needed to finance the construction of River Rouge Plant, which in turn sparked a long legal battle that eventually resulted in Ford buying their shares for over $24 million in 1916 (Dodge, Dodge, & Stevenson, 1918).

During that year an infirmary was opened to treat workplace injuries with a dedicated team to investigate the causes and suggest modifications to decrease workplace injuries. Ford also created the first discount store, the precursor to all discount superstores (Meyer, 1981). FMC continued to produce positive financial results with profits of over $60 million and cash at hand of $53 million (Ford Motor Company, 1953).

As the US was pulled into World War I in 1917, Ford expanded its market to more than just cars, he incorporated *Henry Ford and Son's Co.* to make a lightweight tractor that sold well in England and created the first one-tone chassis truck, the precursor to the Ford F series (Brinkley, 2003). It was also

during that year Model T was redesigned with a more elegant style and the River Rouge Plant was opened, the largest production facility till date, while Highland Park was the second largest (Ford, 2005). Despite the expansion into new product lines the production of Model T was unaffected, and nearly 750,000 cars were produced that year (Chandler, 1964). In 1918, for the first time since the Model T was launched, sales declined to only 500,000 cars but soon resumed their upward trend, selling over 820,000 cars in 1919, more than all other automakers combined (Brinkley, 2003). In that same year wages were increased to $6 a day and the Model T was redesigned to include an electric starter and detachable wheels as optional extras, features that were included in every *Cadillac* since 1912 (Meyer, 1981; Brinkley, 2003). The cost of Model T declined even further to $440 for the basic model, while the 2-seater which also was launched that same year, cost only $395 (Ford Motor Company, 1927).

By 1919, Ford resigned as president and appointed his son Edsel Ford to take command of FMC. However, it soon became clear that Henry Ford was still effectively in command of the company as Couzen was rehired by Henry after Edsel terminated his contract (Ford, 2005; Brinkley, 2003). By 1923 FMC had accumulated assets in excess of $535 million and was producing 1.8 million cars a year (Chandler, 1964). Model T accounted for two-thirds of all vehicle registrations but only 34% of the closed car market (Ford Motor Company, 1953). The River Rouge Plant with its 93 buildings, 7,000 machines and a workforce of 75,000 produced 4,000 cars a day (Ford Motor Company, 1927). It was the major assembly center, while Highland Park became the center to manufacture parts. River Rouge was designed to reduce supplier dependence and streamline operations even further with the use of conveyor belts and cranes inside the factory floor (Dassbach, 1989). Light rail was used to connect the 93 buildings with each other and the port and railroads (Dassbach, 1989). The foundry inside the plant was exclusively dedicated to the production of engines powered by coal gas as opposed to coal directly, an unusual adoption at the time, but it proved to be cleaner and more efficient (Brinkley, 2003). In 1926 Model T was remolded for the last time, a new engine was installed that produced 40 horsepower and it was offered again in a choice of colors (Ford, 2005). The following year Ford announced the discontinuation of Model T after 15 million of them were manufactured (Ford Motor Company, 1927).

7.4 GM: Consequences of Uncoordinated Decentralization

7.4.1 Product Overlap

The first issue Sloan addressed was the need to have and implement a product policy (Sloan, 1963). GM had seven car lines at the time, but with the exception of *Buick* and *Cadillac* which occupied distinct segments within the automobile market, the remaining divisions produced competing products

(General Motors Corporation, 1949). The table below details the product line and price ranges of GM by 1921 and shows the extent of overlap between the different divisions (Sloan, 1963).

Table 1: Product Range 1921

Make/Model	Cylinders	Price Range	Remarks
Chevrolet 490	4	795-1,375	
Chevrolet FB	4	1,320-2,075	Overlap with Olds FB
Oakland	6	1,395 – 2,065	Overlap with Olds 6
Olds FB	4	1,445 – 2,145	Overlap with Chevrolet FB
Olds	6	1,450 – 2,145	Overlap with Oakland 6
Olds	8	2,100 – 3,300	
Scripps-Booth	6	1,545 – 2,295	Overlap with Oakland 6, Olds 6
Sheridan FB	4	1,685	Overlap with Chevrolet FB
Buick	6	1,795 – 3,295	
Cadillac	8	3,790 – 5,690	

Source: Sloan (1963)

The decentralized structure of GM meant each division was independently run, deciding on its product, price and production, which resulted as we can see from Table 1 in an overlap in products, meaning cannibalism often occurred that negatively affected GM's performance (Barabba, 2004). *Scripps-Booth* came along with the acquisition of *Chevrolet* while *Sheridan* was purchased by Durant in 1920 for reasons that have eluded Sloan (Dassbach, 1989). Neither company used their own engine, and they had a poor network of dealerships and low production run, with *Scripps-Booth* producing only 8,000 cars a year (General Motors Corporation, 1949). *Oakland* and *Olds* where the two divisions in direct competition with each other and their car design was growing obsolete (Pound, 1934). *Oakland* suffered from a low quality product and an erratic production schedule while *Olds* needed a new engine (Sloan, 1963).

7.4.2 Technological Adoption: Copper Cooled Engine

The coordination between the divisions to create a comprehensive product line was not the end of the managerial problems faced by GM (Bradley, 1959). A similar conflict arose between the divisions and the central office when the divisions faced adopting a new technology, such as the copper cooled engine. Kettering, head of Dayton Laboratories and inventor of the self-starter ignition and lighting systems, worked out a new air cooled engine that used copper fins to cool the engine (Sloan, 1963). The use of copper fins created specific metallurgical issues but had the benefit to lower costs and weight by making the radiator and plumbing system unnecessary and increasing engine performance (Sloan, 1963). The Executive Committee first decided to adopt the new engine in the Chevrolet 490 but shortly afterwards added the Oakland 6 to the program (Pound, 1934). In the meantime *Chevrolet* was working

on modifying the current engine and the body of the 490 (Sloan, 1963). The executives overrode *Chevrolet's* division manager and mandated *Chevrolet* to produce 25 cooper cooled cars a day as part of the test run (Bradley, 1959).

It was the first time in GM's history that the research and production division would coordinate the adoption of a new technology. However, without proper channels to coordinate, responsibilities began to blur and without a well defined reporting and decision hierarchy a conflict between them ensued (General Motors Corporation, 1949). *Chevrolet* was skeptical about the success of the new engine, while the research division wanted a more direct role in production to avoid modifications (Bradley, 1959). The two divisions unable to resolve their issues, the executives turned to *Oakland* to test the new engine (Sloan, 1963). In 1921 the first copper cooled engines were sent to be tested at *Oakland* and the results supported the division's skepticism (Sloan, 1963). The new engines were then tested on the Chevrolet 4 and had similar results (Sloan, 1963). A year later no progress was made on both the 4 or 6 cylinder engines and all the while the divisions were postponing the launch of the new models until the issue was settled (Pound, 1934).

To resolve the issue and to have production resume two parallel program were created, one for water-cooled and the second for copper-cooled engines (Chandler, 1964). The research division continued to work on the copper cooled engine while the production divisions worked to further refine the water cooled engines (Dassbach, 1989). An advanced engineering department was required in every division to attend to issues of engineering, production and adopt new technologies for mass production, along with a central staff of advanced engineering to fill gaps and take a longer term view of creating new technologies (General Motors Corporation, 1949). By 1922 Knudsen, former FMC Production Manager, provided a temporary solution; he adapted the new body to the old engine of the 490 and sales picked up (Sloan, 1963). The executives at the time decided the Olds 6 would have the new copper cooled engine while *Chevrolet* was to proceed cautiously, starting a production of 10 cars a day only to increase to 50 cars a day the following year (General Motors Corporation, 1983). Knudsen had made 250 copper cooled engines by year end which were well received by the public, but as soon as production began technical issues surfaced (Barabba, 2004). The production of the engine was painfully slow and it proved to be unreliable (Pound, 1934). Nearly two years after testing began the new engine was abandoned. *Chevrolet* had to recall the nearly 800 copper cooled cars and instead refined their 490 (Chandler, 1964). *Oakland* and *Olds* also abandoned the copper cooled engine and went back to water cooled engines (Sloan, 1963).

7.4.3 Inventory Levels

Similar to the problem of adopting new technologies, uncontrollable inventory levels lead to a financial crisis in the company during the economic slump of 1920/21 (Pound, 1934). Sloan created the General Purchasing Committee to centralize the purchase of common materials, a common practice at the time (Sloan, 1963). Before the committee was created, each division would buy materials according to their own production schedule (Barabba, 2004). Compounding the problem was that each division's production schedules were not based on economic or market data but on general rules of thumb or the subjective notions of the manager (Cheape, 1995). This lead to a sharp increase in inventory levels as each divisional manager was optimistic about future sales, but with the economic slump sales declined sharply and much needed cash was frozen in inventory (General Motors Corporation, 1949). Inventory levels in 1920 reached $209 million, $59 million more than what was authorized by the Executive Committee (Sloan, 1963).

7.4.4 Finances before Controls

Before financial controls were in place each division controlled its own cash and had its own bank accounts. The central office had no authority over the banks and needed to request cash from the divisions to pay for its own expenses. The central office treasury would guess the cash balances of the divisions until reports were submitted. Buick and other cash rich divisions often delayed the submittal of reports to avoid funding the corporate office. When the latter did have the proper information divisions often refused to fund corporate expenses. The result was an extremely inefficient use of cash with some divisions having an excess while others had a shortfall and a discordant management each fighting over to pay the least to the corporate office (Bradley, 1959).

7.5 Entrepreneurial Knowledge and Firm Capabilities

The experiences that Ford and Durant have accumulated early in their careers helped shape the firms. Henry Ford's exposure to machinery and engines meant he gained practical knowledge in engineering that gave him the ability to construct three quad bikes and a steam-powered sawmills (Ford, 2005). Durant on the other hand was a banker and stock speculator and at a young age became a manager when he purchased a firm that was renamed to *Durant-Dort Carriage Company* (NNDB, 2014). Durant therefore had gained practical knowledge in the financial sector and organizational knowledge as a manager (Dassbach, 1989). When each applied their specific knowledge set to the automotive industry they sought out complementary knowledge to build firm capabilities, giving each its distinctive structure and competitive advantage. Ford combined his engineering knowledge with that of Knudsen and Klann

to use interchangeable parts, the moving assembly line and faster production techniques to produce a quality mass market product at a reasonable price (Chandler, 1964; Brinkley, 2003). In essence Ford focused on the exploitive capabilities of the firm to constantly reduce unit production times and therefore unit costs, and it is for this reason FMC was able to keep its dominant position in the low segment of the market for over twenty years (Sloan, 1963; Ford, 2005).

Durant, on the other hand, used his financial knowledge to acquire a large number of automotive companies mainly through equity swaps and requiring only a small amount of cash (Chandler, 1964). Unfortunately the rapid expansion and the subsequent financial crisis did not allow Durant to apply his organizational knowledge to build the cohesive structure of dealerships networks, suppliers and automakers to create a wide variety of products, much like he did at *Durant-Dort Carriage Company* (Sloan, 1963). The acquisitions made GM have larger cognitive distances, which had the benefits of providing more product variety and product innovation but also had the disadvantage of less control, in essence an explorative capability. GM's rise to a dominant position occurred only after the organizational assets of the firm were developed to allow for effective decentralized coordination, an endeavor that took nearly ten years to complete (Dassbach, 1989).

8. Financial Crisis of 1920 and 1921

8.1 Ford's Response

In 1920 a financial crisis began affecting sales of Model T. In early 1920 Model T production reached one million for the first time. It had 90% of the lower segment and 54% of the entire car market (Chandler, 1964). As the financial crisis deepened car sales slumped and with a pending liability of $58 million the company had to act quickly (Brinkley, 2003). Prices for cars were cut by 17% and trucks by 34%, nearly three-fourths of the workforce was laid off, railroad hauls time decreased from 22 days to 14 days (Ford, 2005). Highland Park facility was closed after producing 125,000 cars and Edsel removed the territories of dealerships that Couzen setup to encourage sales (Ford Motor Company, 1927). The result was that FMC was able to repay its liability on-time and the company became leaner and more financially stable (Ford, 2005). In fact, after the crisis nearly 20% of automakers declared bankruptcy (such as *Winton Motors*, the oldest car company) and even more filed for bankruptcy protection including *Lincoln Motors* (Chandler, 1964).

Trouble at FMC only showed up next year when Frank Klingensmith resigned as VP Treasurer, Knudsen was fired, the Sociological Department was scrapped and Sorensen was appointed to head up

operations (Ford, 2005). In 1922 the price of a Model T dropped to $370, a price so low that FMC was competing with used Model Ts (Ford Motor Company, 1927). Next year FMC had a workforce of 150,000 employees and produced 1.8 million Model Ts and again the price dropped to $319 and finally to $269 (Nevins, 1954). Even though the price of Model T continued to drop, FMC announced pretax profits of $119 million and acquired *Lincoln Motors*, Ford's first step in horizontal integration (Brinkley, 2003).

8.2 GM's Response

The organizational incoherency started to strain GM by 1920, and although GM was legally identified as an operating company its operations were independent, each division acting on its own best interest. Durant's informal way of doing business and his lack of interest in accounting, finance and management issues did little to reorganize GM (General Motors Corporation, 1949). Chrysler and Sloan had made proposals to reorganize the company and implement some coordination policies between the various divisions within GM, to no avail (Sloan, 1963). Durant refused to accept such changes despite his acknowledgement that financial controls were poor (Sloan, 1963). Chrysler resigned from GM due to the lack of commitment from Durant to organize, and established *Chrysler Corporation* (Chandler, 1964). GM faced an economic and management crisis as most of the plants shutdown except *Buick* and *Cadillac*. Every division of GM apart from *Buick* and *Cadillac* was unprofitable; *Chevrolet's* output declined by 50% from the previous year and by year end recorded a loss of $5 million (Sloan, 1963). The remaining divisions offered a poor, unreliable car and when the economic slump of 1920/21 spread across the nation the weaknesses of each division revealed themselves (Barabba, 2004). The result was a declining market share from 17% in 1920 to 12% in 1921; FMC's market share on the other hand jumped from 45% to 60% (Chandler, 1964).

Every division overspent as each divisional management was optimistic about future sales. Inventory levels rose sharply combined with rising input costs, and every division had ambitious plans of future expansion so that funds quickly dried up (Bradley, 1959). High inventory costs and commitments at old inflated input prices made products unprofitable combined with a confused product line and a lack of operational and financial controls; the company desperately needed more funding of approximately $100 million but could only raise $11 million (Sloan, 1963). Durant attempted to control the rising inventory issue by setting up a Committee of Appropriations Request Rule with Sloan as its Chairman to limit inventory purchases, and later a Special Inventory Allotment Committee to establish inventory and spending limits, but due to the degree of decentralization the divisions refused to comply and the central office could do little to enforce its new policies (Pound, 1934).

The company was saved when a group of bankers agreed to provide the required funding and settle Durant's outstanding debts with brokers in excess of $20 million in exchange for Durant's resignation (Sloan, 1963). Durant resigned as president of GM, never to return, and Pierre du Pont to take his place (Cheape, 1995). The new organizational chart proposed by Sloan to coordinate some of the decentralized management structure of GM some years before was approved in 1921 and began the first experiment in coordinated decentralized (General Motors Corporation, 1949). At the time centralized management was the norm with FMC as a centralized organization and overtime becoming more centralized, *du Pont* on the other hand was centralized but moving towards decentralization, and GM at the other end of the spectrum starting off completely decentralized and moving towards coordination (Chandler, 1964).

8.3 Response Comparison

The economic slump of 1920/21 caused a decline in unit sales for the entire industry and both companies had obligations due in 1921 that could not be extended (Chandler, 1964; Brinkley, 2003). Ford's solution was to further develop its exploitive capability: it reduced prices on its products, reduced train hull times and laid off a large part of the workforce after the finished product was made (Ford Motor Company, 1953; Nevins, 1954). The only financial solution FMC sought was to force its dealerships to buy part of the inventory and delay payment to its suppliers; in the end FMC sold more units in 1921 than in 1920, remained solvent and ready to meet new customer demand (Brinkley, 2003). GM performed far worse during the period, losing a great deal of its market share (Barabba, 2004). First the central office tried to limit inventory purchases by the establishment of the Committee of Appropriations Request Rule and Special Inventory Allotment Committee but the lack of coordination and control from the central office rendered it ineffective (Bradley, 1959; Sloan, 1963). The lack of control also extended to divisional finances making it impossible to mandate budget cuts (General Motors Corporation, 1949). The solution was a financial one when a group of banks extended the required funds to keep it solvent (Sloan, 1963). The lack of organizational knowledge meant GM had to resort to the only practical knowledge it had, financial, while FMC did not have any organizational issues and could therefore implement cost cutting measures.

9. Cognitive Distances

9.1 Ford and Lincoln: Increased Cognitive Distance

Lincoln Motor Co. was established in 1921 by Henry Leyland to produce luxury cars such as the L-series, a V-8 engine vehicle with a comfortable ride and fashionable styling. In 1921 as the financial crisis gripped the country *Lincoln Motors* temporarily shut down and filed for bankruptcy protection but soon reopened in March. *Lincoln* in 1921 still had not adopted the assembly line production process and its 5,000 workforce produced only 6,000 cars a year. In 1922 FMC bought *Lincoln* for a total of $8 million in an attempt to enter the higher end segments of the automotive market. Leyland was fired shortly after the acquisition and Edsel was appointed as president. Edsel decided that *Lincoln* and FMC dealerships would not be combined. The production of L-Series continued under Edsel's management but made minimal gains in market share and Lincoln contributed little to FMC's bottom line. It did however prove to be an invaluable acquisition because FMC was able to adopt luxury features and adapt them to lower-end cars (Brinkley, 2003).

In 1927 River Rouge plant was shut down, 60,000 workers was laid off and $80 million of new machinery was brought in as FMC began developing the Model A (Chandler, 1964). This model boasted a 3 speed transmission, hydraulic shock absorbers and shatter proof glass- all of which were luxury features developed by *Lincoln Motors* but adopted to a mass market car (Dassbach, 1989). The final product was a lower riding vehicle with a top speed of 65 mph with a price tag of $485 (Ford Motor Company, 1927).

While the factory was shut down Knudsen was appointed President of *Chevrolet* and GM leaped ahead in production and market share (Chandler, 1964). Production at River Rouge resumed in November but remained sluggish as the workforce learned to mass produce the new car (Ford Motor Company, 1953). *Chevrolet* sold 1.7 million cars that year while FMC only produced 480,000 cars despite FMC spending over $1.5 million in advertising (General Motors Corporation, 1983; Brinkley, 2003). Next year the trend continued with FMC selling 633,000 cars while *Chevrolet* sold 880,000 (General Motors Corporation, 1983). It was only in the following year, 1929, that FMC finally outsold *Chevrolet*, selling 1.5 million cars as opposed to *Chevrolet's* 1.1 million cars, a small victory and one of FMC's last (Chandler, 1964). This small victory was due to a new concentration of advertising, styling and sales, the incorporation of *Universal Credit Corporation*, a joint venture between FMC and *Guardian Detroit Bank* to offer installment plans to customers (Brinkley, 2003). The launch of the Model AF specifically to

Europe and the creation of European subsidiaries resulted in year end profits of $81 million (Ford Motor Company, 1927).

9.2 GM: Coordinated Decentralization

GM was the first to tackle the issues of control and decentralization, and since it was one of the largest manufacturers in the country, providing a complex product, the management was in uncharted waters trying to address large and complex problems, studying the problem more carefully than most universities (General Motors Corporation, 1949). Sloan's unique experience as president of *Hyatt Roller Bearing Company* and then president of *United Motors Company* both before and after it was acquired by GM made him the perfect candidate to tackle the organizational issues of GM (Sloan, 1963). Sloan first worked for *Hyatt*, a small organization that made only one product; the highly centralized structure didn't require committees and there were few organizational issues (Pound, 1934). Later *Hyatt* was sold to *United Motors* that had multiple unit organization with each division making a product (Sloan, 1963). The only common thread between the units was the Service Division, standardized accounting practices and a return on investment benchmark was used to evaluate performance (Dassbach, 1989).

9.2.1 Product Overlap

To address the issue of a confusing product line an Advisory Staff was established in 1921 with Hawkins, FMC's former Chief of Sales, as part of the committee. The final report commissioned by the committee had identified a product policy, marketing strategy and an overall concept of business. The first decision was that product policy would be determined by the central office and that it covered all divisions. The Executive Committee decided not to change *Cadillac* or *Buick* but wanted a division in the low price segment to compete with FMC. *Chevrolet* was to be the low priced segment, but with a market share of only 4% as compared with FMC's 60%, and the fact that a comparable *Chevrolet* costed $90 more than a Model T it was unclear if the policy would be effective. They also decided that the car line should cover all segments with no duplications in product lines and that price ranges should not have wide gaps. In reality the policy never fully materialized but they did reduce product lines from 10 to 6 classifications with the lowest end starting at $450 to the highest product priced at $3,500. The price ranges were soon revised after the price collapse in 1921, with *Cadillac* taking the lead in reformulating their costs, prices and volumes. Lastly *Sheridan* and *Scripps-Booth* divisions were liquidated in 1921 and the following year the Chevrolet FB was dropped from the product line (Sloan, 1963).

Table 2 below shows the product and price range of GM as of 1924. Although much better than in 1921 it did reveal some gaps. To fill in the market gap *Oakland* and *Chevrolet* coordinated their

physical resources to mass produce a car. The endeavor was the first of its kind where two automakers would coordinate to make a new mass production product; mass production before meant a uniform product like the Model T. The cooperation was a success in making *Pontiac*, and eventually the practice of divisional cooperation for production was eventually adopted by all GM divisions. *Pontiac* launched their first car in 1926 with a price tag of $825, halfway between *Chevrolet's* vehicle of $645 and *Olds's* products of $950 (General Motors Corporation, 1983).

Table 2: Product Range 1924

Model/Make	Price	Remarks
Chevrolet	510	Price gap to be filled with Chevrolet 6 but soon made Pontiac
Olds	750	
Oakland	945	
Buick 4	965	
Buick 6	1,295	Price gap filled with Cadillac La Salle in 1927
Cadillac	2,985	

Source: Sloan (1963)

9.2.2 Technological Adaptation

Sloan's investigation of the copper cooled program revealed that GM had multiple weaknesses when trying to adopt new technology (Barabba, 2004). The most important of which was that the executives strayed from their role in making policies and focused instead on specific engineering issues that should have been left to the divisions (Cheape, 1995). Equally as important was having Kettering in charge of both research and production (General Motors Corporation, 1949). The result was that although the copper cooled engine was sound in design and construction the research engineers had little experience in chassis design and did not anticipate production problems (Sloan, 1963). Lastly, too many individuals concerned themselves with the administration, so that communications and decision making was spread across too many individuals for effective coordination (Bradley, 1959). To avoid similar issues in the future the research laboratories were given a chief engineer to foresee production issues (General Motors Corporation, 1949). Production divisions were free to adopt any new technologies developed, and the Executive Committee would not interfere with divisional decisions (Sloan, 1963). The committee was extended to include divisional heads for better coordination (Pound, 1934). The committee would make the policy for GM while the president was responsible to administer (General Motors Corporation, 1949).

To coordinate between the divisions and corporate office a General Technical Committee was created in 1923 (Barabba, 2004). It was composed of members from the car divisions, central staff engineering and research lab all with the objective to improve product integrity (Bradley, 1959). The

committee was designed not to be involved in operations but instead dealt with engineering and technical problems shared by all the divisions, and to formulate the engineering policy of the corporation (Chandler, 1964). For example the committee formulated new policies regarding fuel efficiency and braking (Chandler, 1964). Part of the committee was to register patents of new technologies which were later spun off into the New Devices Committee (Sloan, 1963). The committee was successful in coordinating between divisions and the research laboratories and shared information to investigate technological developments for adoption (General Motors Corporation, 1949). The most successful achievement was the creation of the Proving Grounds, the first in the auto industry to have standardized test procedures and measurement equipment to compare divisional products, including engine performance (Rupert, 1995). In addition to the Proving Grounds, the committee carried out an educational program for dealers and sales department, created criteria to determine car value, documented car specifications to avoid duplicate models and conform to the product policy and lastly the separation of research and divisional issues (Pound, 1934).

9.2.2.1 Successful Technological Adaptation

The annual model change evolved out of competition against FMC and was not purposefully designed (Sloan, 1963). *Dodge Brothers* was the first to adopt annual changes in the industry starting in 1923 (Pound, 1934). *Cadillac* created a styling department in 1926 and *Chevrolet* the following year (Barabba, 2004). FMC on the other hand was the last to adopt annual model changes, starting only in 1929 (Brinkley, 2003). GM began with annual changes every year after 1923 but this was not a formal internal policy until a manual was created in 1935 (General Motors Corporation, 1949). The manual provided a definite and orderly method for submitting essential economic, financial and engineering data to evaluate a new model (Barabba, 2004). It mandated progress reports from the approval to production (Barabba, 2004; Pound, 1934). Overall the development of a new model takes approximately two years, costs up to $600 million and requires the coordination of styling, engineering, *Fisher Body* and the research division (Sloan, 1963). The first year is dedicated to styling while the second is dedicated to engineering design, capital expenditure and the preparation for mass production (Pound, 1934).

The process requires the creation of clay then plastic models and finally a metal model. Economic and financial calculations are being performed by the different departments and all require approvals by the various divisions, committees and policy groups (Bradley, 1959). Once the model has gone through final approval, capital expenditure begins at *Fisher Body* and the divisions prepare for production (Sloan, 1963). GM was the first to use clay, plastic and metal models and to document a

procedure for model changes; the method proved quite successful and has now become standard practice (Chandler, 1964).

Product improvement played an equally important role in developing a mass-class era with GM at the center refining their product to make the modern car (Pound, 1934). From the 1920s, as the use of automobile expanded there has been a focus to improve engine performance, lower fuel consumption, smooth transmissions and other features such as power breaks, steering and windows (Chandler, 1964). Higher compression ratios are the primary way to improve engine efficiency and power, however higher compression could cause engine knocks if the fuel did not burn slowly enough (Sloan, 1963). Engine knocks resulted in a loss of energy and potentially engine damage. It was believed engine knocks could be reduced by adjusting the timing of the spark plugs and in fact many cars at the time came with a lever to adjust the timing but Kettering thought otherwise (Barabba, 2004). Kettering discovered engine knocks happened because of fuel knocks or ignition knocks (Sloan, 1963).

Fuels at the time varied enormously in quality and therefore would not burn consistently (Chandler, 1964). In response GM devised a method to measure the anti-knock qualities of fuel and its ability to be compressed to create the octane measurement (Bradley, 1959). A fuel with 100 octane is a perfect fuel with no fuel knocks. The first measurement device was made in 1926 by Graham Edgar; it consisted of a Kettering cylinder with variable compression to measure octane (Pound, 1934). The device and measure have become an industry standard still in use today by automakers and petroleum refiners (Dassbach, 1989). In fact GM supplied high-compression engines to the petroleum industry to test fuel quality and assist them in refining techniques (Dassbach, 1989). To improve octane, Kettering and Midgley, a former *Standard Oil* employee, both worked on the problem and discovered that adding tetraethyl lead to the fuel would reduce engine knocks without adjusting the spark plugs (Sloan, 1963). GM and *Standard Oil* made a joint partnership in 1924 for the mass production of Ethyl fluid (Sloan, 1963).

The second limitation to engine power was the lack of alignment and integration between the components. As a result the car would vibrate, particularly at higher speeds, reducing the quality of the ride and even making the car dangerous. A higher level of integration was required to increase engine performance and ride quality; GM research laboratories identified the main source of the problem as the unbalance between the engine and crankshaft. In 1920 they worked on a balancing machine which was installed in *Cadillac* in 1924. The component eventually spread to other divisions but it remained exclusively in GM vehicles for an extended period (Pound, 1934).

GM employed a large number of electrical engineers; therefore, since the 1920s GM's engineers worked on an electrical transmission. The transmission was tried on buses and trucks first and remains in use today on diesel locomotives. By 1923 the public lost interest in electric transmissions; therefore, GM began experimenting with infinitely variable, step ratio and hydraulic automatic transmissions. After fifteen years of research the fully automatic transmission went into production first in *Cadillac's* 1928 model with synchromesh gearshift, and then in *Chevrolet* by 1932. After a great deal of experimentation the hydra-matic transmission became the dominant design and remains the basis for all modern automatic transmissions. In 1940 *Olds* launched its first vehicle with hydra-matic transmission and *Cadillac* followed the next year (Barabba, 2004).

GMC Truck and Coach Division were developing a closed-circuit, fluid turbine automatic transmission which had the quality of smooth transmissions. The idea was first developed in GM Europe but then was modified to the US market. The first transmission of this type was installed in buses as early as 1937, and beginning in 1941 the Engineering Staff worked on modifying this technology for passenger cars but as WWII started research on passenger cars stopped. The research laboratories instead worked on automatic transmissions for larger and heavier vehicles mainly tanks. The solution was a heavy duty hydra-matic transmission with a fluid-torque convertor. It met with such success that a large number of military vehicles built during WWII had them installed. The Transmission Development Group worked a transmission specifically designed for tanks and came up with a special cross-drive that combined the functions of steering and transmission into a single component. The transmission was such a success that after the war it was installed on a larger number of heavy duty vehicles. After the war *Buick* started to offer heavy duty hydra-matic transmission with a fluid-torque convertor on passenger cars as early as 1948, and *Chevrolet* soon following by 1950. GM made the technology available to the mass market in 1948, and it soon spread to other automakers that either bought GM made transmissions or created their own (Sloan, 1963).

As cars became faster and driven for longer times ride quality became a bigger issue. Ride quality depends on engine smoothness, road and tire quality. Early tires were made from either solid or vented rubber of poor quality (Chandler, 1964). A switch to inflated tires happened in the early 1920s but also suffered from poor quality, and often had the problems of front-end instability, scuffing of tread, squealing, fast braking and wheel tramping, caused by an imbalance between the tire and wheel (Pound, 1934). GM's Technical Committee worked on the problem with the tire industry to standardize tire sizes and improve quality (Bradley, 1959). The second way to address ride quality was through

better suspension. European automakers used front wheel independent springs to solve the issue but US automakers had not adopted that technology until GM investigated the subject (Sloan, 1963).

At the time soft front springs caused issues in handling or would entirely come off (Sloan, 1963). Andre Dubonnet was hired by GM because he had a patent of one type of independent spring and at the same time Lawrence Fisher met with Maurice Olley of *Rolls Royce* who was also working on the same issue (Bradley, 1959). *Cadillac* made two experimental cars, one with front springing and a second with a wishbone suspension (Chandler, 1964). The wishbone had steering issues but it was soon corrected when the steering was redesigned (Sloan, 1963). In 1933 *Cadillac* conducted tests on its experimental cars and used *Buick's* car as a control (General Motors Corporation, 1983). The results showed such a difference in ride quality that *Buick*, *Olds* and *Chevrolet* decided to launch their next model with independent front suspension (General Motors Corporation, 1983). Actually the divisions adopted both front springing and wishbone technology but the wishbone became more refined and therefore the dominant design (Sloan, 1963).

In addition to the technological innovation mentioned above GM also addressed the issue of engine deterioration by inventing crankcase ventilation in the early 1920s. In 1959 GM made an internal crankcase to reduce air pollution which it made available to the industry in 1962. GM also played a leading role in 4-wheel hydraulic brakes, power breaks and steering and finally air conditioning (Sloan, 1963).

9.2.3 Inventory and Forecasting

To balance the needs of the divisions and the corporation the General Purchasing Committee was made up of divisional heads and a central office purchasing staff (Bradley, 1959). The committee however was constrained by the decentralized nature of the firm which meant that each division's knowledge and technology had unique requirements (Chandler, 1964). A large number of the parts and suppliers were not common, and those items that were common did not have to be bought centrally, since each division's purchase was large enough to receive discounts (Dassbach, 1989). But to avoid another crisis the committee purchased common materials and was successful in standardizing materials when possible and left smaller unique purchases to the divisions (Barabba, 2004). Each of the divisions however was granted a limit to purchase; any amounts beyond that limit would require committee approval (General Motors Corporation, 1949).

In addition to the General Purchasing Committee, the Finance Committee established an Inventories Committee in 1920 headed by Pratt (Sloan, 1963). Pratt was trained as a civil engineer but started working at *du Pont* in 1905 and by 1918 became head of the Development Department (Cheape,

1995). The department worked closely with GM and the following year he joined GM as an assistant to Durant (Pound, 1934). The first order of business for the Inventory Committee was to stop all purchases and shipments until they could review the situation with each divisional manager over items that were deemed necessary (Barabba, 2004). The committee and divisions reached an agreement except for the tractor division which was settled only after litigation (Sloan, 1963). The next order of business was to place controls, the most important of which was a divisional report to be submitted monthly. The report forecasts sales, materials, and payroll for a four month period (Bradley, 1959). Once approved by the committee and the division, it became the inventory budget and was revised every month (Cheape, 1995). The committee was successful in controlling runaway inventory budgets. Inventory levels in 1920 were $215 million but by 1922 were reduced to only $94 million, likewise the inventory turnover ratio doubled from two to four in that same time period (Sloan, 1963).

The Inventory Committee was an emergency solution brought about by overly optimistic divisional managers and executives and was soon discontinued for inventories to be handled by the divisions. The reporting channels however remained in place; to be reviewed and approved by the corporation's vice president of finance and the president. The report set the divisional budget for materials. The report itself, however, became more comprehensive to include plant investments, working capital, outstanding commitments and production earnings. Before the implementation of divisional forecasting the Treasurer of the corporation made a forecast for sales, earnings, working capital and cash position, but it was for the corporation as a whole and did not include sales estimates of the divisions. The forecast was not accurate, divisional managers were not accountable to reach the sales target and did little in controlling the division's plans (Barabba, 2004).

GM recorded strong sales in 1923 and production ran short but early on in the following year sales slumped (General Motors Corporation, 1983). Many of the managers expected sales to remain strong; however, Sloan's visit to the dealership showed otherwise, with many of them having reasonable inventory levels (Sloan, 1963). *Chevrolet* and *Oakland* suffered the worst from a production overrun while *Cadillac* was unaffected (General Motors Corporation, 1983). Sloan ordered a reduction in production by 30,000 units a month, and identified that the production overrun was caused by a lack of retail data (Sloan, 1963).

Sales estimates were the most difficult to forecast but had to be made despite the lack of data available (Cheape, 1995). The estimates were used in building up finished stocks for spring's peak demand and yet completely sell out by year end (Sloan, 1963). It was difficult to change the sales estimate since it determined the production schedule and materials required. The divisions started to

provide actual production and sales for a ten day period the tenth and twentieth of every month and a monthly report detailing the unfilled orders, finished products at plants, and an estimate of finished products at dealerships by 1921 (Sloan, 1963). The reports were the first to be produced by the industry and while they lacked retail data they were used to determine the production schedule (Barabba, 2004). The divisions knew quantities sold to the dealerships but didn't know sales of dealerships, giving them a limited ability to observe market trends (Cheape, 1995). By 1922 divisions were required to submit a yearly forecast of operating results in addition to the regular four months forecast (General Motors Corporation, 1949). The annual forecast included sales, earnings and capital requirement under conservative and optimistic scenarios (Chandler, 1964). The annual forecast proved to be inaccurate while the shorter four month forecast was reasonably accurate (Pound, 1934).

The first attempt to collect retail data started in 1923 when the Sales Section made a comprehensive report forecasting the market size several years into the future, broken-down into segments (Sloan, 1963). The market study considered market demand for the different price ranges as defined by the Operating Committee (General Motors Corporation, 1949). The report used the past three years as a starting point to forecast the following year, and detailed the percentage make up of each division in the price range which became known as the index volume (Cheape, 1995). The index volume was also used by the divisions when they reported their forecasts (Cheape, 1995). The report also included the effects of price reductions, competition between new and used cars and a saturation point (Sloan, 1963). The report was the first to recognize the relationship between demand and income distribution and that product improvement and continuous economic growth are key stimulants to demand (Bradley, 1959).

To receive retail data all dealerships were required to submit a report every ten days detailing the sales and deliveries of new and used units for the period (Pound, 1934). The new data allowed the central office and the divisions to make more accurate forecasts and make adjustments whenever necessary (Bradley, 1959). Lastly the new data made the divisions more accountable and have their production schedule under more scrutiny (Cheape, 1995).

When the production division finalized the forecast they attempted to keep production as stable as possible throughout the year while taking into account seasonal fluctuations. An inventory level had to be kept at the dealerships to handle seasonal fluctuations in sales but in interest of factory efficiency a stable production was preferred. The balance between the two is still a point of debate until today but addressing the differing needs resulted in more stable employment. Staff divisions helped the divisions in seasonal analysis and worked out minimum and maximum levels of inventory. The ten day forecast

report was compared to actual sales to review production and purchasing schedules to make any changes. The result was reduced conflicts between the central office and divisions, better control of expenses and more stable investment. Inventory turnover ratios increased from a low of 2 in 1921 to a high of 10.5 in 1925. Dealership turnover saw a similar trend, increasing by over 25% and contributing positively to their bottom line (Sloan, 1963).

9.2.4 Financial Controls

9.2.4.1 Cash Accounts

In 1922 GM was the first to set up a consolidated cash account. The cash account was under the authority of the central office and all payments and receipts irrelevant of the divisions were made from that account. Withdrawals were handled by the central Financial Staff who also set minimum and maximum balances for each account. Excess cash was transferred to a central reservoir bank also handled by the Financial Staff. Divisions had to request funds from the headquarters and an interdivisional clearing house was established to settle interdivisional trades. Before the establishment of the clearing house interdivisional trades were settled by cash but the clearing house replaced it by issuing certificates. This method is still used today because of many benefits, the most important of which are the ability to conduct monthly cashflow forecasts and compare them with actual cashflow, the more efficient use of capital, and greater access to credit (Pound, 1934).

9.2.4.2 Investment Criteria

Next up on Sloan's list was to setup investment controls in response to the near ruin GM faced in the economic slump of 1920/21 and the lack of systematic methods that Durant left behind (Barabba, 2004). By 1920 GM had outstanding debt of $83 million and by 1922 had to write-off nearly $90 million in bad investments, about one-sixth of total assets (Sloan, 1963). Donaldson Brown and Albert Bay were the main men behind the implementation (Cheape, 1995). As *du Pont* was the main shareholder and members of the Finance Committee both men were brought over from du Pont. Brown joined GM in 1921 as VP Finance while Bay joined in 1919. Brown started off in the sales department of *du Pont* and by 1912 was promoted to assistant (Bradley, 1959).

Du Pont at the time was heavily invested in the manufacturing of explosives and management wanted realistic reports on the efficiency of each department (Cheape, 1995). Brown developed a methodology to reveal the facts of their activities and focused on capital turnover and profit margins as methods to measure performance (Cheape, 1995). Management promoted him again to Junior Assistant Treasurer in the Finance Department (Sloan, 1963). While there he was the first to bring in economists

and statisticians into the department to help with the decision making process (Dassbach, 1989). The performance measure he created was adopted by *du Pont* to measure GM's performance and was later used by GM to measure divisional performance (Pound, 1934).

Brown focused on average return on investment over a long horizon with a formula based on profit margin and turnover of invested capital (Chandler, 1964). The valuation uses standard working and fixed capital requirements, commercial and manufacturing expenses and past performance to measure return on investment (Barabba, 2004). Monthly divisional reports on operating results are used by the central finance department to evaluate performances which are submitted back to the divisions (Sloan, 1963). To allow for divisional comparison, however, a standardized set of accounts had to be created which began in 1919 with the establishment of divisional comptrollers (Bradley, 1959). The comptrollers were responsible to report to both divisional management and the corporate comptroller (Dassbach, 1989). A standard classification of accounts was created in 1921 which was then formalized into a manual by 1923 (Sloan, 1963). By 1925 long-term return on investment based on "standard volume" expectations was adopted as the key evaluation criteria (Pound, 1934). The method developed by Brown focused on long-term earnings with a price guide (Cheape, 1995). The method allowed for price-cost evaluation and measured efficiency by detailing operating standards and practices and classifying manufacturing expenses into fixed, semi-fixed and variable (Sloan, 1963).

Larger projects required an independent review subsequently checked by an appropriations sub-committee before they was submitted to the Finance and Executive Committees for approval (Sloan, 1963). Before the Finance Committee could approve the project it had to make sure that the project is consistent with general policies, pass a test of return on investment and be necessary for the corporation (Sloan, 1963). An appropriations manual was developed and approved by both committees in 1922 to detail the information to be presented for proposed expenditures (Bradley, 1959). The information presented is of both an economic and engineering nature and specified that monthly update reports were to be submitted, accurate records were to be kept, and ensured an equal treatment for requests (Barabba, 2004). The procedure was successful in controlling costs and for the first time management received accurate and orderly reports but it was discontinued shortly after its implementation (Bradley, 1959).

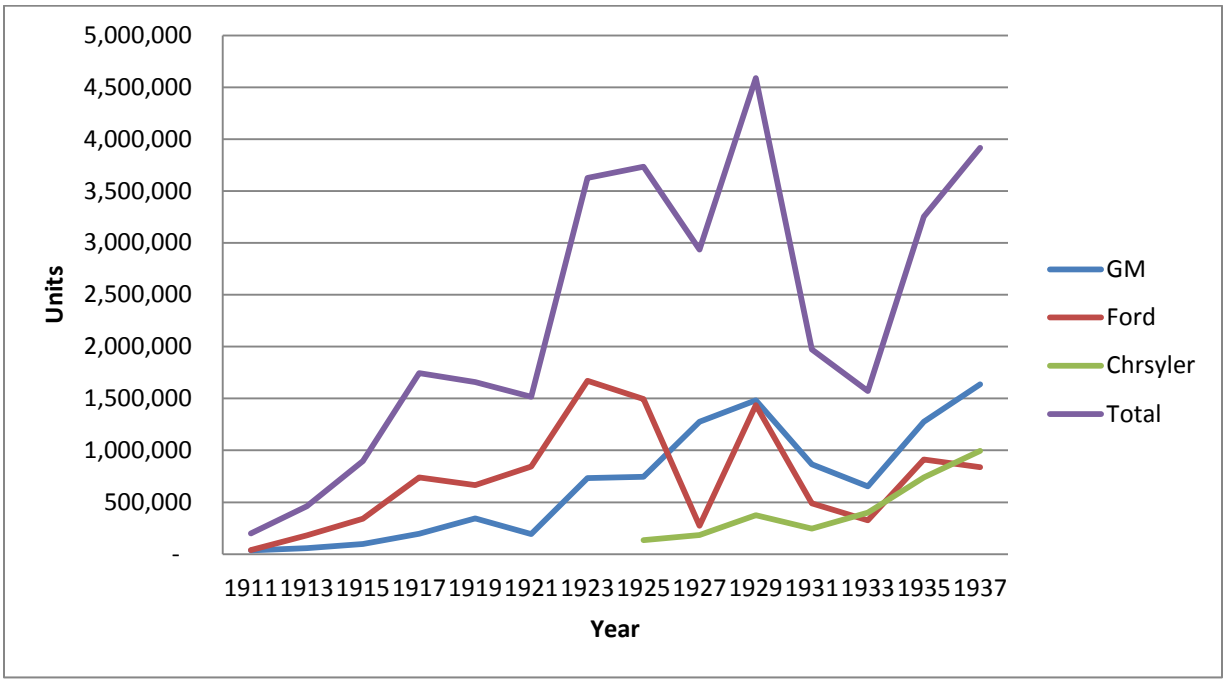
9.3 Exploitive vs. Explorative Capability

The historical account reveals the benefits and costs of FMC's exploitive capabilities. Most notably the price of a Model T continually declined from $850 when it was first launched in 1908 to

$290 by 1926 (Brinkley, 2003; Chandler, 1964; Ford Motor Company, 1953). This came in part due to the large number of machinery that was brought in while at Highland Park and was continued when Rouge River Plant was designed exclusively to produce large volumes of Model T (Chandler, 1964; Ford, 2005). Another factor was the introduction of the $5 a day wage in 1914 which, due to the conditions imposed to qualify for the wage, reduced cognitive distances and increased productive efficiency (Meyer, 1981). In fact FMC developed its exploitive capability to such an extent that new and used Model Ts were closely priced to each other and therefore FMC began to compete with itself (Brinkley, 2003; Chandler, 1964). Production runs show a similar picture, as shown by the chart below, with FMC outproducing GM every year until 1927 when Rouge River had to shut down to retool for Model A (Brinkley, 2003; Chandler, 1964; Nevins, 1954).

The downside of the exploitive capability was the lack of flexibility to introduce new products or ability to adapt to market changes. This can be seen by FMC's static car concept, producing only Model T for eighteen years from 1908 till 1926, and the car itself did not improve significantly over the period (Ford Motor Company, 1953). When FMC decided to introduce Model A the plant had to be shut down for most of 1927 because the machinery was designed only to produce Model T (Ford, 2005). Furthermore the employees' focus on productive efficiency meant it took them an entire year to learn how to produce a new model before output could return to normal levels (Brinkley, 2003). The launch of Model A was possible because of the increased cognitive distances that occurred with the acquisition of *Lincoln*. Nearly every feature of Model A was taken from *Lincoln* and when combined with FMC's exploitive capability allowed luxury features to be introduced into the mass market (Brinkley, 2003). Ford had hoped that the production run of Model A would last as long as Model T, but the Great Depression caused financial distress and lead FMC to abandon the static car concept (Chandler, 1964).

Figure 1: Unit Sales



Sources: General Motors Corporation (1983); Ford Motor Company (1953)

GM through its acquisitions had much greater cognitive distances than FMC and therefore had developed explorative capability. The historical account provides a great number of examples of GM benefiting from product innovation while also coping with disadvantages of organizational discord. To start off GM had offered up to ten different products from its seven divisions as opposed to FMC's static car concept and GM had annual model changes as early as 1923 (General Motors Corporation, 1983; General Motors Corporation, 1949). Unlike FMC none of GM divisions had to shut down to retool for a new model, the division's machinery and staff had the flexibility to retool for a new model while working on the current production run (Sloan, 1963). In addition to model changes and a wider variety of models, GM's explorative capability gave rise to many of the features of the modern car such as closed bodies, automatic transmission, starter motor and high compression engines, to name a few (Barabba, 2004; Dassbach, 1989; Pound, 1934).

The downside to its wide cognitive distance was the lack of controls and the required organization to coordinate. The bulk of the literature on GM covers the problems of coordination that the central office had with the divisions and the proposed solutions such as unsustainable inventory levels and financial controls (Barabba, 2004; Bradley, 1959; General Motors Corporation, 1949). The most important evidence however is the overlapping product line which was only addressed through product policy (Sloan, 1963). GM not only exhibits the solution to such coordination with its

implementation of committees, advisory and policy groups but also the complexity of the coordination which requires a revision of advisory groups or all together discontinuation of them as circumstances changed (Barabba, 2004; Cheape, 1995). Most notable was the discontinuation of the Inventory Committee after the crisis period of 1920/21 despite its success and the merger of the Executive and Finance Committees during the Great Depression, only to be split up into Executive, Finance and Operation Committees during WWII (Sloan, 1963). GM worked on developing its organizational assets after the economic slump of 1920/21 which nearly caused its bankruptcy, only to prove highly successful during the Great Depression.

10. The Great Depression

10.1 Ford's Response

As the Great Depression took full effect it virtually wiped out the luxury car market, with *Kissell* and *Peerless* the first to file for bankruptcy (Brinkley, 2003). The depression did not affect FMC till 1931 with sales of only 500,000 cars and *Chevrolet* taking the lead again. FMC reduced the labor force by 50%, shifted part of the workforce to farms, decreased wages from $7 a day back to $6 a day and temporarily stopped the production of Model A for several months to reopen again later that year (Ford Motor Company, 1927). By October however production of Model A ceased again, only this time it was permanent (Ford, 2005). In 1932 FMC launched Model B, a V-8 engine styled to look like Model A, with a price tag of $550 (Ford Motor Company, 1953). Unfortunately it had an unreliable engine so its sales were sluggish and did little to alleviate the financial burdens of the company (Brinkley, 2003).

Models Y and AF on the other hand sold well in European markets and allowed FMC to continue operations through the Great Depression (Chandler, 1964). Later on that year FMC laid off another 50,000 to 60,000 workers. The workers went on strike in retaliation and resulted in a violent outbreak between workers and strike breakers (Ford Motor Company, 1953). Early next year much of FMC's accumulated wealth dried up, and with GM in the lead and *Plymouth* ranking third in sales the company had to act quickly (Chandler, 1964). With only two cars in production, the Lincoln K and the V-8 Model B, FMC had no product for the middle segment (Ford, 2005). Edsel assigned John Tjaarda to develop prototypes to fill the market gap; they came up with the Ford Zephyr, a stripped down Lincoln K tailored to the middle segment (Ford Motor Company, 1953). It sold reasonably well but couldn't bring the company out of the red as all car sales slumped in the midst of the Great Depression (Chandler, 1964).

By 1933 accumulated losses of FMC had reached $120 million, a trend that would reverse in the following year (Brinkley, 2003).

In 1935 FMC launched the Lincoln Zephyr, a luxury 12 cylinder car made from light and strong metal alloy (Dassbach, 1989). With a price tag of only $1,250 as opposed to the Lincoln K's price tag of $4,000 it sold over 17,000 in its first year (Brinkley, 2003). The Lincoln Zephyr helped the division post its first profits more than 10 years after it was acquired (Ford Motor Company, 1953). Next year sales climbed even further to 25,243 cars with more than half of them made in Japan (Brinkley, 2003). The following year, in the midst of worker strikes happening at every automaker except GM and FMC, the Ford Deluxe was launched (Chandler, 1964; Brinkley, 2003). The engine shared much of the components of the Zephyr but was fine tuned to deliver 85 hp, 25 hp more than the standard Ford and selling for $750 (Dassbach, 1989). During that time the Mercury was being developed, a more powerful version of the Deluxe with sleek elegant style, 95 hp and a top speed of 90 mph (Brinkley, 2003). The Mercury was launched the following year, selling for $900 but with Packard's Six, Nash Ambassador and the Pontiac and Oldsmobile 8 in the same segment it sold less than 70,000 vehicles that year (Chandler, 1964). In 1939 Mercury was introduced to world markets and Edsel began designing the Lincoln Continental, which shared much of the technology of the Mercury but was being marketed as a more luxurious vehicle (Dassbach, 1989). It was released in 1940, but its sales where sluggish, selling only 460 vehicles (Ford Motor Company, 1953).

10.2 GM's Response

GM had become a leader in decentralized management and financial controls and the Great Depression was the best possible testing ground to measure its effectiveness. GM recorded profits despite a 50% decline in sales between 1931 and 1932 and a 72% decline between 1929 and 1932 (Chandler, 1964). Financial and reporting controls meant that the central office did not have to intervene in the operations of the divisions but would only take corrective action if performance declined (Bradley, 1959). GM reported sales of $1.5 billion in 1929 which then declined to $983 million the following year (Sloan, 1963). Profits witnessed a similar drop from $248 million in 1929 to only $165,000 in 1932 and unit sales likewise dropped from 1.9 million to only 526,000 over the same period (Sloan, 1963). The success of the GM's controls is clearly visible where unlike 1920/21, inventory levels declined with sales. Sales over the 1929 to 1932 period declined by 71%, and inventory levels paralleled that trend, declining by 63% (Pound, 1934). By 1932 GM was operating at only 30% of its capacity; FMC however was performing even worse which meant GM's market share climbed gradually from 34% in

1929 to 38% in 1932 (Chandler, 1964). In response to declining sales GM had to make budget cuts, including wages, but that wasn't enough to avoid losses (Barabba, 2004).

The success of *Chevrolet* meant key men were assigned to different positions such as Knudsen who was made VP of Operations of the central office (Sloan, 1963). The interdivisional committee was replaced by Staff Division and an Advisory Group was set up for better coordination (Bradley, 1959). The Advisory Groups were created in 1931 for the executives to focus on operational issues and made suggestions for more centralization (General Motors Corporation, 1949). To economize a greater focus was given to interchangeable parts and three standard body types were created (Pound, 1934). They also concerned themselves with coordinated purchasing, design, production and selling while focusing on increased interchangeability on the purchasing and design issues (Sloan, 1963). In 1932 *Chevrolet* and *Pontiac* were folded into a single division and the same happened with *Buick* and *Oldsmobile*; the number of divisions was reduced from five to three (General Motors Corporation, 1983). Lastly dealers were allowed to sell makes from *Buick*, *Oldsmobile* and *Pontiac* (Chandler, 1964).

The increased coordination however meant policy and administration needed to be redefined and to help policy groups were formed to deal in engineering, distribution and overseas operations. A total of nine policy groups were formed, made primarily of executives and functional staff while divisional managers and administrators were excluded. The groups made policy recommendation to respective committees of the central office but had no authority themselves. Each of the groups reported to General Staff of the respective function. The Engineering Group concerned itself with product programs and launch of new models and made recommendations on coordination issues encountered by the Engineering Staff. In 1937 a Policy Committee replaced the Finance and Executive Committee and lasted until 1946. The new committee was made of board members, operating and financial officers and made policy decisions regarding labor, distribution and oversea subsidiaries. The increasing complexity of the problems to be tackled made the committee ineffective and in 1946 it was replaced by Executive, Finance and Operations Committees made of active and outside directors (Bradley, 1959).

10.3 Comparison

During the Great Depression the performance of each company had completely reversed. FMC had responded by reducing salaries and the workforce and had deviated slightly from its static model by launching five new products (Chandler, 1964; Brinkley, 2003; Ford, 2005). Unfortunately none of the models were as successful as Model T and with many of them sharing similar components and styling

none seemed attractive to consumers (Brinkley, 2003). This is not to say FMC lost its exploitive capability but only that FMC had no great product like Model T to exploit its potential. GM on the other hand had completed its transformation to become a decentralized operating company with the proper coordination and control to manage market changes (Dassbach, 1989; Sloan, 1963). While building up its controls GM introduced the use of market, financial and statistical data to help in its decision making process, a practice created by *du Pont* (Bradley, 1959).

The data helped GM spot the change in market trend and with the controls in place the company could respond quickly (Barabba, 2004). Like FMC, GM reduced wages but it went beyond that and shifted to a more exploitive capability (Pound, 1934). Cognitive distance decreased when the number of divisions was reduced from five to three and a greater focus on exploitation lead to an increased number of interchangeable parts and standardized body types (Sloan, 1963). Policy groups were formed for increased coordination, to address interdivisional issues and share complementary resources. The successful adoptions lead to positive financial results despite difficult economic decisions (Chandler, 1964). The table below shows the disparate financial results. Every year GM outperformed FMC in revenue and net profits and unlike FMC, GM never announced losses during the Great Depression (Chandler, 1964).

Table 3: Financial Highlights

	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
GM – Rev	1,289.23	1,481.75	1,532.21	1,005.33	828.21	440.90	583.75	862.67	1,155.64	1,439.29	1,606.79
Ford – Rev	355.98	551.71	1,144.69	873.52	460.07	254.68	297.15	531.93	834.49	760.49	847.49
GM – NP	262.27	296.26	265.82	157.60	116.74	8.36	80.51	99.12	176.70	239.55	202.67
Ford – NP	(30.45)	(70.64)	91.53	40.00	(37.18)	(70.85)	(7.89)	21.36	18.57	21.46	8.22

Source: Chandler (1964)

11. Ford: Mark II Entrepreneurship

The 1940s proved to be a difficult transition period for FMC. In 1941 the United Auto Workers (UAW) finally became recognized as the collective bargaining agent and one of their first demands was the creation of a pension plan. In 1942 Edsel was diagnosed with stomach cancer and underwent surgery. The surgery was successful but he never fully recovered and passed away the following year. Henry Ford again took on the role of president but since he suffered a stroke back in 1938 he was incapable to put in the long hours required to run the factory. Also a series of bitter fights in the early 1940s between Edsel on the one hand, and Sorensen, Henry and Bennett on the other resulted in Sorensen resigning in 1944 and Benet taking over. In 1945 Henry Ford II, a person with no real interest in

automotive design or mechanical engineering, was appointed president. Although he did attend Yale he failed courses in both Engineering and Sociology. One of his first acts as president was to fire Bennett and any close associates of his. With limited experience gained while working under Shedrick in River Rouge and much of the experienced staff either fired or resigned Ford II resorted to copying GM's organizational design and practices. At the time FMC had virtually no accounting or financial controls and suffered from poor financial reporting. In addition, after the resignation of Couzen FMC had no job titles, organization chart or even a basic authority matrix to delegate tasks; instead, FMC ran like a one-man shop with a highly centralized decision making hierarchy, which even at the time was outdated (Brinkley, 2003).

To address the issue of financial controls and reporting Ford II brought in Ernest Breech, a person who worked for GM subsidiaries such as Yellow Cab Company, American Aviation and Bendix Aviation and was probably the most knowledgeable in GM's accounting practices (Brinkley, 2003). While at FMC he constructed the facilities at Atlanta and St. Louis, reformed the organization where Highland Park would be exclusively dedicated to the production of buses, trucks and tractors while River Rouge would be dedicated to car production (Chandler, 1964). In addition, he hired Lewis Crusoe, also a former GM employee working at Bendix Aviation (Dassbach, 1989). Crusoe adopted GM's accounting procedures at FMC; those who resisted the change resigned or were fired (Ford Motor Company, 1953).

Crusoe also adopted GM's organizational hierarchy and division. Ford II had hired specialists to document the organizational chart of GM and in fact knew GM's organizational structure better than GM employees (Brinkley, 2003). He adopted 6 divisions, each responsible for a particular branch of the firm's operations. Most of the divisions were headed by former GM employees: Graeme Howard headed the Foreign Operations Division; Harold Youngern the Staff Division and John Dykstra headed the General Division (Chandler, 1964). Combined with GM accounting practices brought in by Breech and Crouse, each division was able to report its financial statements; each division was expected to be profitable, even those who exclusively dealt with other divisions (Ford Motor Company, 1953).

As part of the reorganization, Mercury and Lincoln were combined into a single division headed by Earl MacPherson, yet another former GM employee (Brinkley, 2003). MacPherson eventually launched the standard Mercury, a car that turned the division profitable (Brinkley, 2003). The Production Division adopted indoctrination classes about employees' rights and responsibilities (Dassbach, 1989). The foremen were required to receive continuous education and the firm's infirmary was expanded to cover overall healthcare including annual checkups (Chandler, 1964). Over a period of two years employee turnover dropped by 50% to 2.9%, much lower than the industry average of 4.9%

(Dassbach, 1989). The workforce at River Rouge Plant dropped by 20,000 to only 60,000 employees', only 5,000 of which were laid off or fired, while the remainder resigned (Brinkley, 2003). The Foreign Division made headway into international markets as FMC's ambition to create a universal car slowly dissipated (Ford Motor Company, 1953). The Ford Pilot V-8 was launched exclusively to the English market, Vedette to the French market and the Tanus and Model Y for Germany (Dassbach, 1989). The Vedette was designed in the US during WWII to be the civilian car of choice after the end of the war; however it was a small car with an underpowered engine and was deemed undesirable to US customers (Brinkley, 2003). Management agreed that the car would not be successful in US markets and the design was scrapped only to be launched many years later by Ford France (Ford Motor Company, 1953). Closer to home the F-series pickup trucks were reintroduced and became the second bestselling vehicle of all time (Fleischfresser, 2012).

The result was that FMC finally started to claw back market share at home and abroad and resumed to announce profits. Ford England became the most reputable automaker in England; Ford France was turned around and become profitable but then was later sold to *Scima* (Brinkley, 2003). By 1948 the transformation that closely mirrors GM practices was almost complete (General Motors Corporation, 1949). International units were centralized into a single division where the plans and general orders were given from the central office, while the units had the discretion over model creation (Chandler, 1964). After the transformation was complete FMC regained a competitive edge in the auto industry and was able to mimic GM capabilities such as annual model changes, wider product line and product development (Brinkley, 2003).

12. Conclusion

This cognitive or knowledge theory of the firm does well to explain the structural and performance differences of FMC and GM. FMC historically had smaller cognitive distances and developed exploitive capability, a strategy that worked well during the infancy of the auto industry (Sloan, 1963). It was because of this capability that the mass market was able to afford a car that permanently changed the landscape of the world (Brinkley, 2003). However, smaller cognitive distances have the downside of less product innovation and dynamic capabilities. The result was that after an initial successful phase, FMC was unable to adapt to new market conditions, where buyers came in for a second time looking for more variety, features and a higher quality product (Chandler, 1964). FMC lost its competitive advantage and often ranked third in sales during this period only to regain its edge when Henry Ford II copied most of GM's organizational practices (Nevins, 1954). The economic slump of

1920/21 revealed the organizational weakness of GM; after it had developed its organizational assets it was able to effectively coordinate its decentralized organization (Barabba, 2004). The new financial and statistical capabilities lead GM to identify and satisfy the next market phase (Pound, 1934). Larger cognitive distances allowed for product variety and product innovation, many of which have become standard features in the modern car (Chandler, 1964).

That being said, it should be clear that we do not mean to say that GM was more innovative than Ford or GM was using better technology. Instead, FMC developed a different technology set based on its practical knowledge to create efficiency gains that made the car accessible to the mass market, while GM technological achievements were primarily directed at product innovations giving us many of the features of the modern car, dominant practices in related industries and to larger extent modern management techniques.

The historical account we have selected focuses on major differences in structure and performance that support the theory but in fact our research found a great deal more to support the theory that was not covered due to space limitations. For example, a more recent analysis of financial performance of the two reveals that FMC has lower overhead than GM, signifying the lower governance costs that come with smaller cognitive distances (Securities Exchange Commission, 2014). GM, on the other hand, outperformed FMC in terms of return on assets and equity (Securities Exchange Commission, 2014). The details can be found in table 4 of the appendix. The only part of the theory we should be careful about is Rothwell's definition of mark I and II entrepreneurship (Rothwell, 1985). Rothwell believes that as a firm grows in size it will develop into mark II entrepreneurship, but the historical account of FMC shows otherwise (Brinkley, 2003; Rothwell, 1985). FMC started out in mark I phase and was slowly moving into phase II but that trend was soon halted and reversed with the termination of Couzen even as FMC grew in size by all measures (revenues, output, net profits and total assets) (Brinkley, 2003). FMC did lose its competitive edge when it reverted back to mark I, and only successfully transitioned into the mark II phase under the leadership of Henry Ford II with the development of organizational assets. Rothwell's premise would hold true if first, we could incorporate the development of organizational assets into his premise and second qualify his argument by stating for a firm to remain competitive it must successfully transition into mark II phase.

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Appendix

Table 4: Financial Highlights 2012 till 1991

	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
GM Sales	150,295	148,866	135,311	104,589	147,732	177,594	170,651	158,623	163,341	155,831	150,250	143,173
Ford Sales	126,567	128,168	119,280	105,893	129,166	154,379	143,307	153,503	147,134	138,442	134,425	131,528
GM COGS	140,236	130,386	118,768	112,130	149,257	165,573	163,214	158,254	152,115	143,408	138,558	130,158
Ford COGS	112,578	113,345	104,451	100,016	127,103	142,587	148,869	144,944	135,856	129,821	125,137	129,159
GM GP	10,059	18,480	16,543	(7,541)	(1,525)	12,021	7,437	369	11,226	12,423	11,692	13,015
Ford GP	13,989	14,823	14,829	5,877	2,063	11,792	(5,562)	8,559	11,278	8,621	9,288	2,369
GM GP %	6.69%	12.41%	12.23%	-7.21%	-1.03%	6.77%	4.36%	0.23%	6.87%	7.97%	7.78%	9.09%
Ford GP %	11.05%	11.57%	12.43%	5.55%	1.60%	7.64%	-3.88%	5.58%	7.67%	6.23%	6.91%	1.80%
GM SG&A	13,593	12,105	11,446	12167	14,253	14,412	13,650	13,003	25,969	11,797	11,680	12,430
Ford SG&A	9,006	9,060	9,040	8,583	11,356	16,060	12,359	12,768	11,455	10,152	9,819	9,937
GM SG&A % S	9.04%	8.13%	8.46%	11.63%	9.65%	8.12%	8.00%	8.20%	15.90%	7.57%	7.77%	8.68%
Ford SG&A % S	7.12%	7.07%	7.58%	8.11%	8.79%	10.40%	8.62%	8.32%	7.79%	7.33%	7.30%	7.56%
GM Net Profit	6,136	9,287	6,503	105,217	(31,051)	(38,136)	(1,978)	(10,417)	2,701	3,859	1,574	601
Ford Net Profit	5,664	2,431	6,561	2,957	(14,672)	(2,723)	(12,613)	2,024	3,487	495	(980)	(5,453)
GM Profit Margin	4.08%	6.24%	4.81%	100.60%	-21.02%	-21.47%	-1.16%	-6.57%	1.65%	2.48%	1.05%	0.42%
Ford Profit Margin	4.48%	1.90%	5.50%	2.79%	-11.36%	-1.76%	-8.80%	1.32%	2.37%	0.36%	-0.73%	-4.15%
GM Total Assets	149,422	144,603	138,898	136,295	91,039	148,883	186,304	480,093	482,347	450,311	370,142	323,969
Ford Total Assets	192,366	179,248	165,793	197,890	222,977	285,727	290,217	275,940	305,341	315,920	295,222	276,543
GM SE	37,000	38,991	37,159	21,957				14,653	27,360	24,903	6,814	19,707
Ford SE	15,989	15,071				5,628		12,957	16,045	11,651	5,590	7,786
GM ROA	4.11%	6.42%	4.68%	77.20%	-34.11%	-25.61%	-1.06%	-2.17%	0.56%	0.86%	0.43%	0.19%
Ford ROA	2.94%	1.36%	3.96%	1.49%	-6.58%	-0.95%	-4.35%	0.73%	1.14%	0.16%	-0.33%	-1.97%
GM ROE	16.58%	23.82%	17.50%	479.20%				-71.09%	9.87%	15.50%	23.10%	3.05%
Ford ROE	35.42%	16.13%				-48.38%		15.62%	21.73%	4.25%	-17.53%	-70.04%

Table 4 (Continued): Financial Highlights 2012 till 1991

	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	Avg.	SD.
GM Sales	160,627	156,107	137,161	156,095	148,190	143,666	134760	119,686	113,323	105,025	144,586	19,610
Ford Sales	141,230	136,973	119,083	122,935	118,023	110,496	107,137	91,568	84,407	72,051	123,441	21,581
GM COGS	138,303	134,111	121,491	128,225	123,195	121,300	113,319	106,421	105,248	97,550	131,419	18,985
Ford COGS	126,120	119,046	104,782	108,907	108,882	101,171	96,180	85,168	81,748	71,827	114,441	20,668
GM GP	22,324	21,996	15,670	27,870	24,995	22,366	21,441	13,265	8,075	7,475		
Ford GP	15,110	17,927	14,301	14,028	9,141	9,325	10,957	6,400	2,659	224		
GM GP %	13.90%	14.09%	11.42%	17.85%	16.87%	15.57%	15.91%	11.08%	7.13%	7.12%	8.96%	6.17%
Ford GP %	10.70%	13.09%	12.01%	11.41%	7.75%	8.44%	10.23%	6.99%	3.15%	0.31%	7.19%	4.44%
GM SG&A	16,246	14,324	11,918	11,971	11,999	12,500	11,319	11,531	11,232	10,769	13,196	3,147
Ford SG&A	9,884	9,548	7,616	7,082	6,625	6,044	5,131	4,968	4,434	3,993	8,860	2,990
GM SG&A % S	10.11%	9.18%	8.69%	7.67%	8.10%	8.70%	8.40%	9.63%	9.91%	10.25%	9.17%	1.81%
Ford SG&A % S	7.00%	6.97%	6.40%	5.76%	5.61%	5.47%	4.79%	5.43%	5.25%	5.54%	7.01%	1.39%
GM Net Profit	4,452	6,002	2,956	6,698	4,963	6,881	4,901	2,466	(23,498)	(4,523)	2,982	26,169
Ford Net Profit	3,467	7,237	22,071	6,920	4,446	4,139	5,308	2,529	(7,385)	(2,258)	1,530	7,552
GM Profit Margin	2.77%	3.84%	2.16%	4.29%	3.35%	4.79%	3.64%	2.06%	-20.74%	-4.31%	3.32%	23.36%
Ford Profit Margin	2.45%	5.28%	18.53%	5.63%	3.77%	3.75%	4.95%	2.76%	-8.75%	-3.13%	1.23%	6.24%
GM Total Assets	303,100	274,730	246,688	231,752	222,142	213,663	198,598	188,200	190,196			
Ford Total Assets	284,421	276,229	237,545	279,097	262,867	243,283	219,354	198,938	180,545	174,429		
GM SE	30,175	20,644	15,052	17,506	23,418	23,346	12,823	11,238	6,225			
Ford SE	18,610	27,537	23,409	30,734	26,762	24,547	21,659	15,574	14,753	22,690		
GM ROA	1.47%	2.18%	1.20%	2.89%	2.23%	3.22%	2.47%	1.31%	-12.35%		1.72%	20.00%
Ford ROA	1.22%	2.62%	9.29%	2.48%	1.69%	1.70%	2.42%	1.27%	-4.09%	-1.29%	0.68%	3.23%
GM ROE	14.75%	29.07%	19.64%	38.26%	21.19%	29.47%	38.22%	21.94%	-377.48%		19.59%	149.21%
Ford ROE	18.63%	26.28%	94.28%	22.52%	16.61%	16.86%	24.51%	16.24%	-50.06%	-9.95%	7.40%	37.01%

Source: Securities Exchange Commission (2014)