

Implementing Electronic Trading at the New York Stock Exchange - A Case of Organizational Change

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Abstract

Over the course of the last few years, the New York Stock Exchange quickly changed its trading mechanisms from floor-based to mainly electronic trading. Researchers did not expect this change to happen because they assumed the organization to be too inert. Organization theory also has different views about the adaptability of organizations to change and about the question whether the organizational management of the environment is the trigger for change. In order to investigate this question this paper analyzes the New York Stock Exchange's move towards electronic trading from a rational adaptation view, from a perspective that takes endogenous feedback mechanisms of culture and resistance into consideration, and from the perspectives of management inertia and management choice. It becomes obvious that only the combination of perspectives is able to create the observed behavior, but that different trajectories according to other organization theories would also have been possible.

Key Words

Organizational Change, Adaptation, Punctuated Equilibrium, Organizational Inertia, Determinism, Choice, New York Stock Exchange

1 Introduction

When thinking of the New York Stock Exchange (NYSE) one may picture a loud and boisterous place, a crowd clustered around the trading booths, and much shouting for an eighth of a dollar of price improvement. If one were to visit the New York Stock Exchange now, it would render a surprise for most visitors. Today, since many stock transactions are matched by computers in-

stead of people, the same trading floor is empty and quiet.¹ Three of the five trading floors closed down permanently, and the remaining two convey an almost idle atmosphere. The lively picture of manual floor trading dominated the exchange until the end of 2005. Then electronic trading rapidly replaced the lively floor trading by which orders were still matched by people so that in 2007 already more than 95 percent of trades and more than 85 percent of volume were handled by computer programs. A drastic change has taken place.

The lively process of manual trading is shown in Figure 1. A buyer of e.g. 1000 shares of the Sony Corporation gets in contact with his broker or brokerage firm which can be his bank, for example. This firm is in contact with a floor broker, a person who is physically situated on the NYSE trading floor. The floor broker then goes to the specialist who ‘makes the market’ in the Sony Corporation securities and brings together supply and demand.² The frequent bidding of many floor brokers around the specialist booth created the loud and boisterous trading process that was symbolic for the New York Stock Exchange. The market making activity of the specialists provides value by fulfilling the following responsibilities: Specialists are supposed manage the auction process by maintaining a fair and orderly market, they execute orders from floor brokers, match orders and work as catalysts by bringing together buyers and sellers. Additionally, they are supposed to step in with their own capital to minimize imbalances in buy and sell orders and to stabilize prices.³

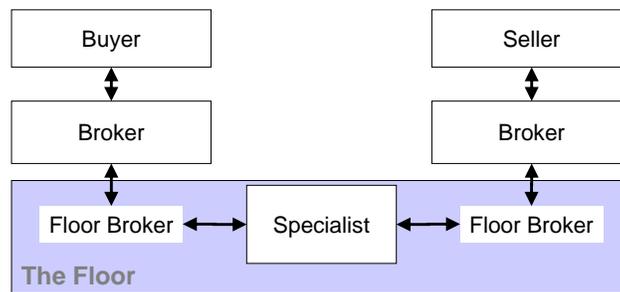


Figure 1: Trade participants and interactions

Despite these valuable qualities of the specialists, the last decades showed a tendency towards more and more electronic or automated trading in the US and worldwide securities markets. Here a computer replaces the whole trading floor and assumes the matching of orders between buying and selling brokers. This form of trading developed from the technological possibilities of the last decades as well as from the rise in institutional investors.

Since the 1950s, institutions like pension and investment funds held more and more capital. From 1950 until now, securities held by institutions increased from more than 5-fold.⁴ For the

¹ Cf. Steverman, Ben: NYSE: Hooray for Market Volatility, in: Business Week Online (2007), Issued 5. Nov. 2007, p. 25.

² At the New York Stock Exchange, the ‘market maker’ is called a ‘specialist’. “Specialists on the trading floor are charged with maintaining fair, orderly and continuous trading markets in specific stocks by bringing buyers and sellers together and, when circumstances warrant, adding liquidity by buying and selling stock for their own account.” (NYSE Group, Inc.: Annual Report of 2006, New York City 2007a, p. 4).

³ Cf. NYSE Euronext: Types of Members, [Home > Products & Services > NYSE Equities > Trading Licenses > Overview > Types of Members], accessed 24. Oct. 2007: <http://www.nyse.com/productservices/nyseequities/1167954368183.html>.

⁴ Cf. NYSE Euronext: Facts and Figures, [NYSE Time Series Data]: <http://www.nyxdata.com/nyxdata/Default.aspx?tabid=115>: Facts and Figures > Institutional Investors > Holdings of corporate equities in the U.S. by type of institution, accessed: Aug. 21, 2008 .

New York Stock Exchange the institutional investors are the greatest source of order flow.⁵ Since these organizations trade professionally, they often take advantage of tiny price differences and engage in what is called arbitrage. Here, they also make use of computer programs to place, change, and cancel orders so as to participate in the trading process at maximum speed.

Due to the increase in available technology, in institutional customers and their growing demand for automation and speed, many of the NYSE's competitors implemented electronic trading much earlier. NASDAQ, for example, was founded in 1971 as an electronic communications system and later purely electronic stock exchange and the NYSE's largest competitor today. The Cincinnati exchange implemented an electronic system already in the late 1970s.⁶ Researchers as well as industry experts predicted this trend to continue.⁷ The electronic brokerage effect supports this view because it states that direct exchange between agents will replace intermediaries, and electronic markets will fulfill the intermediaries- functions.⁸ Clemons and Weber expect technology-triggered changes in the securities market, but they also admit that there will be resistance from the exchanges' most powerful members.⁹ Threatened intermediaries may also form cooperative groups attempting to stop their disintermediation, like banks do with S.W.I.F.T. to retain their primacy in money transfer.¹⁰

With a history of more than 200 years the New York Stock Exchange is a very long-established organization of manual floor trading. The NYSE is often even regarded as a national symbol. Its trading process was boisterous, but as an organization it portrayed both stability and strength and the image of a conservative gentlemen's club. Lucrative specialist positions used to be passed on from fathers to sons, making it difficult for outsiders to get their feet in the door of this 'gentlemen's club'.¹¹ With the image of conservatism and strength, the New York Stock Exchange was for long a symbol for the US economy as the largest and most prestigious stock exchange of the world. With the rise of institutional investors and electronic trading there were many voices affirming the New York Stock Exchange was becoming outdated, because it was not expected to change and adapt. The organization was even described as a non-innovative socialist collective.¹² Already in the 1970s, many researchers firmly believed in the decline of the New York Stock Exchange because they thought it to be both getting out-dated and unchangeable.¹³

⁵ Cf. Blume, Marshall E., Jeremy J. Siegel and Dan Rottenberg: *Revolution on Wall Street: The Rise and Decline of the New York Stock Exchange*, New York, London 1993, pp. 105 and 108.

⁶ Cf. Seligman, Joel: *The Transformation of Wall Street: A History of the Securities and Exchange Commission and Modern Corporate Finance*, rev. Ed., Boston 1995, p. 521.

⁷ Cf. Feldman, Stuart: *Electronic Marketplaces*, in: *Internet Computing*, IEEE, Vol. 4 (2000), No. 4, p. 95; and Clemons, Eric K. and Bruce W. Weber: *Information Technology and Screen-Based Securities Trading: Pricing the Stock and Pricing the Trade*, in: *Management Science*, Vol. 43 (1997), No. 12, p. 1695; and Picot, Arnold, Christine Bortenlänger and Heiner Röhr: *The Automation of Capital Markets*, in: *Journal of Computer-Mediated Communication*, Vol. 1 (1995), No. 3, electronic article without page number.

⁸ Cf. Malone, Thomas W., Joanne Yates and Robert I. Benjamin: *Electronic Markets and Electronic Hierarchies*, in Allen, Thomas J. and Michael S. Scott Morton (Ed.): *Information Technology and the Corporation of the 1990s: Research Studies*, New York, Oxford 1994, pp. 67-68.

⁹ Cf. Clemons and Weber: *Information Technology and Screen-Based Securities Trading*, 1997, p. 1706.

¹⁰ Cf. Picot, Arnold, Christine Bortenlänger and Heiner Röhr: *Organization of Electronic Markets: Contributions from the New Institutional Economics*, in: *The Information Society*, Vol. 13 (1997), No. 1, p. 115.

¹¹ For an economic analysis of cooperative club membership see Buchanan, James M.: *An Economic Theory of Clubs*, in: *Economica*, Vol. 32 (1965), No. 125.

¹² Cf. Blume, Siegel and Rottenberg: *Revolution on Wall Street*, 1993, p. 256.

¹³ Cf. Blume, Siegel and Rottenberg: *Revolution on Wall Street*, 1993, pp. 253-259.

Abolafia, for example, describes how specialists perceived decline and the threat of extinction around 1990. (Cf. Abolafia, Mitchel Y.: *Making Markets: Opportunism and Restraint on Wall Street*, Cambridge, MA, London 1996, pp. 130-151.

Still in 2003, the then CEO Richard Grasso confirmed the idea of continuity, strong traditions, stability, even inertia with regards to the future of the exchange:

“... change at the NYSE is likely to be incremental at best -- with the interests of his seat holders remaining a matter of paramount importance. Elimination of the exchange's floor-trading system, as urged by some exchange critics, ... is not about to happen. The specialists are the exchange... [...]. Specialists and floor brokers are likely to continue to hold sway at the exchange, for the simple reason that they own it and dominate its corporate culture.”¹⁴

This creates a puzzle. On the one hand researchers expected stock exchanges to automate and adapt to technological possibilities and institutional investors' demands. On the other hand, nobody expected the New York Stock Exchange to do the same; they expected it to remain inert and finally fail. Apparently the New York Stock Exchange radically transformed itself in the recent past, proving wrong those who predict the gradual adaptation of electronic trading as well as those who predicted the NYSE's cessation. In the organizational theory literature this duality of adaptability and inertia actually represents one of the most important fields of research. Organizational researchers heavily discuss whether organizations are adaptable at all, and if whether they change incrementally or radically. A further question of high relevance is whether changes are determined deterministically by environmental developments or whether there is room for choice and management action.

In order to solve the puzzle, different views on organizational change will be presented in more detail in the following. Developments in the environment of the New York Stock Exchange, the US securities market, will also be elaborated as well as researchers' opinions about the future of this market. Within this context, the transformation of the NYSE will then be analyzed in a case study. In order to understand how this change came about, different aspects will be taken into consideration—that of adaptation to environmental pressures, of culture and resistance, as well as that of management. Neither of these is able to fully explain the transition that the NYSE went through, but by their combination they give a more complete account of the dynamics of how the changes unfolded.

2 Deterministic and Deliberate Views on Organizational Change

Researchers portray organizational change as an adaptation process vs. a radical transformation as well as a result from environmental forces vs. management action. The literature is divided here; assumptions range from what is called the organizational imperative to the environmental and technological imperative. The organizational imperative regards organizations as transformable in accordance with management aims, other than the deterministic environmental imperative which assumes that either organizational inertia renders the organization unchangeable so that environmental selection determines its fate or that the environment forces the pace and the timing of adaptations. Different theories thus postulate very different drivers of organizational change and different outcomes.

¹⁴ Weiss, Gary: The \$140,000,000 Man, in: Business Week (2003), No. 3849, Issued 15. Sep. 2003, pp. 90-92.

“The problem is that different schools of thought tend to focus only on single sides of issues and use such different logics and vocabularies that they do not speak to each other directly.”¹⁵

As a consequence, Astley and Van de Ven regard it essential to create awareness of the assumptions and biases that underlie a single theory.¹⁶ There is demand for consolidation and integration of the different schools of thought for making progress in the organization theory field. In order to reduce this either-or thinking of environmental, technological or organizational drivers of transformations, multiple views will be described as well as attempts of their integration in order to get a better understanding of organizational change. Child adopts the view that different organization theories or paradigms are irreconcilable in their philosophical underpinnings, i.e. in their world view, school of thought, their assumptions, but they are not incommensurable when they are applied to the study of organizations.¹⁷ In order to utilize each theory’s contributions, the deterministic views of rational adaptation as an adaptation to the environment, of the population ecology approach as a non-adaptation to developments, the organizational imperative of the deliberate strategic choice approach as well as the mixed punctuated equilibrium view will be discussed.

In the first half and well into the second half of the 20th century organization theory was dominated by views of rational adaptation which may also be the most prominent view of organizational change. Many theories fall under the category: the classical theories of scientific management, Fordism, and Weber’s bureaucracy, industrial organization economics which is an economic theory of the rational behavior of organizations in markets, contingency theories, and resource dependence theories. In their core these theories assume human rationality and rely on humans as decision makers according to the image of man of the self-interested and utility maximizing homo oeconomicus or economic man.¹⁸ Based on this cognitive and behavioral assumption of humans and organizations, organizations are assumed to adapt to the environment. Hannan and Freeman describe rational adaptation as “designed changes in strategy and structure of individual organizations in response to environmental changes, threats, and opportunities.”¹⁹ Due to the environment-triggered adaptation Mellahi and Wilkinson as well as Child call these theories deterministic.²⁰ Deliberate management choice is assumed to play a minor role in rational adaptation theories.

¹⁵ Astley, W. Graham and Andrew H. Van de Ven: Central Perspectives and Debates in Organization Theory, in: Administrative Science Quarterly, Vol. 28 (1983), No. 2, p. 246.

¹⁶ Cf. Astley and Van de Ven: Central Perspectives and Debates in Organization Theory, 1983, p. 270.

¹⁷ Cf. Child, John: Strategic Choice in the Analysis of Action, Structure, Organizations and Environment: Retrospect and Prospect, in: Organization Studies, Vol. 18 (1997), No. 1, p. 44.

¹⁸ A concept of man is the theory’s mental model about the nature of human beings. Already in the late 19th century, a concept of man developed which describes humans as rational and self-interested utility maximizers. It is a deterministic concept of man. The term homo oeconomicus was formed by Vilfredo Pareto in the beginning of the 20th century, but according to Stengel, the idea goes back to Adam Smith, Thomas Malthus, David Ricardo, and John Stuart Mill. (See, for example, Pareto, Vilfredo: Manual of Political Economy: Transl. from the French ed. of 1927, London [u.a.] 1972, The original edition *Manuale d’economia politica* was published in 1906; and Stengel, Martin: Psychologie der Arbeit, Weinheim 1997, p. 78.

¹⁹ Cf. Hannan, Michael T. and John Freeman: Structural Inertia and Organizational Change, in: American Sociological Review, Vol. 49 (1984), No. 2, p. 150.

²⁰ Cf. Mellahi, Kamel and Adrian Wilkinson: Organizational failure: a critique of recent research and a proposed integrative framework, in: International Journal of Management Research, Vol. 5/6 (2004), No. 1, p. 23; Child: Strategic Choice in the Analysis of Action, Structure, Organizations and Environment, 1997, p. 45; and Child, John: Organizational structure, environment and performance: The role of strategic choice, in: Sociology, Vol. 6 (1972), pp. 8 and 10.

The assumption of organizational inertia

Coming back to the New York Stock Exchange, most researchers predicted the failure of this organization because they expected it to be inert and unable to undergo necessary organizational change. Inertia expresses the idea that organizations do not change as quickly or completely as some groups want them to change in order to be adequately adapted to the environment. In the view of Kieser, Hegele and Klimmer as well as Hannan and Freeman, inertia symbolizes a lack of adaptation ability what means that an organization is not able to react to a change in circumstances, even if it tries.²¹

Opinions about the usefulness of inertia differ. Larsen and Lomi as well as Hannan and Freeman regard inertia as an important outcome of daily operations which gives the organization reliability and continuity. They admit that inertia prohibits organizational change, but they also emphasize that continuity is advantageous for experience and performance.²² Change attempts render the formerly *experience* obsolete.²³ But in the change management literature, inertia is also often referred to as a cause of the failure of innovation initiatives.²⁴ Adequate change is desired. Already Darwin proposed that surviving species are those who are the most adaptive to change.”²⁵

Population ecology

Organizational inertia is a central aspect of the population ecology perspective. Hannan and Freeman question organizational rationality and they also regard analyzing the whole organizational population more useful than the rational adaptation theory's focus on the organization only. They assume an ecological-evolutionary process of the manifestation of strong inertial forces within populations that prevent major changes.²⁶ Due to this process the investigation at the whole population level is crucial for understanding organizational change. Following the ecological-evolutionary perspective on whole populations Hannan and Freeman call their point of view population or organizational ecology. Remembering that for the New York Stock Exchange most researchers predicted the organization to be so unchangeable that it would fail, this organization theory seems worth looking at.

Population ecology addresses the question of whether organizations change through adaptation or replacement.²⁷ The theory links to evolutionary biology by its assumption is that a population evolves by Darwinist selection. This also means that changes cannot be planned and enacted by organizational members. The whole population becomes the unit of analysis in the evolution-

²¹ Cf. Kieser, Alfred, Cornelia Hegele and Matthias Klimmer: *Kommunikation im organisatorischen Wandel*, Stuttgart 1998, p. 123 and Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 151.

²² Cf. Amburgey, Terry L., Dawn Kelly and William P. Barnett: *Resetting the Clock: The Dynamics of Organizational Change and Failure*, in: *Administrative Science Quarterly*, Vol. 38 (1993), No. 1, p. 52; and Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 149.

²³ Cf. Larsen, Erik R. and Alessandro Lomi: *Representing change: a system model of organizational inertia and capabilities as dynamic accumulation process*, in: *Simulation Modelling Practice and Theory*, Vol. 10 (2002), No. 5-7, p. 276; Larsen, Erik R. and Alessandro Lomi: *Resetting the clock: a feedback approach to the dynamics of organisational inertia, survival and change*, in: *Journal of the Operational Research Society*, Vol. 50 (1999), No. 4, p. 408; and Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 153.

²⁴ See for example: Tushman, Michael L. and Elaine Romanelli: *Organizational Evolution: A Metamorphosis Model of Convergence and Reorientation*, in Cummings, Larry L. and Barry M. Staw (Ed.): *Research in Organizational Behavior*, 7. Vol., Greenwich, CT 1985, p. 177

²⁵ Cf. Darwin, Charles: *The Origin of Species*, London 1971.

²⁶ Cf. Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 149.

²⁷ Cf. Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 150.

ary theories, and an organization is regarded as a “cohesive organism”.²⁸ The seminal papers of Hannan and Freeman were crucial for the development of population ecology.²⁹ The theory focuses on the organization-environment relations with particular focus on the effects of environmental change on an organization or population. Perrow emphasizes that an evolutionary perspective and the ecology point of view often go hand in hand. This has the effect that it strengthens organizations which are adapted best and makes maladapted organizations disappear.³⁰ Due to significant organizational inertia, this theory has little room for adaptive processes within organizations.³¹ In contrast to the approach of rational adaptation which was described earlier, the evolutionary population ecology explains changes mainly by the failure of maladjusted and the creation of new organizations.³² Inertia can be stronger than decision makers' attention and can block change completely.³³

Population ecology is a point of view that is also part of what could be called the environmental imperative. Astley and Van de Ven argue that population ecologists conclude that the environment has primacy. Since population ecology focuses its analysis on the environmental level only, it also assumes internal dynamics and strategic choice, and an organization's effect on its environment to be of minor importance.³⁴ Later Hannan and Freeman attenuate their earlier theory by acknowledging that minor organizational changes

“occur frequently and that organizations sometimes even manage to make radical changes in strategies and structures. Nevertheless, we argue that selection processes tend to favor organizations whose structures are difficult to change. That is, we claim that high levels of structural inertia in organizational populations can be explained as an outcome of an ecological-evolutionary process.”³⁵

Strategic choice

Child challenged both the rational adaptation theory as well as population ecology for their deterministic explanation of change as either an adaptation process or for the assumption that inertia renders organization immutable. Knowing that the New York Stock Exchange finally underwent a major change a new explanation seems worth looking into. Child criticized that rational adaptation theories and population ecology explained change deterministically as a result only of environmental constituencies.³⁶ This criticism addressed methods and content of research. Child pointed out that the common analysis leaves underlying processes to be inferred and clouds the complex network of direct and indirect interrelationships. The deterministic environmental and technological theories do not see a sphere of influence of those with power in the

²⁸ Cf. Child: *Strategic Choice in the Analysis of Action, Structure, Organizations and Environment*, 1997, pp. 66-67.

²⁹ Cf. Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984; and Hannan, Michael T. and John Freeman: *The Population Ecology of Organizations*, in: *The American Journal of Sociology*, Vol. 82 (1977), No. 5.

³⁰ Cf. Perrow, Charles: *Complex Organizations: A Critical Essay*, New York [u.a.] 1986, pp. 208-210

³¹ Cf. Adler, Paul S. and Bryan Borys: *Materialism and Idealism in Organizational Research*, in: *Organization Studies*, Vol. 14 (1993), No. 5, p. 663; and Hannan and Freeman: *The Population Ecology of Organizations*, 1977.

³² Cf. Mellahi and Wilkinson: *Organizational failure: a critique of recent research and a proposed integrative framework*, pp. 21–41; and Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 150.

³³ Cf. Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 155.

³⁴ Cf. Astley and Van de Ven: *Central Perspectives and Debates in Organization Theory*, 1983, pp. 257-258.

³⁵ Hannan and Freeman: *Structural Inertia and Organizational Change*, 1984, p. 149.

³⁶ Cf. Child: *Strategic Choice in the Analysis of Action, Structure, Organizations and Environment*, 1997, p. 45.

organization.³⁷ Many theories give too much weight to constraints and too little to choice. They underestimate the dominant coalition's power in choosing organizational structure and criteria of performance.³⁸ Regarding technology Child applies the same criticism that technology may restrict work in the short-run, but that decisions will finally be carried out by those in control of the organization.³⁹ In the deterministic theories the distinction between environmental reality and its perception and evaluation is often overlooked so that perceptions and interpretations of the environment are frequently mixed with environmental qualities and characteristics. Child states that the exercise of choice requires a prior evaluation of the environment.⁴⁰ Actions do not follow from environmental conditions per se.

25 years after the development of the strategic choice theory Child slightly amends his earlier theory and puts greater emphasis on the mutuality of deliberate action and environmental constraint, i.e. on voluntarism combined with determinism. He focuses on the role of agency and choice in organizational analysis, the nature of the organizational environment, and the relationship between organizational agents and the environment.⁴¹ Child admits that also in the strategic choice perspective the organization-environment fit or the performance indicators represent an important input for decision-makers.⁴²

Overall, the strategic choice perspective reveals the importance of choice as a tool of the organization's decision makers. It concentrates on the actions of leading groups in organizations and their role in shaping the organization. The role of agency and choice, the nature of the organizational environment, and the relationship between organizational agents and the environment are central.⁴³ Strategic choice makes no restrictions on the pace and extent of transformation; it leaves open how changes take place: incrementally and adaptively, radically, or else.

Punctuated Equilibrium

Tushman and Romanelli propose a holistic theory of organizational evolution that combines elements of population ecology and strategic choice and that has a clear suggestion to how changes take place.

“Patterns of organizational evolution are characterized by periods of convergence punctuated by reorientations leading to the next convergent period. These cycles are driven by the emergence of tension between organizational and institutional forces for inertia and competitive, technological and legal pressures on performance which are mediated by the perceptions and decisions of executive leadership.”⁴⁴

Due to the assumption of convergence periods punctuated with reorientations this theory is also called punctuated equilibrium. It links to all of the aforementioned theories and combines aspects of each of them.

³⁷ See Child: Organizational structure, environment and performance, 1972, pp. 1-2.

³⁸ Cf. Child: Organizational structure, environment and performance, 1972, p. 19.

³⁹ Cf. Child: Organizational structure, environment and performance, 1972, p. 6.

⁴⁰ Child: Organizational structure, environment and performance, 1972, pp. 4-5.

⁴¹ See Child: Strategic Choice in the Analysis of Action, Structure, Organizations and Environment, 1997, pp. 43 and 48-49.

⁴² Cf. Child: Strategic Choice in the Analysis of Action, Structure, Organizations and Environment, 1997, p. 48.

⁴³ Cf. Child: Strategic Choice in the Analysis of Action, Structure, Organizations and Environment, 1997, p. 43; and Child: Organizational structure, environment and performance, 1972.

⁴⁴ Tushman and Romanelli: Organizational Evolution, 1985, p. 181.

“Our punctuated equilibrium model of organization evolution borrows from ecological, [rational] adaptation and transformational approaches to evolution. Environments do actively select out firms which do not align themselves with environmental constraints. [...] Those organizations that evolve over a product class life cycle are those that initiate and successfully implement strategic reorientations. Environments select out those firms which either do not reorient, choose inappropriate reorientations and/or can not implement strategic reorientations. Finally, for successful organizations, the period between strategic reorientations is characterized by incremental, adaptive change, as structures, systems and processes are more finely tailored to the firm's strategic orientation.”⁴⁵

In Tushman and Romanelli's view population ecology, industrial organization economics, strategic management and organization theory literatures all regard organizational competence as related to the fit between the organization's strategic orientation and its internal and external environmental conditions.⁴⁶ There are strong linkages between structure, processes, and values. The organization needs to be both adapted to its environment and internally consistent. Periods of convergence bolster normative developments in organizations, e.g. the development of “values, beliefs, and ideologies at individual, group and organization levels of analysis”⁴⁷. This is a reinforcing mechanism which is supported by respective recruiting, socialization, training, and leadership behavior.⁴⁸

In internally consistent organizations reorientations face political challenges. “Coalitions of interests in large organizations are made up of stable, self-perpetuating groups who have a vested interest in the status quo, and who make consequential decisions slowly and with frequently biased and distorted information.”⁴⁹ This means that interest groups may make change attempts difficult and that information processing may be biased.

The punctuated equilibrium theory of Tushman and Romanelli states that in convergent periods pressure for change accumulates in the environment. But due to the accumulation of inertia within the organization, the perception of and reaction to these pressures is biased. The executive team has great importance in this process. Its homogeneity creates bias and hinders the perception of outside pressures. Executive leadership mediates the two opposing forces which are inertia and pressures for change in the environment. Due to the biased perceptions of executive leadership, reorientations will most frequently occur after a sustained performance decline or with an outside successor in leadership.⁵⁰ The performance decline as well as when an outsider takes office reduce the commitment to the current strategic orientation which makes receptive for outside pressures and often triggers radical change.

“Given the pervasiveness of inertial forces, both perception and action are usually triggered only by sustained low performance, a major shift in the distribution of

⁴⁵ Tushman and Romanelli: *Organizational Evolution*, 1985, p. 214.

⁴⁶ See Tushman and Romanelli: *Organizational Evolution*, 1985, p. 188.

⁴⁷ Tushman and Romanelli: *Organizational Evolution*, 1985, p. 192.

⁴⁸ Cf. Tushman and Romanelli: *Organizational Evolution*, 1985, p. 192; referring to Argyris, Chris and Donald A. Schön: *Organizational Learning: A Theory of Action Perspective*, Vol. 1. Reading, Mass. [u.a.] 1978

⁴⁹ Tushman and Romanelli: *Organizational Evolution*, 1985, p. 192. Tushman and Romanelli refer to Downs (1967), Olson (1982), and Wilensky (1967).

⁵⁰ Cf. Tushman and Romanelli: *Organizational Evolution*, 1985, p. 211.

power, and/or organizational crises. These perceptions and the response to changing strategic requirements are shaped by the characteristics of executive leadership”⁵¹

Reconciliation

Overall organization theorists do not agree on the question of how organizations change—adaptively and continuously or seldom and then radically—and the question whether the environment determines transformations or whether there is room for deliberate management choice. Rational adaptation theories expect a deterministic adaptation of organizations to environments; population ecology as a further deterministic theory expects the environment to select out non-adapted organizations. Strategic choice theory then also allows for deliberate management action. Then Tushman and Romanelli as well as Astley and Van de Ven as well as Adler and Borys called for a reconciliation of change theories. Researchers have similarly different views concerning the evolution of stock exchanges. Research in the development of stock exchanges predicted and predicts a strong prevalence of environmental forces. The electronic market hypothesis expects a strong decline of intermediaries; and stock exchanges are expected to automate. The picture that researchers portray is that of rational adaptation to the environmental and technological forces in the market. For the New York Stock Exchange in particular predictions were different. The NYSE was described as inert, traditional, and it was expected to remain unchangeable and eventually die. A case study of the New York Stock Exchange’s transformation will be analyzed with respect to organization theories, to the prevalence of adaptation vs. inertia, as well as determinism and choice.

3 Method Mix

Method

The case study of the New York Stock Exchange will be analyzed with a mix of methods. Here, journal as well as newspaper articles, NYSE time series data, an ethnographical analysis of the NYSE blog, four interviews as well as system dynamics modeling of the issue will help the clarification of the case as well as its analysis. There has been no study of the transformation of the New York Stock Exchange from an organizational perspective so far. Research on the change is sparse and the existing articles rather focus on finance aspects. There is popular science research by Gasparino who studies the years preceding the NYSE’s change. His book offers valuable insights, but he explained the observed behavior or incidents by the personalities of important individuals, on the individual’s play of politics as well as on events.⁵² My approach radically differs as I analyze the *underlying forces* of the same behavior. The focus is on how the behavior emerges from these forces, and how dynamic forces allow for the observed events. Behavior is often looked at as a course of events, but here it will be important what are the factors allowing for certain types of events rather than the details of the events themselves.

In order to test the impact of these effects on the implementation of electronic trading, the system dynamics method is used. Here, a formal model reveals the structure of the underlying system. At the same time it aims at reproducing real world behavior as well as well as at illuminating behavior in different scenarios.

⁵¹ Tushman and Romanelli: Organizational Evolution, 1985, p. 204.

⁵² Cf. Gasparino, Charles: King of the Club: Richard Grasso and the Survival of the New York Stock Exchange, New York 2007.

Validation

System dynamics models should be validated for (1) plausibility and relevance, (2) behavioral consistency, and (3) dominant structure analysis.⁵³ First, plausibility analysis tries to gain face validity for causal relationships, equations, and model structure in general by reference to data. This data can be numerical, qualitative or it can be experts' mental models. This is done to build a model that includes the areas which plausibly explain the reference behavior. Second, by a behavioral consistency analysis one makes sure that the behavior of the model matches behavior or schematic patterns of behavior observed in the real world.⁵⁴ It is particularly concerned with the relevance of parameters and non-linear functions in the model. Third, the loop dominance analysis helps gain confidence in the model by providing a causally coherent story and explanation.⁵⁵ The author of this paper will follow these steps and combine the plausibility analysis—the search for face validity of causal relationships and model structure—with the case description. Dominant structure analysis of the important loops will be done continuously, and behavioral consistency will be tested both continuously as well as in a separate analysis of model sensitivity.

The three-step organization of the case study with the external environment perspective, the endogenous perspective of stakeholder pressures and the management perspective serve to fulfill the requirements of the relevance and behavior analysis. It leads to the relevant model boundary, revealing which pressures are relevant, but also how they endogenously create reactions and how feedback is created in the system.

4 Change at the New York Stock Exchange

From Oct. 6, 2006 to April 2, 2007 the New York Stock Exchange completed the rollout of the Hybrid Market that is a mostly automated market with elements of both automation and floor trading. It combines specialist obligations and floor broker expertise with the speed of electronic markets in order to be liquid and provide better market quality than purely electronic exchanges.⁵⁶ In June 2008 the New York Stock Exchange introduced further changes. It even turned away from the "old" specialist system which it had protected for so long, not completely abandoning it, but abandoning some of the specialist responsibilities and advantages and making them designated market makers.⁵⁷ This happened in response to falling market share and the acknowledgement of customer demands.⁵⁸

⁵³ This tripartite division of model validation was expressed by Mohammad Mojtahedzadeh (Mojtahedzadeh, Mohammad: Personal Communication 2008, Apr. 2008).

⁵⁴ Cf. Sterman, John D.: Business Dynamics: Systems Thinking and Modeling for a Complex World, Boston [u.a.] 2000, p. 860.

⁵⁵ Mojtahedzadeh: Personal Communication, 2008.

⁵⁶ Cf. NYSE Regulation, Inc.: Information Memo: Hybrid Market Implementation – Phase IV, No. 07-12, 29 Jan. 2007

[http://apps.nyse.com/commdata/PubInfoMemos.nsf/AllPublishedInfoMemosNyseCom/85256FCB005E19E885257272006565C6/\\$FILE/Microsoft%20Word%20-%20Document%20in%20in%2007-12.pdf](http://apps.nyse.com/commdata/PubInfoMemos.nsf/AllPublishedInfoMemosNyseCom/85256FCB005E19E885257272006565C6/$FILE/Microsoft%20Word%20-%20Document%20in%20in%2007-12.pdf), accessed 20 Aug. 2008.

⁵⁷ According to NYSE Group, the Designated Market Maker has similar responsibilities to the specialist and will:

- Be rewarded for quoting, which benefits other traders, the DMM, and NYSE as a whole;
- Be obliged to maintain an orderly market in assigned stocks;
- Not have an advance "look" at incoming order information;
- Be required to quote at the national best bid or offer for specified percentages of the time;
- Also be required to facilitate price discovery at the open, close and in periods of significant imbalances;
- Provide liquidity based on a Capital Commitment Schedule that will be programmed into the Display Book but will receive no order information;
- Have economic incentives that will be transparent and based on performance, which will be reviewed periodically.

Change at the New York Stock Exchange started when the former CEO of the Exchange, Richard Grasso, got involved in a scandal about his outrageous pay and retirement package which was considered inappropriate for a CEO of a non-profit company. The scandal broke after Grasso tried to cash in his 140 million retirement money. When he left the Exchange, Grasso said that changes at the NYSE would be incremental, major changes would be unlikely due to the corporate culture that was committed to the specialists and the floor trading system.⁵⁹ Grasso finally was replaced by Thain, the former co-president of Goldman Sachs. He brought change into the management team and the organization. With him came a major shift in the way the New York Stock Exchange does business. In 2001, as Figure 2 shows, the NYSE under Grasso had already enabled purely electronic trading for small orders. This meant that these small orders were matched by a computer instead of having the human intervention of the specialist. Since it concerned small orders only, the way of doing trading changed incrementally only. In 2004, however, the change was somewhat more substantial when the limit on the size of orders that could be handled electronically got removed. Then, over the period of 2006 to 2007 the Exchange implemented the Hybrid Market. This is a form of trading that allows the customers to trade electronically, and it enables them to choose whether their order gets executed by a computer or whether their order is routed to the specialist.

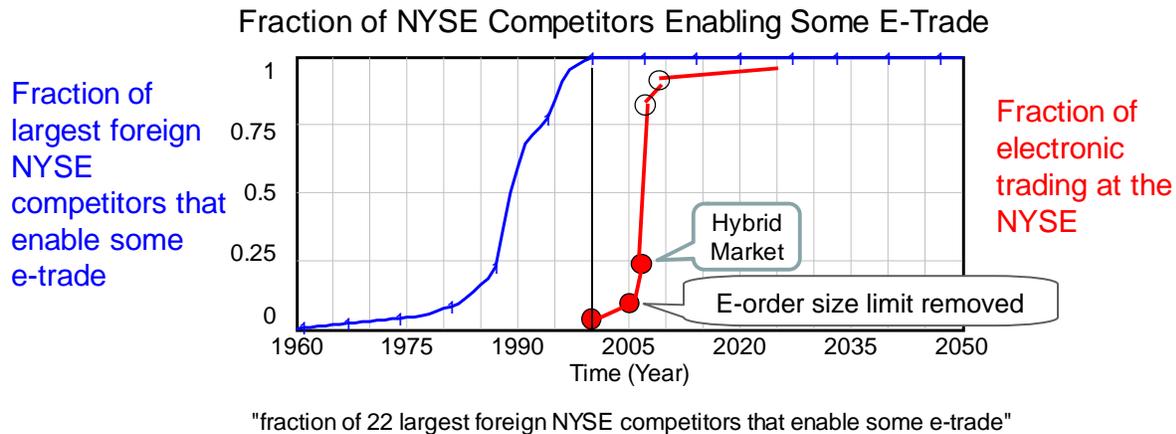


Figure 2: Reference mode

Institutional customers make use of the electronic trading possibilities.⁶⁰ As a consequence, the trading floor is quiet now. Additionally, the trading floor space was reduced.⁶¹ Most surprisingly, the NYSE inflicted damage on its floor brokers and specialists who until quite recently had great influence in the Exchange's board and were the symbol for the institution.

The automation of trading was not the only change that Thain introduced. He also arranged a merger of the New York Stock Exchange with Archipelago, a purely electronic trading platform, and one with the European Euronext exchanges. Additionally, the NYSE demutualized and

cally;
 -- Be able to trade on parity with other orders.

⁵⁸ Cf. Lucchetti, Aaron: NYSE Plans to Revise Specialist-Trader Rules, in: Wall Street Journal - Eastern Edition (2008), p. C4.

⁵⁹ Cf. Weiss: The \$140,000,000 Man, 2003, pp. 90-92.

⁶⁰ Cf. McGeehan, Patrick: Next to Downsize On Wall Street? The Exchange Floor, in: New York Times (2007), Issued 23. Sep. 2007, p. 37.

⁶¹ Cf. McGeehan: Next to Downsize On Wall Street, 2007, p. 37.

is a publicly traded corporation now. Yet, since trading represents the NYSE's core activity, only the transformation of its way of trading will be analyzed.

How did this change away from purely floor trading towards mostly electronic trading come about? The reasons for this change seem obvious. Many of the NYSE's competitors implemented electronic trading much earlier, e.g. the Cincinnati Exchange in the late 1970s. Nevertheless, concerning the implementation of automated trading, it took the NYSE 25 years to follow suit. It thus seems interesting to analyze what led to the NYSE's adoption of electronic trading and why it happened at this point of time. It will also be interesting to see whether the exchange could have followed a different path and implemented electronic trading earlier or maybe not at all.

Thus, there are three areas of interest for the analysis of the NYSE's shift towards electronic trading. First, it will be important to know about the forces that pressured for the adoption of electronic trading following the rational adaptation point of view. Second, the pressures against this adaptation process are vital. This may reveal a picture of organizational inertia following the population ecology point of view. Here, analyzing the impact of the specialists' culture and their cohesiveness and resistance will be important since they are the symbol of the Exchange. Third, the influence of the management on the evolution of the New York Stock Exchange may be important as well. The effects of inertia as well as the effect of market share will be analyzed.

5 Model Structure and Basic Behavior

Figure 3 shows an overview of the system dynamics model, and outlines its scope and boundary. While the *characteristics of the market*, like its time to execution (trading speed) and extent of e-trade are external influences, the following mechanisms work endogenously. The *management's decision on the extent of electronic trade* is central. Then, depending on the relative *characteristics of the market*, the effects of customers' accumulated dissatisfaction with the NYSE's relative speed is considered in the *pressure* that this creates on the decision about e-trade. On the other hand, non-institutional customers value the specialist system, and the two forces work against each other. This would be a view of rational adaptation to environmental forces. Floor firms themselves value the floor system, too. The *pressure for the floor system* that this valuation creates is part of the analysis as well. Taken together these forces may represent what Hannan and Freeman call the population ecology model. Finally, it will be considered how the *management's commitment to the current strategic orientation* influences the *management's decision about the extent of e-trade*.

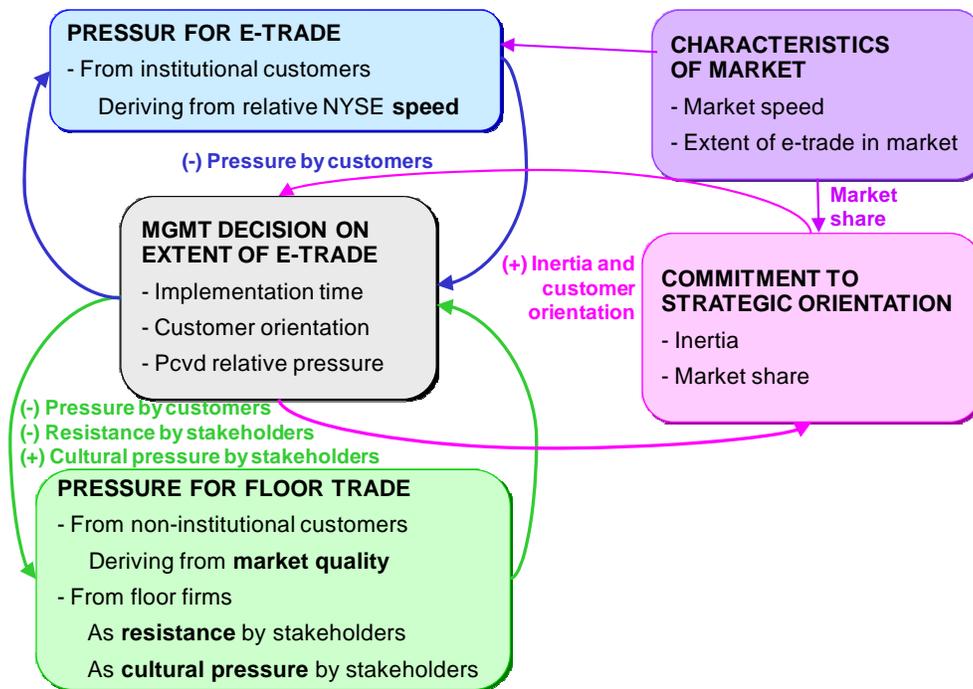


Figure 3: Sector diagram

In order to understand these relations in more detail, causal loop diagrams of the system dynamics model will be presented in the following section.

5.1 Causal Details and Behavior

5.1.1 Adaptation View

Figure 4 shows an excerpt of the model, and it points at an important driver of change. Since the 1950s, more and more *securities were held by institutions*, over the last 60 years, this number increased from about 7% to well more than 50%.⁶² According to Blume et al., “[b]y the 1970s, institutional investors had replaced individual investors as the dominant force in the market.”⁶³ The percentage of trading that is done by institutions instead of individual investors rose from 20% in 1950 to 75% in 1975.⁶⁴ These large institutional customers are mutual and pension funds and investment banks, for example. The Exchange’s largest two customers—the leading investment and wealth management banks Goldman Sachs Group and UBS AG—each account for about 10% of the trading.⁶⁵

⁶² Cf. NYSE website: [Facts and Figures](#) > [Institutional Investors](#) > Holdings of corporate equities in the U.S. by type of institution (Oct. 1, 2007).

⁶³ Blume, Siegel and Rottenberg: *Revolution on Wall Street*, 1993, p. 108.

⁶⁴ Cf. Blume, Siegel and Rottenberg: *Revolution on Wall Street*, 1993, p. 105.

⁶⁵ Cf. NYSE Group, Inc.: Annual Report of 2005, New York City 2006, Note 5—Related Parties and other Relationships, p. 139, <http://ir.nyse.com/phoenix.zhtml?c=129145&p=irol-reportsAnnual> (15. Nov. 07).

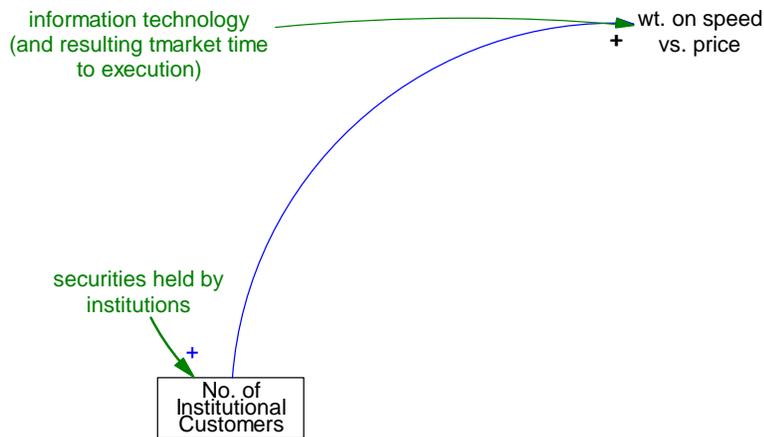


Figure 4: External changes and the valuation of speed

It was and is crucial for these large institutional customers to gain direct access to the New York Stock Exchange’s trading floor because it gives them faster and less costly access.

Furthermore, as a second influence from outside, computer technology developed and paved the way for electronic trading. This led to the formation of Electronic Communication Networks (ECNs) where NYSE-listed stocks can be traded as well as to the foundation of NASDAQ, which from then on has tried to take away market share in NYSE-listed stocks. For example, in the first page of the “NASDAQ Facts”-webpage, NASDAQ states to be the member⁶⁶ routing more order flow to the NYSE than any other member. They also maintain that their “trading systems are the faster, more efficient, transparent, better way to trade NYSE-listed securities.”⁶⁷

Since large institutional customers trade professionally, they often make use of tiny price differences and engage in what is called arbitrage. Here, they also make use of computers and computer programs which issue the orders in order to automate the trading and to issue orders faster. This kind of trading is called algorithmic trading. Abolafia describes a similar mechanism for the bond market and its new forms of trading.⁶⁸ Since algorithmic trading on the side of the customer is done by computers and since it uses minimal price differences in arbitrage, the trade execution time becomes highly important. As Figure 4 reveals, customers put more weight on the speed of order execution than on the spread which represents the price difference between the bid and offer. The spread is a measure for the quality of the price that the customer receives or pays, and small spreads are desired.

How this creates a balancing feedback loop can be seen in Figure 5. One major factor determining the time to execution is the fraction of electronic trading.⁶⁹ With all possible technical

⁶⁶ A “member” is an entity owning at least one “seat” of the NYSE. A “seat” is an expression for the right to directly trade on the NYSE floor. They are still referred to as “seats” because in the early days of the NYSE, members sat in assigned chairs. (NYSE Glossary: “Seat”, www.nyse.com/glossary/Glossary.html) (Dec. 7, 2007).

⁶⁷ NASDAQ website, NASDAQ Facts, Home > Nasdaq Corporate > Nasdaq Facts, http://www.nasdaq.com/reference/nasdaq_facts.stm (Dec. 7, 2007)

⁶⁸ Cf. Abolafia: Making Markets, 1996, pp. 5-6.

For a detailed stock and flow diagram of the above-mentioned processes please refer to Appendix I: Institutional Customers.

⁶⁹ It needs to be said here that the fraction of e-trade in the market follows the access to information technology. This is the variable which drives e-trade in the remaining market and the markets time to execution. More details can be seen in

support, manual floor trading involves a specialist decision and cannot be done in less than a few seconds. Electronic trading is fast and a market classifies as a fast market if the time to execution is one second or less. Depending on the relative fraction of e-trade and resulting time to execution of the NYSE and the market, institutional customers build up dissatisfaction with the trading speed. This creates a balancing loop (B) which Appendix II reveals in full detail in a full stock and flow diagram. Depending on their level of dissatisfaction, institutional customers exert pressure for the implementation of electronic trading because going electronic is a way to particularly increase the speed of trading. When e-trade gets implemented the relative time vs. the NYSE's competitors improve and dissatisfaction decreases.

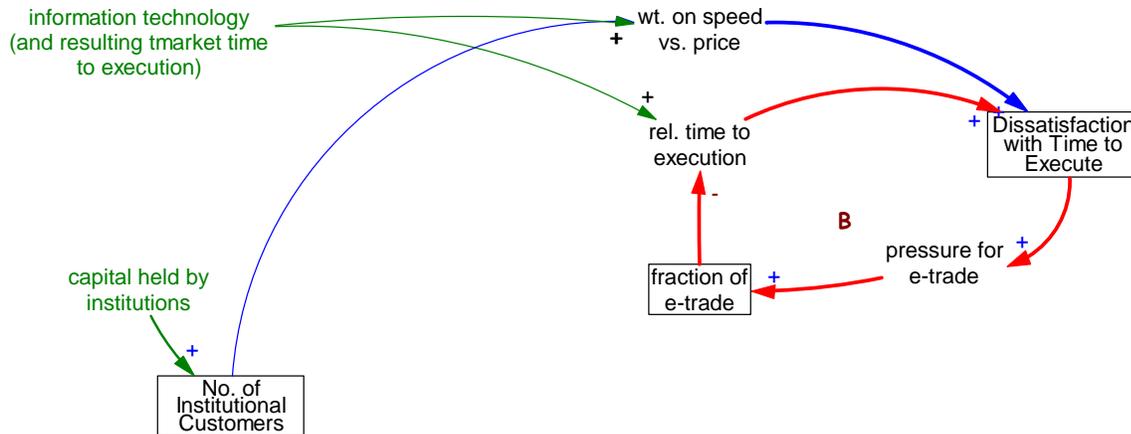


Figure 5: Customer pressure for e-trade

The move towards electronic trading has consequences which the balancing feedback mechanism in Figure 6 reveals. Here non-institutional customers like individuals who directly invest in securities pressure for the retention of the specialist system.⁷⁰ They have no interest in fast executions since they do not engage in arbitrage and algorithmic trading, but they have a high preference for receiving the best price. With more and more trades being executed electronically the specialist is not needed any more, and the market quality from specialist participation is lessened in line with the reduction in this activity that has occurred. Market quality is a measure for the specialists' tasks of price improvement, stabilizing prices, reducing volatility, and providing liquidity. Specialists participate in floor trades and provide liquidity particularly for lower-volume stocks.⁷¹

According to NYSE Group, volatility increased only slightly since the implementation of the hybrid market because they were able to increase liquidity simultaneously.⁷² But the analysis of the NYSE weblog revealed that a group of customers is extremely dissatisfied with the missing price improvement and demands more specialist participation.

“... we need the specialists to add liquidity, and stabilize the price's. The value the specialists add is what makes the NYSE the best place to trade and its what makes the

⁷⁰ Appendix III reveals in more detail what pressure for the specialist system by customers depends on.

⁷¹ Cf. Ellul, Andrew, et al.: Order dynamics: Recent evidence from the NYSE, in: Journal of Empirical Finance, Vol. 14 (2007), No. 5, pp. 637 and 658. See also Appendix III: Customer Valuation of , which reveals this mechanism in more detail.

⁷² NYSE Group, Inc.: NYSE Completes Hybrid Market Phase III Activation, NYSE Group, Inc., [News Release], accessed 11. Dec. 2007: <http://www.nyse.com/pdfs/HybridPhaseIV1.24.07.pdf>, p. 1-2.

exchange different from the other exchanges. The new CEO has to get them involved if the NYSE has any chance of getting better for their customers.”⁷³

“Your customers want the ability to execute blocks, be price improved, and not be charged an arm and a leg to do it. We also want the specialists to create a better quality market [...]”⁷⁴

A perceived inadequacy of market quality thus creates customer pressure for more floor trade. This closes the balancing feedback loop.

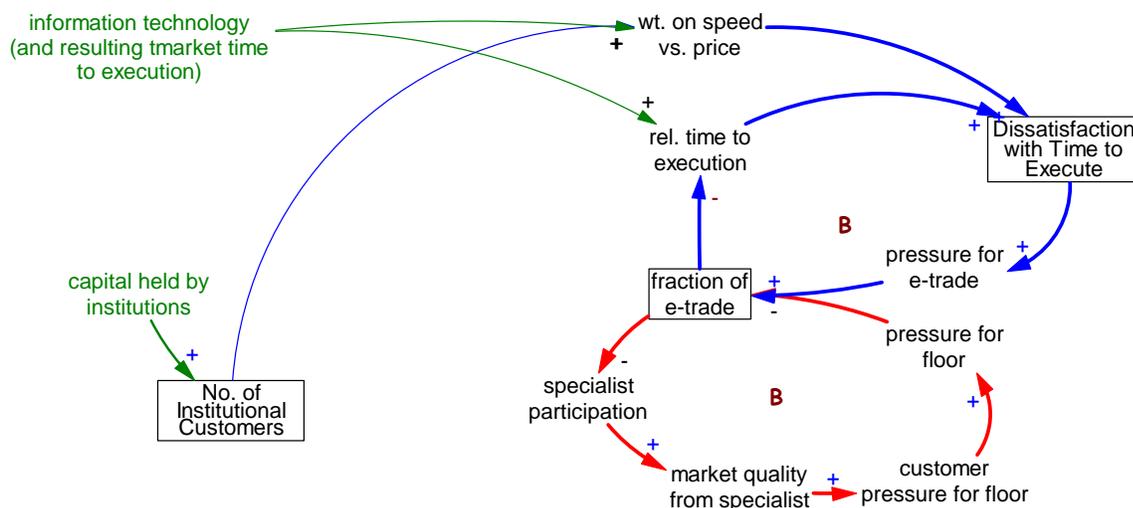


Figure 6: Customer pressure for floor trade

This model represents an adaptation view of organizational change since the NYSE can be regarded as adapting to the external forces of the market. The customers exert pressure for more electronic trading if the speed is worse than in the market so that it closely follows the trend in the market. Figure 7 shows that only when change starts to get implemented, non-institutional customers perceive the disadvantages in market quality and start pressuring for the retention of the old system. This creates a slow down of the otherwise simultaneous implementation of e-trade in the market and the NYSE.

⁷³ NYSE Exchanges Blog: Comment by Tony Dey, owner of a day trading firm, http://exchanges.nyse.com/archives/2007/11/men_at_work.php (25. March 2008).

⁷⁴ NYSE Exchanges Blog: Comment by Tony Dey, owner of a day trading firm, <http://exchanges.nyse.com/archives/2007/06/duncan.php> (25. March 2008).

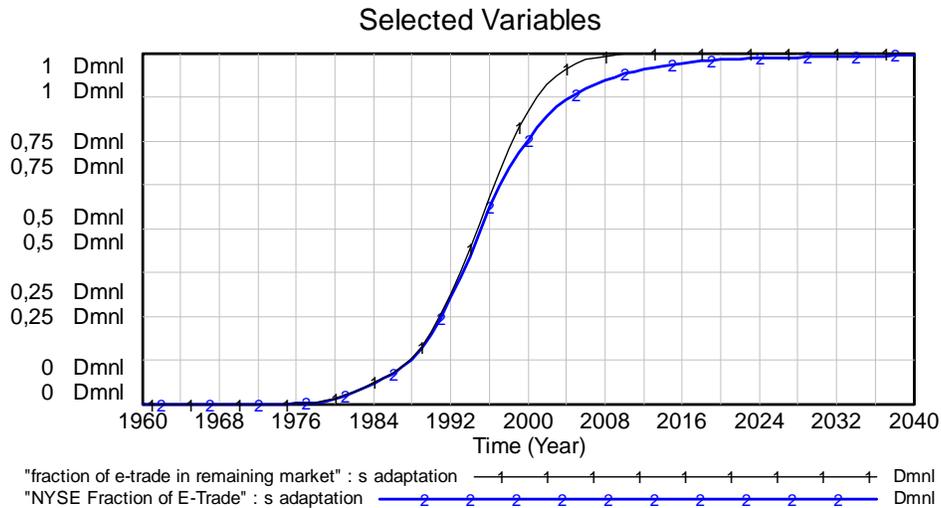


Figure 7: Adaptation view

Yet, this adaptation does not yet give a realistic picture of reality. Change happened later and more radically. As Figure 6 indicated already and as the following figures will show, there is not only pressure for e-trade but also *pressure for the floor system*.

5.1.2 Culture and Resistance View

When specialists and floor brokers noticed that a shift to electronic trading was imminent, some specialists started to protest. According to an informant, one of them still wears around 20 stickers on his suit showing his opposition to electronic trading and to the way it was implemented. Although he used to be a member of the board, his opposition is rather powerless now. Specialists make money from brokerage commissions, from the spread between the bid and ask price for their stocks, and from trading for their own account.⁷⁵ It is thus not surprising that specialists and floor brokers showed resistance against the implementation of e-trade which would reduce the spread. It is not only the profitability but also the specialist' participation and employability that decreases with electronic trading, and thus both lead to resistance. Thus, based on the lower participation (employability) and profitability some resistance occurred, and its balancing loop is shown in Figure 8.⁷⁶

⁷⁵ Blume, Siegel and Rottenberg: Revolution on Wall Street, 1993, p. 40.

⁷⁶ Appendix IV: Resistance Pressure shows a detailed stock and flow diagram of the two resistance effects, profitability and employability.

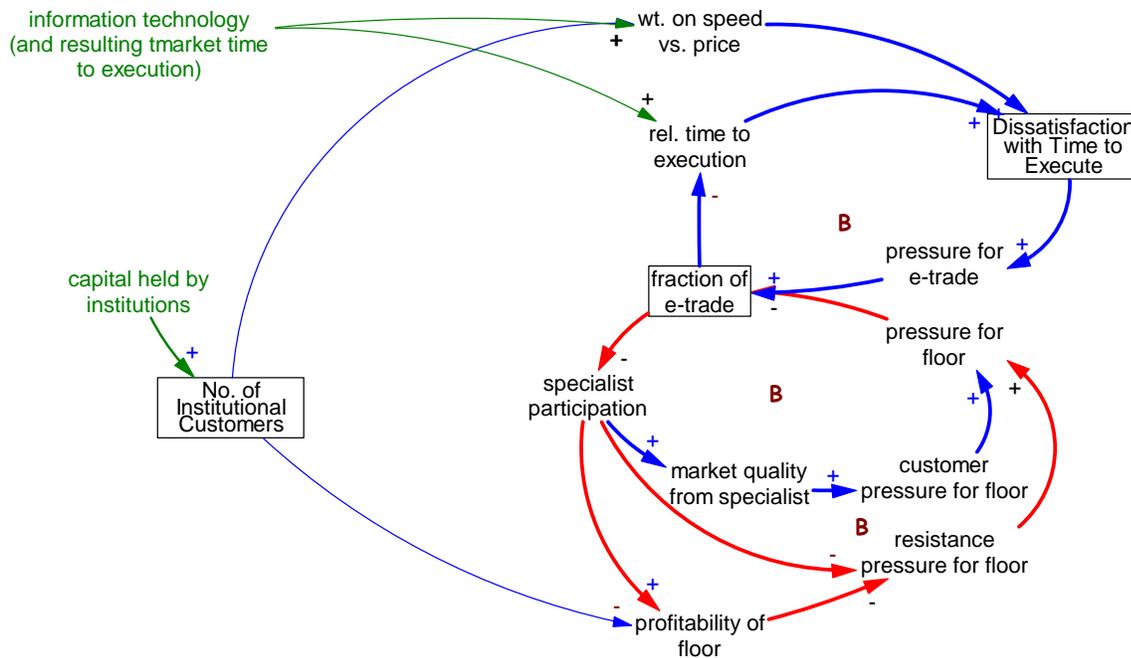


Figure 8: Resistance pressure from floor

The specialists themselves plus other companies which mainly receive their revenue from trading on the floor enforce this pressure. In Figure 8 a reinforcing feedback loop shows how specialists value their own culture depending on their ability to make profits and on their merits in providing market quality.⁷⁷ Their profession used to be a “license to make money”. Specialists and floor brokers could maintain their cartel for fixed commissions until the first half of the 1970s.⁷⁸ But afterwards commissions diminished.⁷⁹ This creates a reinforcing loop, but since the specialists’ valuation of themselves increases faster than it decreases, specialists in general only slowly let loose of their culture; and for a long time they still pressure for their system, even if profitability and their ability to provide market quality has long been diminished.

⁷⁷ Further details can be found in Appendix V: Floor Valuation of Floor Culture.

⁷⁸ Cf. Abolafia: Making Markets, 1996, p. 109, and Blume, Siegel and Rottenberg: Revolution on Wall Street, 1993, p. 25.

⁷⁹ Cf. Gasparino: King of the Club, 2007, p. 48.

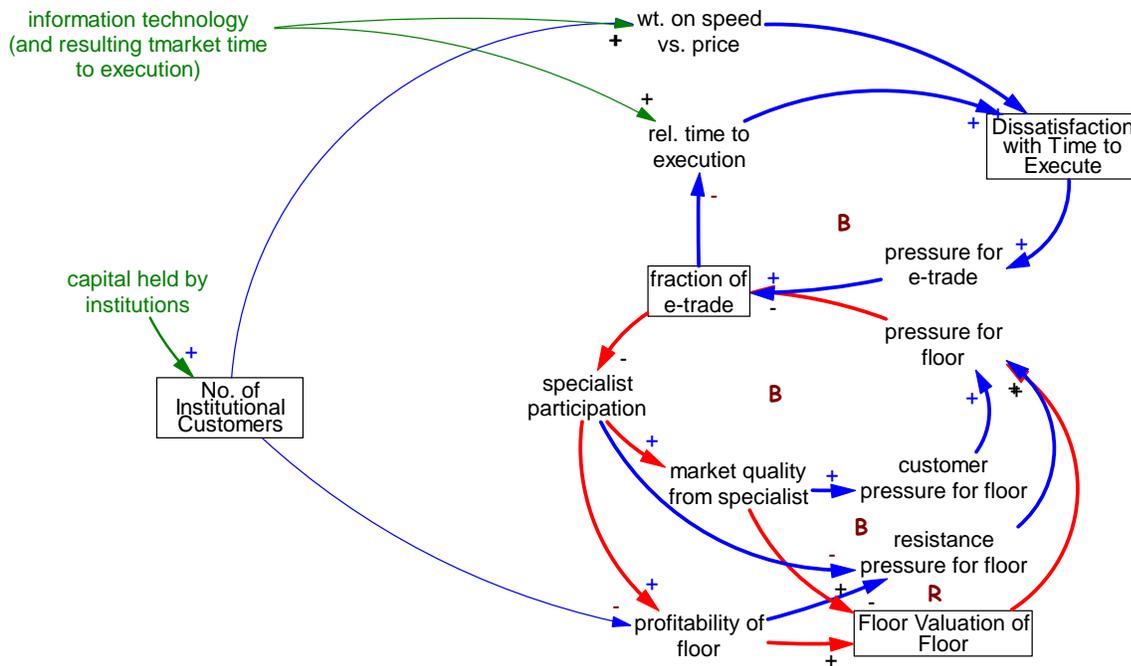


Figure 9: Cultural pressure from floor

A remarkable factor that helped shape the pressure for the floor is the power that floor firms have. Already in the beginning of the 1990s a specialist commented: “It was always a great business because we earned a commission on whatever we acted as agent on. There is tremendous pressure on us to give up that business now.”⁸⁰ In order to stay profitable and be able to provide sufficient liquidity many specialist firms consolidated. Others went out of business. Since they have to put their own or the company’s capital at risk when they work as specialists, many of them exited with the capital they had accumulated earlier. The number of specialist firms at the New York Stock exchange decreased from about 150 in 1960 to 40 in 1990 and to six firms today, making the whole specialist community less powerful. This decline in power was triggered by the growth of institutional investors. Additionally, floor firms’ power depends on the market quality that specialists provide. Picot, Bortenlänger, and Röhl state that their power is defined by the volume they attract to the exchange.⁸¹ Volume is influenced by market quality. A decrease in market quality from the introduction of electronic trading thus also diminishes power. Figure 10 reveals the reinforcing mechanism which this creates.⁸² The power of floor firms is multiplied with the resistance and cultural pressure and thus mediates the floor’s pressure for the old system.

⁸⁰ Quoted in Abolafia: Making Markets, 1996, p. 131. Similar statements of specialists can be found on pp. 135, 141-142 and 145.

⁸¹ Cf. Picot, Bortenlänger and Röhl: The Automation of Capital Markets, 1995

⁸² A detailed view is provided in Appendix VI: Power of Floor Firms.

So far it was assumed that the management implemented everything that the joint pressures of customers and stakeholders called for. Although institutional investors had called for the automation of trading, the NYSE did not automate order execution until the year 2000 when it introduced e-trade for small orders. Before, there had been no signs for a full rollout of e-trade within the next few years. Since the radical shift did not base on sudden changes in the forces for floor and e-trade, the role that management had for electronic trading is also worth consideration.

5.1.3 Management View

The New York Stock Exchange itself regards its own success, market share and complacency as drivers for its decision making and attention to customers.

"Part of being very successful for a very long time and having a large market share [is that] the New York Stock Exchange did become complacent. We have to be receptive to change. We have to give our customers what they're looking for."⁸³

Being successful and not having to change created complacency which is inertia on the one hand and a bias in attentiveness. The organizational change literature discusses their influence as well. Hannan and Freeman as well as Tushman and Romanelli address how inertia renders organizations inalterable. Long periods of convergence strengthen the development of values, beliefs and ideologies.⁸⁴ This reinforcing mechanism is supported by respective recruiting, socialization, training, and leadership behavior.⁸⁵

The New York Stock Exchange did not change the basic principles of its way of trading for more than 100 years. During this convergence period there was much opportunity for the institutionalization of routines and the growth of consistency. New employees seldom came with new ideas from outside, instead they were "grown from within the organization". The resulting inertia led to the observed complacency. For Van de Ven and Poole inertia and persistence maintain old organizational forms, and they are a major force that antagonizes the reinforcing variation loop.⁸⁶ This reinforcing loop is shown in Figure 12. Inertia enhances the commitment to the current strategic orientation and antagonizes the move towards electronic trading. But once some e-trade gets implemented the commitment to the strategic orientation declines and more change becomes possible.

⁸³ Ewing, Jack: When CEOs Talk to Each Other, World Economic Forum in Davos, Switzerland, 2005, in: Business Week Online from 31. Jan. 2005, http://www.businessweek.com/bwdaily/dnflash/jan2005/nf20050131_5572.htm (2. April 2008)

⁸⁴ Tushman and Romanelli: Organizational Evolution, 1985, p. 192.

⁸⁵ Cf. Tushman and Romanelli: Organizational Evolution, 1985, p. 192; referring to Argyris and Schön: Organizational Learning, 1978

⁸⁶ Cf. Van de Ven, Andrew H. and Marshall Poole: Explaining development and change in organizations, in: The Academy of Management Review, Vol. 20 (1995), No. 3, pp. 514 and 518.
The full stock and flow diagram is show in Appendix VII: Management Decision-Making.

They have not gone into effect yet, but the NYSE will turn its specialists into designated market makers with similar obligations. This happened in response to falling market share and the acknowledgement of customer demands.⁹⁰

The NYSE market share used to range between 75 and 80 percent of trading in NYSE-listed securities. Trading volume and market share fell; in September 2007 the NYSE had an average trading volume of 1.4 billion shares per day with a market share of trading in NYSE-listed securities of 44 percent. In June 2008 the NYSE on average traded 1.2 billion shares per day, and its market share had fallen to 29 percent.⁹¹

When the management perceives the market share to be inadequate, they lower their commitment to the strategic orientation and additionally re-direct their attention away from floor firms to customers. Customer orientation increases and with it increases perceived pressures for e-trade from customers; the perception of pressures for the floor diminishes. More e-trade follows. The causal link from market share to the NYSE decision making can be seen in Figure 13. Reorientations thus are “[...] radical and discontinuous changes driven by the opposing pressures of performance and inertia.”⁹²

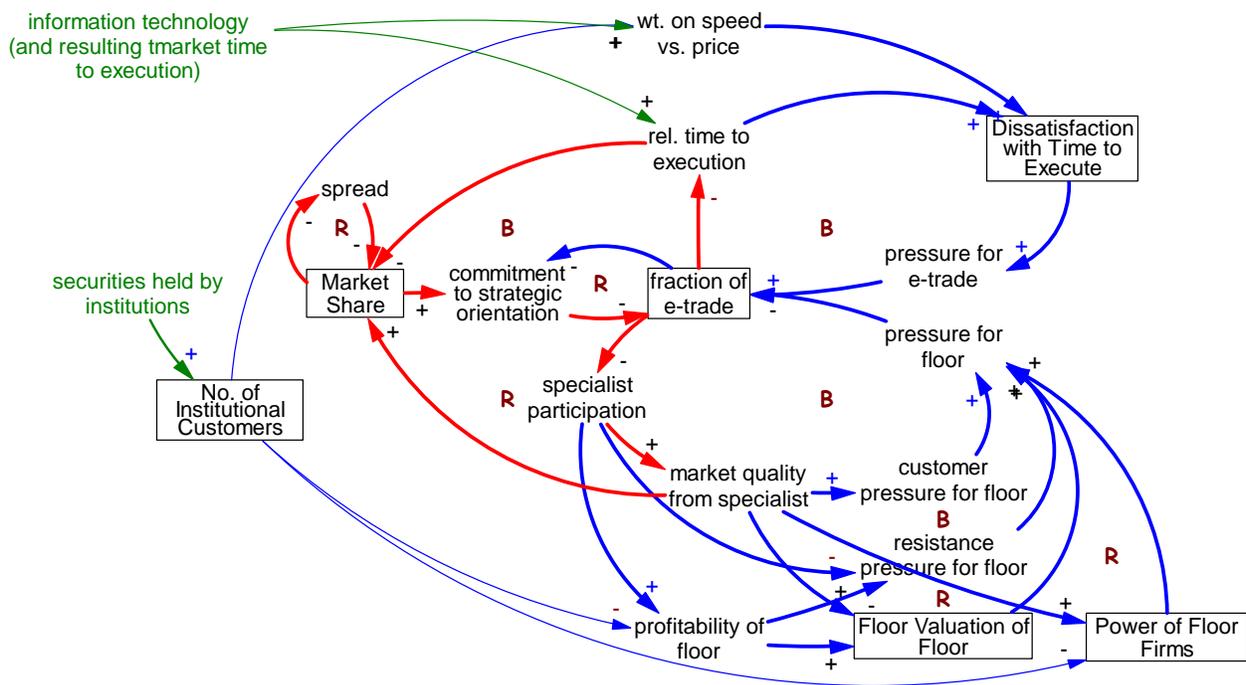


Figure 13: Market share

This figure also shows the determinants of market share itself, so that the relationship “market share → NYSE decision on e-trade → market share” becomes an endogenous feedback

[http://apps.nyse.com/commdata/PubInfoMemos.nsf/AllPublishedInfoMemosNyseCom/85256FCB005E19E885257272006565C6/\\$FILE/Microsoft%20Word%20-%20Document%20in%2007-12.pdf](http://apps.nyse.com/commdata/PubInfoMemos.nsf/AllPublishedInfoMemosNyseCom/85256FCB005E19E885257272006565C6/$FILE/Microsoft%20Word%20-%20Document%20in%2007-12.pdf), accessed 20 Aug. 2008.

⁹⁰ Cf. Lucchetti: NYSE Plans to Revise Specialist-Trader Rules, p. C4.

⁹¹ Cf. Chapman, Peter: Rule Changes: NYSE Euronext Bets on Specialists to Revive Broken Floor, Traders Magazine, accessed 20. Aug. 2008: <http://www.tradersmagazine.com/news/101217-1.html>

⁹² Tushman and Romanelli: Organizational Evolution, 1985, p. 197.

mechanism. Market share rises by a fast relative time to execution, i.e. when the fraction of e-trade is high, which creates a balancing feedback loop. It also rises with high market quality which creates a reinforcing mechanism, indicating that a move towards electronic trading first reduces market quality, then market share and calls for more electronic trading. Therefore, the implementation of e-trade has ambiguous effects on market share, but due to the rising importance of institutional customers the effect of speed prevails.

A further determinant of market share is the liquidity loop in Figure 13.⁹³ Available liquidity reduces the spread between the bid and ask price. Low spreads (i.e. high price quality) in turn attracts more market share. Or as Duncan Niederauer, the now CEO of the New York Stock Exchange expresses it: “liquidity begets liquidity”.⁹⁴ Since high order flow has the effect of reducing the spread, this creates a reinforcing feedback loop which works positive for the exchange that has the greatest market share.

The consideration of the management’s decision-making creates a rather radical shift from manual to electronic trading, as can be seen in the red line number 3 in Figure 14. Taking inertia, market, share, the commitment to the current strategic orientation, and customer orientation into account, creates a long period during which electronic trading is not implemented. The observed delay could thus be explained.

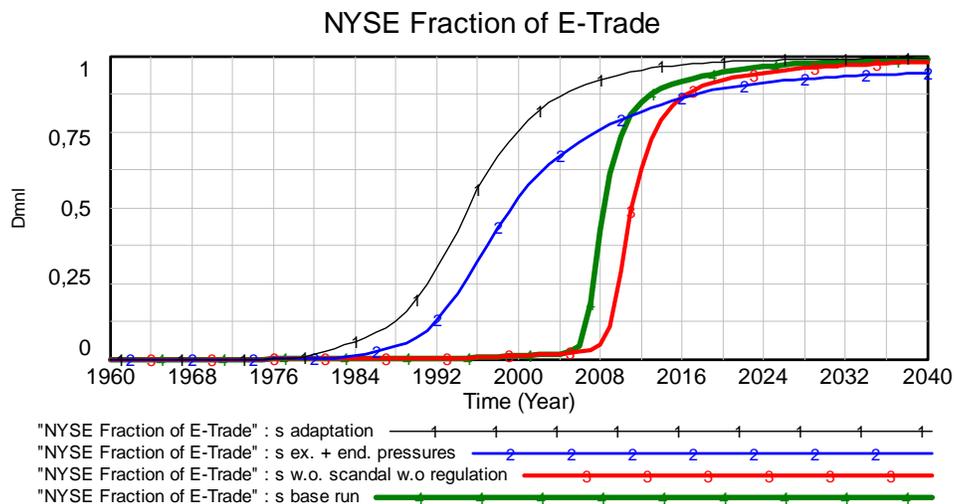


Figure 14: Adaptation, Culture and Resistance, and Mgmt

Figure 15 reveals the different forces leading to this shift. When the pressure for e-trade (line 3) starts exceeding the pressure for the floor (line 4), a very small portion of e-trade gets implemented. The following quick implementation comes about due to the abrupt decline of market share. This drop leads to a drastic rise of the management’s customer orientation which then shifts attention from pressures for the floor to pressures for automation.

⁹³ Appendix VIII: Market Share shows the stock and flow view in more detail.

⁹⁴ NYSE Exchanges Blog: Duncan Niederauer, NYSE Euronext President and Co-COO and Head of U.S. Cash Markets, now CEO, <http://exchanges.nyse.com/archives/2007/08/compensation.php> (25. March 2008).

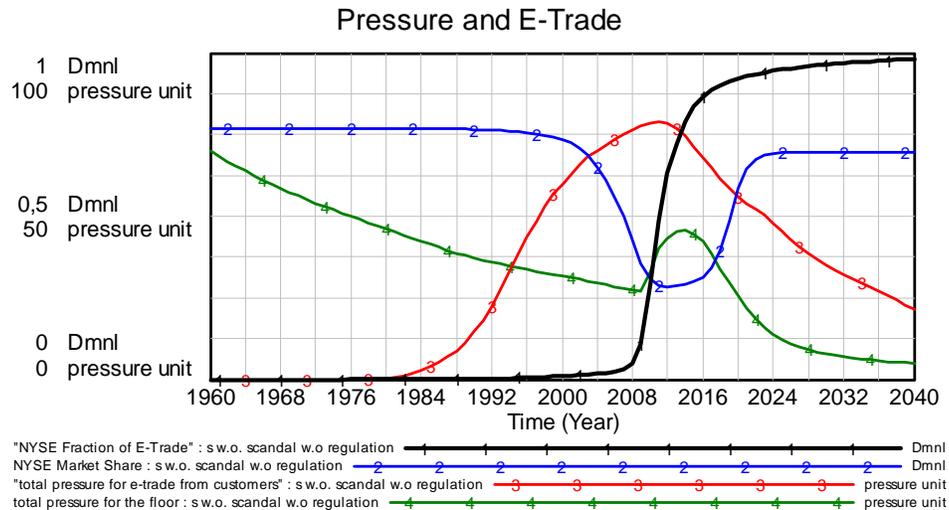


Figure 15: Underlying forces

As the reader may have noticed, the current forces are able to explain the general behavior pattern of a radical change from floor to e-trade, but they do not get the timing right. Two additional external effects will be analyzed in their effect on the timing, the Grasso scandal and a regulatory change. As mentioned earlier, the long-term CEO of the NYSE, Richard Grasso, got involved into a scandal about his retirement package. “Toward the end of his career, Mr. Grasso seemed to consider himself bigger than the institution he ran, leading to a series of missteps that attracted the scrutiny of the Big Board’s secretive practices, [...]”⁹⁵ When information about his pay package became public it led to a scandal. The support of the formerly aligned management quickly diminished, and it ended in a vote in which many of Grasso’s former “buddies” asked him to resign.⁹⁶ The leave of the CEO and his replacement were events that diminished the organizational inertia suddenly and from outside. About two years after the scandal the US Securities and Exchange Commission implemented a new regulation that had effects on the reinforcing “liquidity begets liquidity” loop of market share. The National Best Bid and Offer Rule (NBBO rule) requires exchanges to be connected and send orders to the exchange currently offering the best price. In 2005 the Securities and Exchange Commission suggested and later introduced the Regulation National Market System (Regulation NMS).⁹⁷ This regulatory change reduces market share for two reasons. First, it requires markets to trade fast in order to participate in the national market system that directly sends orders to the trading venue with the best price. Second, even if an exchange quotes the best price, after the change in regulation it is not the full order any more that gets executed at the exchange offering the best price, but often just the first fragment of the order. This weakens the reinforcing liquidity loop, and both effects diminish NYSE market share. Since a falling market share diminishes the confidence in the strategic orientation and enhances customer orientation, the Grasso scandal and the introduction of Regulation NMS are responsible for that the radical shift towards electronic trading occurs about three years earlier.

⁹⁵ Morgenson, Gretchen: The Fall of a Wall Street Ward Boss, in: The New York Times (2003), Issued 19. Oct. 2003, p. 1.

⁹⁶ Cf. Gasparino: King of the Club, 2007, pp. 275-281.

⁹⁷ Securities and Exchange Commission (SEC): Regulations NMS; Final Rule, in: Federal Register, Vol. 70 (2005), No. 124, p. 37496.

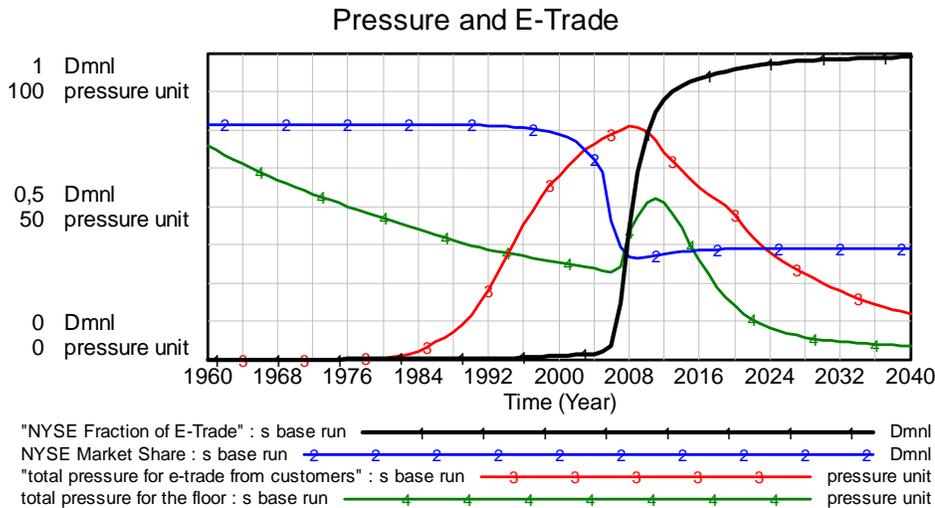


Figure 16: Underlying forces

As can be seen in Figure 16, the base run of the model now to a great extent matches the reference mode, and the radical automation of the NYSE trading starts in 2007. This run reproduces the real events and behavior as closely as possible and marks the reference point for further model analysis. It also becomes obvious that, due to the regulatory change, the market share does not recover to the former high standard any more.⁹⁸ Taken as a whole, the decline in inertia and market share decline made the New York Stock Exchange rethink its past strategic orientation, focus on the customer, and it even triggered a change in corporate culture.

“Within the company, a for-profit, publicly traded corporation since last year, the two [NYSE executives Niederauer and Leibowitz] are trying to transform what was traditionally an inward-looking, exchange floor-dominated culture into an outward-looking, customer-focused culture. Instead of running the organization for the benefit of specialists, for example, Niederauer and Leibowitz say they are trying to satisfy the people that deliver the order flow- [i.e.] the broker-dealers.”⁹⁹

The feedback loops also tell a story. In the beginning the floor valuation by floor firms dominates. Additionally market share keeps the management inattentive to customers. The customer dissatisfaction loop is not able to affect greater changes in the way of trading. Only when the feedback from the relative speed of the NYSE to market share gets strong, this loop triggers a rethinking in strategic orientation, and the falling inertia also triggers more and more change. The process then stops when the system reaches its perceived goal.

6 Presentation and Analyses of Model Behavior

Now, after the structure of the model as well as its behavior have been revealed, it will be important to gain some more confidence in this model. This is done with the help several tests which are applied to the model’s structure and behavior. Here, one of the benefits of the system dynamics method also becomes apparent: unlike econometrical models, we are not only able to test

⁹⁸ Current simulation results match real data quite closely. Simulation results of 45 and 33 percent for the years 2006 and 2008 match the observed data of 44 percent and 29 percent for the years 2007 and 2008 quite closely.

⁹⁹ Chapman, Peter: Men At Work, in: Traders Magazine, Vol. 20 (2007), No. 274, Issued Nov. 2007.

model behavior, but model structure as well. This structural plausibility analysis was mainly done in parallel with the model description as causal relationships were explained with either literature or data from the case study. Additionally the stepwise development of the model structure revealed that adding new structure from the adaptation point of view via the culture and resistance view to the management view created new behavior. The simulation runs in Figure 14 showed this explicitly. Concerning the boundaries of the system, it can thus be said that it was necessary to take these three views into consideration.

A validation test for behavioral consistency illustrates that the model also shows sensible behavior under extreme conditions. If there are no technological developments that allowed for e-trade, no e-trade develops in the model. If there are no institutional customers at the NYSE, no e-trade gets implemented there either. This helps to gain confidence in the model because in reality electronic trading started to get implemented at the New York Stock Exchange only after both forces—institutional customers and technological possibilities for e-trade—were present.

The initial questions concerned adaptive vs. inertial and vs. management forces. The case study of the New York Stock Exchange reveals how inertial forces, endogenous pressures from culture and resistance, and the management impinge on the adaptation process. Figure 17 illustrates the importance of endogenous forces. Concerning this trend of the market, two different assumptions are modeled: a linear growth of electronic trading in the remaining market as well as a more realistic exponential growth with a limit. These two different market behaviors help analyze how closely the adoption pattern of e-trade in the remaining market shaped electronic trading within the New York Stock Exchange. The resulting model behavior for the automation of trading does not significantly differ from the base run behavior of the model. The development of electronic trading in the market is necessary for the New York Stock Exchange to automate, but how the automation is executed and how the implementation process unfolds within the NYSE is subject to endogenous management and stakeholder dynamics.

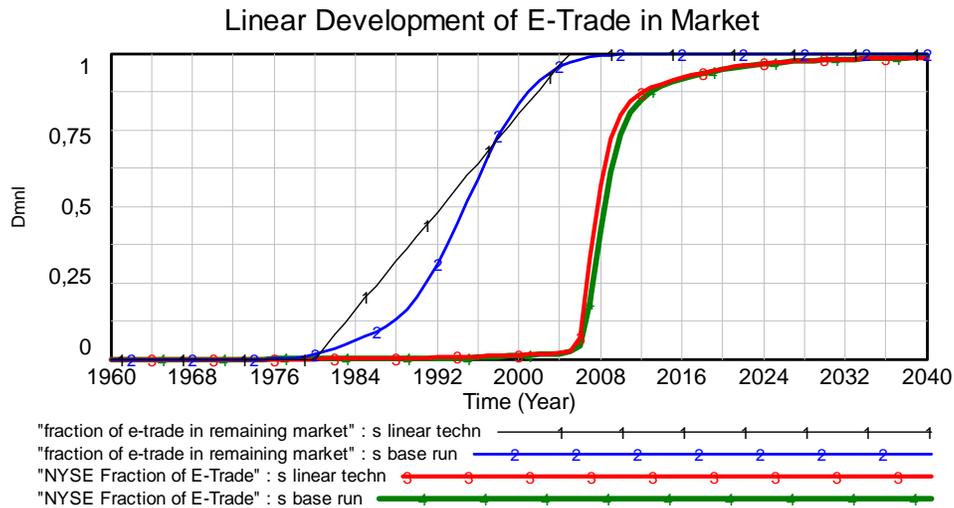


Figure 17: Linear development of e-trade in market

In the following, the endogenous aspects will be analyzed more closely, particularly the effects of each of these determinants on the implementation of e-trade, pressures for and against e-trade, and the market share.

6.1 Sensitivity Analysis

Sensitivity analyses are conducted to analyze model robustness and the relationship between structure and behavior.¹⁰⁰ In the following, first, the sensitivity for the pressure of institutional customers, for the pressure of non-institutionals from culture and resistance, and for management attitudes will be presented.

6.1.1 Analysis of Culture and Resistance Aspects

The upper left graph in Figure 18 shows that the extent to which *e-trade* gets implemented not sensitive to variations in the *reference level of resistance*, i.e. to variations in how much resistance is created by a certain inadequacy of employability and profitability.¹⁰¹ Different strengths of resistance create more or less pressure for the specialist system (right). But it does not affect the automation (left) since this happens only after the New York Stock Exchange started implementing e-trade and already shifted its attention towards institutional customers.

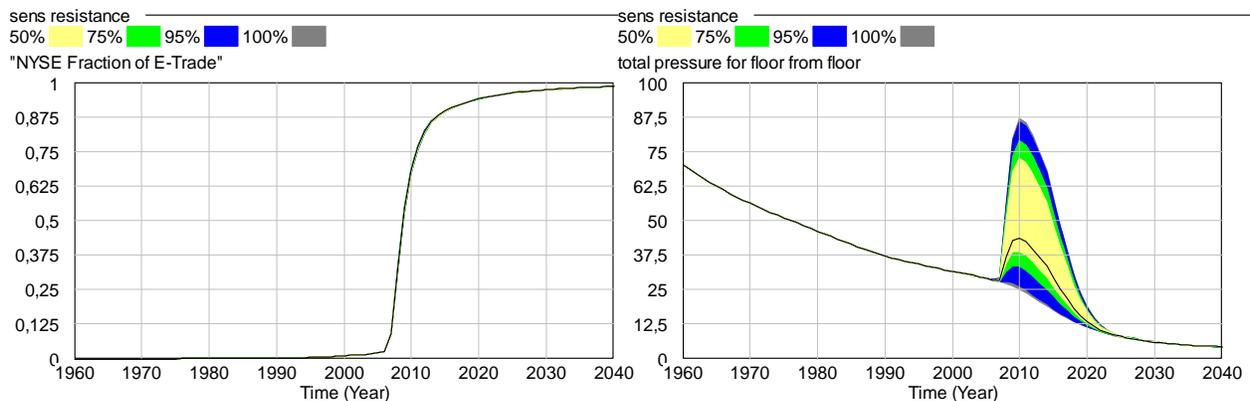


Figure 18: Sensitivity for resistance

The pressure from the floor is also determined by the *power of floor firms*. Floor firms gain power from the participation of the specialist in trading and his positive effect on market quality. They loose power due to the rising number of institutional traders who like to bypass the floor intermediaries. When the sensitivity of the model is checked for changes of the *reference power of floor firms* the fraction of e-trade shows a very low sensitivity, too. It seems that a group of forces determines the implementation of e-trade, so that changes in the cohesiveness of culture and in cultural pressures may have more effect since they operate earlier.

Therefore, as a next step, the sensitivity of the model is checked for three variables at the same time—for the *degree of cohesiveness of floor firms*, the *reference cultural pressure per floor firm* and *reference resistance*—and here the output graphs show more variation. Figure 19 suggests that when all three of them work together the effects on the implementation of e-trade are much greater. For the case this reveals that electronic trading could have been implemented much earlier had the three variables been lower. If the cultural cohesiveness and the resistance

¹⁰⁰ Cf. Sterman: Business Dynamics, 2000p. 830.

¹⁰¹ In a sensitivity analysis, the model is run 200 to 5000 times while a certain parameter or a group of parameters is changed. An overview of parameter values in the base run and ranges in the sensitivity analyses can be found in Appendix IX: Institutional Customers, Program Trading, and Institutional Owners. In all sensitivity analyses, it is assumed that the Regulation NMS comes into effect, but the effect of the Grasso scandal is left out.

had been stronger, it would have been implemented at the same time as in the base run, but it would have been implemented to a somewhat lesser extent since the pressure for the floor system would have been stronger.

The effect of feedback becomes obvious in the lower part of Figure 19. The different extent of the pressures for the floor (lower right) affects the fraction of e-trade (upper left) which then also affects the pressure for e-trade (lower left) and market share (upper right).

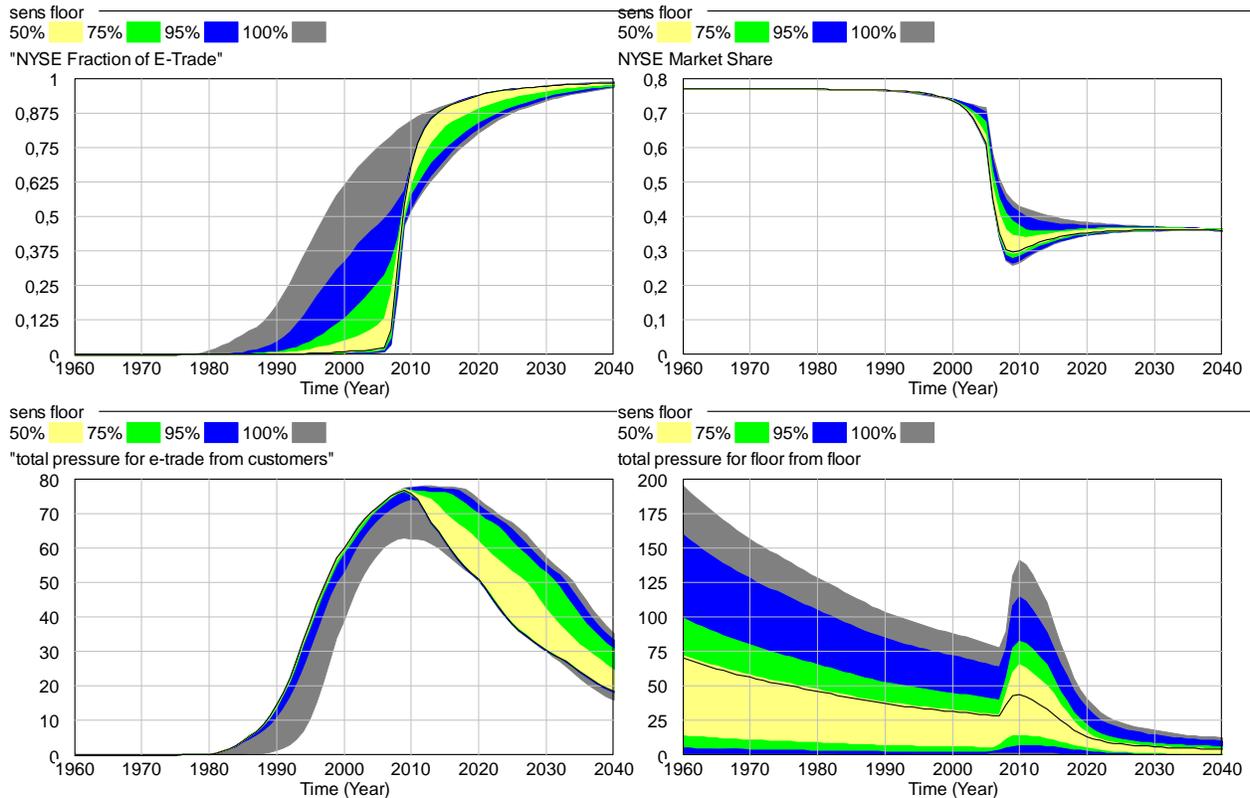


Figure 19: Sensitivity for resistance, culture, and cohesiveness of floor firms

The sensitivity analyses show that floor firms with low power, culture and resistance enable earlier automation. If floor firms show strong power, culture, and resistance, they do not have much direct influence on the point of time when electronic trading gets implemented; it happens around 2007. But the analysis showed that in a situation where cultural cohesiveness and resistance are high and/or where the affected stakeholders are bound to the firm, they can reduce the extent to which electronic trading gets implemented.

6.1.2 Analysis of Management Aspects

In the following, it will be tested how sensitively the system reacts to changes in the time to implement trading, i.e. the organization's general openness to change, as well as the management's general responsiveness to customers. In the case of general openness to change, the *reference time to change trading* is varied. A long reference time means that the current fraction of electronic trading is mainly kept whereas a short reference time leads to a quick adaptation to pressures from outside. Figure 20 shows a sensitive reaction of the extent or pace to which e-trade gets adopted, not to the timing when the launch starts. As the bottom left picture shows, the *pressure for e-trade from institutional customers* reacts very sensitively to lower and higher levels of

e-trade. The floor shows some reaction, too. Depending on the extent of e-trade market share can vary for some time.

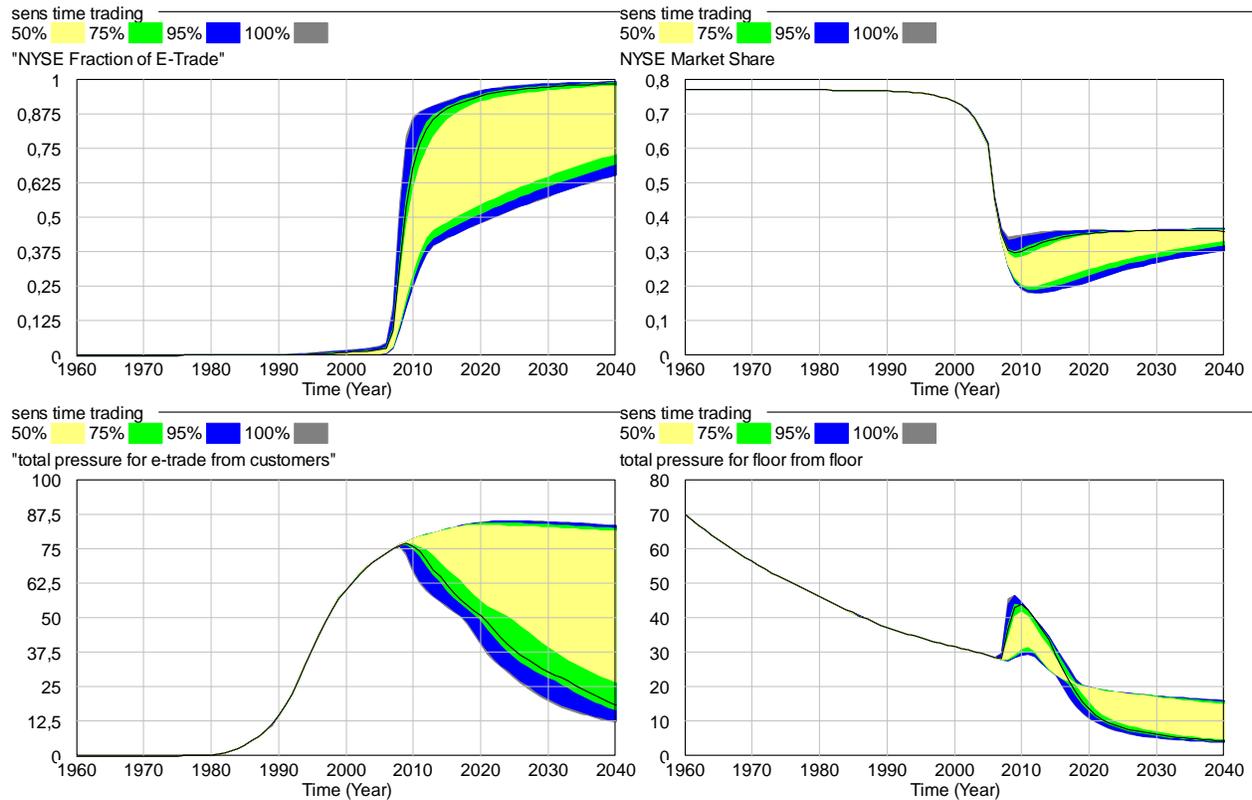


Figure 20: Sensitivity for the time to implement trading

A similar behavior can be observed in the analysis of the management's responsiveness in its orientation to customers. The model's sensitive reaction to changes in the reactions of the *reference time to change customer orientation* can be seen in Figure 21. When market share is inadequate, a low *reference time to change customer orientation* only leads to a slight orientation to customers. As a consequence, the organization still directs most of its attention towards pressures from the floor, and it only very slowly adopts electronic trading. This means that also market share stays low for a long time. The effect on the time to change customer orientation is similar to that of Figure 20.

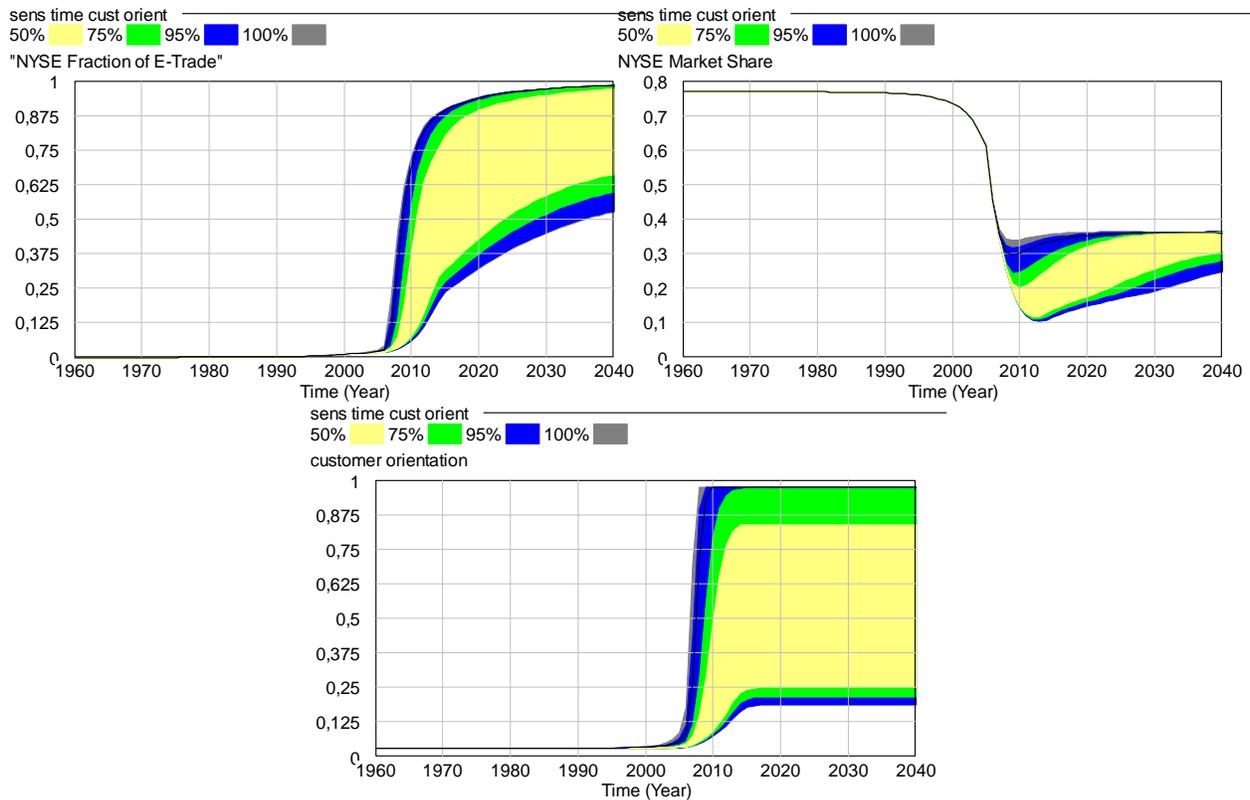


Figure 21: Sensitivity for the time to change customer orientation

The sensitivity analyses for the management's general openness to change and for its responsiveness of customer orientation supports the impact of the management and the organization on the implementation of electronic trading. The graphs show that the shift towards e-trade could have happened somewhat faster had the organization been more reactive. The implementation could also have gone much slower if the organization had been more rigid in its implementation time and its reaction of customer orientation to market share. Thus, the management turns out to be a crucial factor when it comes to the implementation of electronic trading.

The examples so far concerned the effect of changes in a single or a few variables on the implementation of electronic trading; it will be interesting to see what possibilities combined effects open up. Figure 22 shows a sensitivity analysis for a simultaneous random change of all the variables discussed above in the sensitivity analysis.

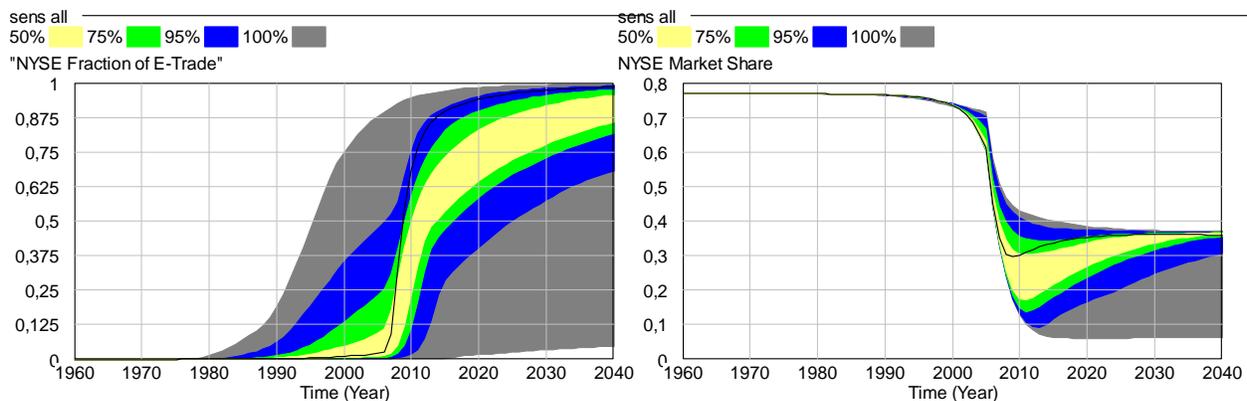


Figure 22: Sensitivity for all

The upper left graph of Figure 22 makes it obvious that the history and the future of the New York Stock Exchange could well have been different. The Exchange could only in very extreme cases have inhibited the shift to electronic trading forever, but the extent to which it got implemented could have been different. On the other hand, automated trading could also have been implemented in the 1990s already. The differences arise from variations in the pressure for and against automation, how vigorously the stakeholder groups pressure for their aims and how powerful their pressure is. Different setups in the management can also lead to different trajectories. As the market share graph of Figure 22 indicates, these different theoretical possibilities lead in different positions of the New York Stock Exchange in the market so that different futures would have been possible.

7 Conclusions

7.1 Insights from the Modeling Process

The analysis reveals that the course of events in the implementation of electronic trading at the New York Stock Exchange could well have been different. It shows that specialists, floor brokers and non-institutional customers were successful at delaying the adaptation process by continuing to pressure for the traditional system. It also shows that, had the floor firms been more cohesive and/or had their cultural pressure and power been higher, the pressure for the old system would have been fiercer.

The model analysis also demonstrates that a management which even in times of performance crisis does not direct its attention to customers could have been a strong force for a further delay in e-trade. Likewise, it was the initial situation where customer orientation was very low due to the historical importance of the floor that was the reason that the shift did not yet happen in the 1990s.

The modeling process is also able to illustrate why the changes appeared to be so radical. It was a long accumulation of pressures, e.g. from dissatisfaction, that for a long time was held up by management. Metaphorically speaking, the shift in management functioned like a valve, so that once the opportunity was apparent, these pressures got released.

Including the management decision-making into the analysis proved to be necessary. At the same time, narrowing the focus to the management only would not provide the desired results since both the environmental developments as well as the management's decisions create en-

ogenous forces like customer and stakeholder pressures that feed back to the management's subsequent decision-making.

7.2 Relationship to Organizational Change Literature

The different scenarios have shown that, on the one hand, the change towards electronic trading is an adaptation process of the New York Stock Exchange to its competitive environment. Since the technology provided for the possibility of e-trade and since there was a growth in institutional customers, automated trading finally also got implemented at the New York Stock Exchange. Without these external forces, no change in the NYSE's way of doing trading would have emerged.

Yet on the other hand, in the case of the New York Stock Exchange the rational adaptation point of view does not give the full picture and cannot explain how—i.e. at what point of time and at what pace—and why the shift to electronic trading at the NYSE really happened. This limitation is apparent in much of the organizational change literature. Therefore, multiple views as suggested by Morgan are necessary in order to provide a rich understanding of the change.¹⁰² Barnett and Carroll divide organizational change theory into adaptive and selective approaches. Whereas the adaptive point of view regards change as an adaptation to technological or environmental change, the selective point of view assumes that organizations neither change quickly nor easily.¹⁰³ Apart from this selective point of view there also exists what is called the organizational or population ecology as a theory of change. Van de Ven and Poole note that in this evolutionary theory competitive survival is the central metaphor. For them retention (including inertia and persistence) is a major force that antagonizes the variation (adaptation) loop.¹⁰⁴ The selective or evolutionary perspective bases on the assumption that organizations are inert and do not change easily. This picture fits the idea of different pressures pressing for the retention of the floor. It also matches the fact that for a very long time the NYSE management did not attend to its customers and only reacted to pressures from floor firms. Although the NYSE finally adapted, its corporate culture was well able to delay this process, thus providing evidence of retention, inertia and persistence.

Yet, as said earlier, this population ecology view does not provide us with the full picture either. Tushman and Romanelli study the evolution of organizations, and their proposal of the punctuated equilibrium fits closest to how the New York Stock Exchange evolved. A very long phase of convergence was punctuated by institutional forces, market share forces, and the management's direction to customers and resulted in radical organizational change. The initial almost exclusive attention to floor firms and the later almost exclusive attention to customers support Tushman and Romanelli's idea of performance-mediated perception bias.¹⁰⁵

Child indicates that there is room for choice to either make change happen or to let go of the opportunity.¹⁰⁶ The New York Stock Exchange seized the opportunity for electronic trading quite late, but when market share dropped, it did decide for electronic trading and against the

¹⁰² Cf. Morgan, Gareth: *Images of organization*, Thousand Oaks, California [u.a.] 1986, pp. 12-13 and 321-322.

¹⁰³ Cf. Barnett, William P. and Glenn R. Carroll: *Modeling Internal Organizational Change*, in: *Annual Review of Sociology*, Vol. 21 (1995), No. 1, p. 218.

¹⁰⁴ Cf. Van de Ven and Poole: *Explaining development and change in organizations*, 1995, p. 518.

¹⁰⁵ Cf. Tushman and Romanelli: *Organizational Evolution*, 1985

¹⁰⁶ Cf. Child: *Strategic Choice in the Analysis of Action, Structure, Organizations and Environment*, 1997; and Child: *Organizational structure, environment and performance*, 1972.

purely manual trading system. It did also decide against full automation and kept parts of its old structure in a customized way in alignment with the new trading system. This was a deliberate decision of the NYSE management that revealed high elements of choice.

Elements of all three theories are present in the New York Stock Exchange's shift to electronic trading. It is the element of choice as discussed above, but overall it is also an adaptation process to what the competitive environment that paved the way to which the NYSE finally but deliberately followed suit. Organizational decline due to the high inertia would have well been another possible path that also many researchers and industry experts assumed the NYSE would take. Thus rational adaptation, population ecology with its assumption of organizational inertia and environmental selection, punctuated equilibrium theory and strategic choice are not that far apart as some researchers suggest. It is important to note that the management view alone also does not explain the changes. The adaptation view, culture and resistance view plus the management view have to be applied simultaneously to make sense of the seemingly radical shift to electronic trading by the New York Stock Exchange. As Morgan points out, each new perspective adds a little different understanding, thus leading to a more complete picture.¹⁰⁷ It is their combination gives the full picture of the dynamics of how the changes unfolded.

The modular build-up of the model that first included elements of the rational adaptation perspective only and was then extended with elements of culture and resistance and finally with elements of management inertia and choice reveals the importance of all of these elements for the explanation of how change came about at the NYSE. But then the sensitivity analyses show that an instantaneous adoption of electronic trading or the maintenance of the floor would theoretically have been possible if the participants had made different decisions. This is consistent with the findings of Sastry who also in a system dynamics model analyzes the differences of the adaptive decision-making literature, the population ecology perspective, and the punctuated equilibrium theory. She also comes to the conclusion that all three theories can be modeled by different assumptions about parameters. The analysis of the case study of the New York Stock Exchange additionally points out that not only parameter changes create these different behaviors, but that parameters have an influence on loop dominance and can put loops as well as whole model sectors out of action. This suggests that different behaviors in the case study involve different boundaries of the model. This further confirms that different organization theories to a great extent differ by their boundaries, i.e. the assumption what needs to be included and excluded in their analysis.

7.3 Limitations and Future Research

This analysis is still limited by several factors concerning the model. First, technological developments are presented as an s-shaped development. This bases on developments of other technologies, e.g. like the mobile phone market, but it could not be grounded in real data. Second, the factors that determine market share are limited to three: relative speed, relative spread, and market quality from the specialist. In the literature, market quality is an important concept, but definitions of what factors market quality includes differ. Others include prices and speed, but these were modeled as separate influencing factors of market share. Third, the implementation of electronic trading always also involves a capacity decision, and it would thus be advisable to actually model the capacity development of floor and e-trades. This part was left out since the fraction of

¹⁰⁷ Cf. Morgan: Images of organization, 1997, pp. 12-13 and 321-322.

electronic trading also illustrates the changes, but including capacity could be included as a further model and behavior test because it could be compared with NYSE data. Forth, concerning the implementation of electronic trading at the NYSE the effects that change may have on experience was not modeled. Since manual trading that involves human experience was replaced by a computer that took over their task, it was assumed to be of minor importance only and completely left outside the model boundary.

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