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Declaration of Authenticity

I confirm to have conceived and written this paper in English all by myself. Quotations from other authors are all clearly marked and acknowledged in the bibliographical references either in footnotes or within the text. Any ideas borrowed and/or passages paraphrased from the works of other authors are truthfully acknowledged and identified in the footnotes.

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New York, 2012

Michael Orantes

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Information Technology: Effects on the Organization and its Structure

1 Introduction

The past thirty years have seen incredible growth in the availability and use of modern information technologies in organizations. Though information technology (IT) - more recently referred to also as information and communication technology (ICT) - is not at all a product of just the past three decades, this period has seen enormous evolution in not only the technologies themselves, but also in their integration into our organizational and everyday lives. In the past, technology was task specific, it was not distributed within the organization, and most organizational members had no access to either the technology or its outputs. Today however, technology is widespread throughout the organization, from the Chairman's office to the mailroom, in production, HR and logistics - no area of the organization remains untouched, and the organization's information is virtually ubiquitous.

> *I/T is transcending its traditional "back office" role and is evolving toward a "strategic" role with the potential not only to support chosen business strategies, but also to shape new business strategies.*
> Henderson and Venkatraman (1999, 472)

IT has truly entered its way into a more strategic role in the organization. In their introduction to an *Organization Science* Special Issue, Zammuto, et al. (2007) note the dichotomy between real world information technology trends, in the recent era, and academic research on ITs relationship with Organization Studies:

> *While the field's* [Organization Studies'] *interest in the relationship between technology and organization declined, IT's penetration of everyday life and the world of organizations increased dramatically. Consider the simple fact that Internet hosts [...] grew from 9,472,000 in January 1996 to 394,991,609 in January 2006.* (750)

Zammuto, et al. go on to ask the question: If there is such a dichotomy, don't researchers run the risk of 'becoming irrelevant' (750) if they are not studying actual or emerging conditions?

This is not the first time this disparity has been exposed. In 1991 Gurbaxani and Whang noted similarly, from the economic view (as an example), that

> *While the importance of the relationship between information technology and organizational change is evidenced by the considerable literature on the subject, there is a lack of comprehensive analysis of these issues from the economic perspective.* (59)

It is clear that, though elements of this topic have been widely studied, there is still no basic agreement as to how to address IT and Organization. Each researcher tends to treat this relationship differently.

In 2001 Orlikowski and Barley contributed their opinion that Organization Science (OS) and IT research should not be separated on departmental lines, but rather researchers should work in concert:

> *Although there are important differences between IT an OS […], the boundary between the two has long been fuzzy. IT an OS are difficult to separate, in part, because many IT researchers were originally trained as organizational scholars and others who were not so trained have been strongly influenced by the organization studies' literature.* (146)

Orlikowski and Barley (2001) go on to propose that, although there is an overlap between the two fields, the relationship should be explored by both disciplines. From the Organization Studies' perspective,

> *most organizational theories have conceptualized technology abstractly, have treated it deterministically (often as a material cause), and have*

> *largely ignored the role of human agency in shaping either design or the use of technology.* (147)

Although it is not completely agreed upon that agency (human or technical) should be studied in connection with IT and organization, it has been presented as an area with possibilities for study and will be reviewed.

In researching this topic it has become clear that though (information) technologies and organizations have existed for millennia, there has been a lack of understanding as to how the relationship between the two should be treated. Thus there is a collection of research that is still struggling not only to coexist, but also to bridge the divide between anecdotal evidence, actual conditions and theoretical research on Information Technology and the Organization.

Orlikowski (2000), a presence in this area of study, argues that there is still little agreement as to what should be studied. She questions how IT should be treated in the literature and how much impact study in one field, Organization Studies, has on the other, IT Studies, and vice-versa. Thus, not only do Organization Studies researchers disagree, so too do IT researchers.

After so much time it would seem to be more relevant to be moving on to new topics dealing with specific information technologies, new innovations, or do testing on specific affects of said information technologies. And although this is the case to a certain degree, before moving on to boutique-like topics in this area, it would seem necessary to address the basics of the relationship between IT and Organization Studies.

> *When anything changes by several orders of magnitude--as the costs and capabilities of information technology have in the past three decades--it is not unreasonable to expect radical changes in other parts of the systems in which the factor that has changed is embedded. In other words we should not expect people and organizations to just continue doing the same old things a little faster or less expensively using new technology. Instead we*

> *should expect, in some cases at least, to find people doing very different things or doing the same old things in very different ways.*
> Malone (1985, 4)

In addition to the fact that technology and organizations are becoming increasingly intertwined, there is the fact that technology over this time period has not remained static, that is, (information) technology has evolved at very high rates, and thus the technologies studied in the 70s, 80s and 90s are today either far removed from their original versions and functions or no longer existent, replaced by completely different technologies. The amount to which technology is integrated into the everyday life of the organization and the individual worker (at all hierarchical levels) is very different today from what it was thirty years ago. Thus there is an increased importance of understanding the dynamics of this relationship.

1.1 Thesis Goals

This paper strives to review past and present research in order to give a 'state of the research' review and to show that several theses have held and continue to hold true:

1. *Information Technology is an enabler rather than an agent of change in the organization structure*

Although early literature was focused on the idea that greater information would cause a transition in the organizational form (e.g. Pfeffer and Leblebici, 1977), more recent literature is now suggesting that this may not be the case. Rather that IT enables strategic changes to be effected.

2. *Information Technology can be used to support any organizational form*

Some researchers are finding that IT can support any organizational form, while doing so at lower cost (Picot, 2008). The form that an organization takes is more a product of either choice or other contextual factors than that of the implementation of IT. IT however has expanded the pool of potential actions available to decision makers.

3. Information Technology enables organizations to expand globally

Although this has less to do with pure structure, IT has enabled organizations to adopt structures better able to yield themselves to global enterprises (Boudreau, 1998). In the past this may have only been possible when revenues or assets would cover the cost of a large organization, however today due to decreases in IT cost and reach, global expansion has taken new forms. An organization no longer needs to be large/well leveraged in order to be active/successful in a global environment.

1.2 Research Method

Several methods have been used in order to achieve this thesis' goals:

1. A survey of journal articles from a variety of academic fields including Sociology, Organization Studies, Management Studies and Decision Sciences has been undertaken. These journals include the *Academy of Management Journal*, *Administrative Science Quarterly*, the *American Sociological Review*, *Journal of Management Information Systems*, *MIS Quarterly*, etc.
2. A comprehensive study of leading Organization Science literature from varied authors, such as Daft, Galbraith, Hatch, etc.

Several criteria were used in order to select the specific papers referenced:

- Relevance to the topic
- Publication date
- Number of times referenced

1.3 Structure of the Paper

The second section of this paper addresses Organization, its Structure and other related concepts. The third section discusses technology and its history, with a special focus on Information Technology and networks.

> *Given that today IT has become a primary means of managing and reducing the uncertainties surrounding production and administrative processes* [sic.!] *we see technology and IT as inextricably linked.*
> Dewitt (2001, 315)

The fourth section describes past and current theories on Information Technology and Organization Structure and how they are linked. The fifth section begins a discussion on the hypotheses above and the final section addresses emerging issues in Information Technology and makes an appeal for additional research.

2 Organization

> *Gradually, theorists began to view organizations as systems in dynamic interaction with their environments (Haberstroh, 1965; Thompson, 1967) and the term 'design' came to refer to the practice of building effective organizations (Thompson, 1966).*
>
> Burton, et al. (2006)

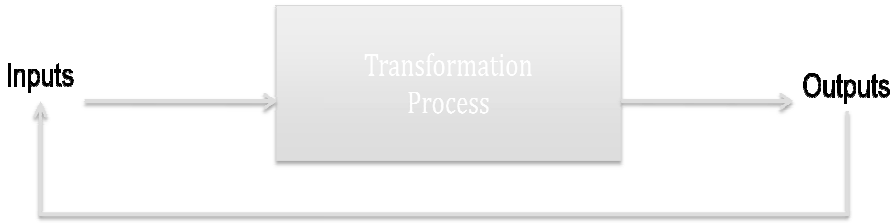

Figure 1 - The organization as a system of inputs, processes and outputs[1]

The organization has many definitions depending on context, however organization science views the organization as a system with input and outputs.

Daft (2004), one of the premier organization scientists, defines organizations as

> *(1) social entities that (2) are goal-directed, (3) are designed as deliberately structured and coordinated activity systems, and (4) are linked to the external environment.* (11)

That is, an organization is inherently collaborative in that there must be multiple actors, acting under some plan, adapting and interacting with to forces outside of their control.

Today the word 'organization' in the English language has become almost synonymous with the words 'company' or 'firm', which is not exactly the definition in this area of research. In the academic definition above there is no mention of which goals must be in order to be an organization (e.g. for profit),

[1] Source: Adapted from Daft (2004)

nor is there any mention of a need for an official status (i.e. legal status). Thus, an organization could be as simple as two people coming together with a specific goal, like buying a car, who create a plan of action to achieve this goal. For the purpose of this paper, however, organizations in the more colloquial sense will be addressed, that is long term, goal-directed organizations such as IBM, Siemens or the United Nations.

2.1 Why establish organizations?

Why organize? This is a question addressed early in the Organization Literature. The argument against multi-person organizations has to do with efficiency: in a perfect market with perfect information there would be no need to create large entities, rather a marketplace full of individual actors partnering for specific projects would be the most effective way of transacting business, etc. But we do organize, so the answer as to why we do, must be that in the present market it is not always most efficient to use the market (or perhaps no market exists); rather, in some cases, it is more efficient to perform some functions internally (e.g. Accounting, etc.).

Coase (1937) and Williamson (in his works on TCE in the 1980s and 1990s) defined the costs of coordinating some economic activity, whether a task is internal or external, as a 'Transaction Cost'. One may decide to perform these functions either internally or externally based on a comparison of these costs. This cost was defined as pertaining to one of three separate categories: Search and information costs, Bargaining and contract costs, and Enforcement costs. This drive toward the most effective and efficient method of transacting is a strong focus in Organization Studies.

> *[T]ransaction cost economics approaches firm and market organization from an efficient contracting/comparative organizational perspective. […] Whether a firm makes or buys–that is, produces for its own needs or procures a good or service from an outside supplier–turns largely on the transaction costs of managing the transaction in the firm, as compared with mediating the transaction through markets.* Williamson (1996, 25)

2.1.1 The information processing view of the organization

The challenge of the organization can be seen as one of information processing, the idea that one of the main functions of an organization is the efficient processing of information in order to make better decisions for each task. A basic goal of this school of thought is to eliminate task uncertainty, which can be defined as, 'the difference between the amount of information required to perform the task and the amount of information already possessed by the organization'. (Galbraith, 1973, 5 from Dibrell and Miller, 2002, 621) It is clear how from an information processing perspective, the idea that IT could enable more effective decision-making as well as efficiency gains through either speed or accuracy is very attractive to decision makers.

Dibrell and Miller (2002) go on to describe Perrow's (1967) analysis that tasks invariably have two dimensions: variety and analyzability – these are measured in terms of degrees. 'If a task has low variety and high analyzability, it can be considered a routine task' (Dibrell and Miller, 2002, 621). The goal of the organization, of course, is to identify its task environment and adequately structure itself to account for uncertainty. However, in the organization there are always non-routine tasks, such as different development activities (e.g. R&D, Software). Thus, an organization will always be on the lookout for methods to manage or mitigate the low-analyzability in non-routine tasks. IT has been looked to as a means to fulfill this role. (Dibrell and Miller, 2002, 622)

2.1.2 On Agency

When looking into this idea of the most efficient/effective way of transacting, we stumble upon the topic of Agency, namely, the study of how to effectively and efficiently incent an operator's behavior upon the allocation of decision rights (i.e. how does one incent an agent to perform a function as prescribed) (Milgrom and Roberts, 1992). Under agency rules, an individual allocates some decision right on a subordinate. This is generally done through a contract (e.g. employment or partnership contracts).

> *Agency theory broadened this risk-sharing literature to include the so-called agency problem that occurs when cooperating parties have different goals and division of labor.* Eisenhardt (1989, 58)

There are several key questions to be addressed when dealing with agency, namely how to ensure proper action by the agent and mitigating conflicts of interest between the two.

> *Agency theory is concerned with resolving two problems that can occur in agency relationships. The first is the agency problem that arises when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing.* Eisenhardt (1989, 58)

Generally this theory is used when addressing contracts between employers and employees or between contracting organizations. However, as will be described later, this relationship has been extended to address the problems which arise when anticipated and actual actions upon IT implementation differ.

In order to understand the organization and its structure, it is necessary to understand the factors that influence it. To do so the following sections address several elements used to measure the organization.

2.2 The Organization: Contextual Factors

Organization Studies describe the internal environment of the organization through the degree of influence of several specific factors, those being: Size, Environment, Strategy/Goals/Mission, Culture, and Technology (Daft, 2004; Hatch, 2006). As wells as some internal factors: Formalization, Specialization, etc. to be described in the next section. The combination and constellation of these factors creates the specific organization.

Though this thesis focuses specifically on the two factors - technology and structure - it is important to understand that there are additional forces at work

within organizations. Many of these relationships have already been studied, as proven by the existing literature, for example: size and structure (e.g. Lal, 1991), structure and culture (e.g. Bate, et al. 2000), effects from the external environment (e.g. Buenger, et al., 1996), etc. One important aspect of using these measures is that there are many ways to define each. Each researcher may mean something different when referring to 'size' for example. For this reason it is important to explicitly define how the specific factor is measured at the outset in order to have robust research.

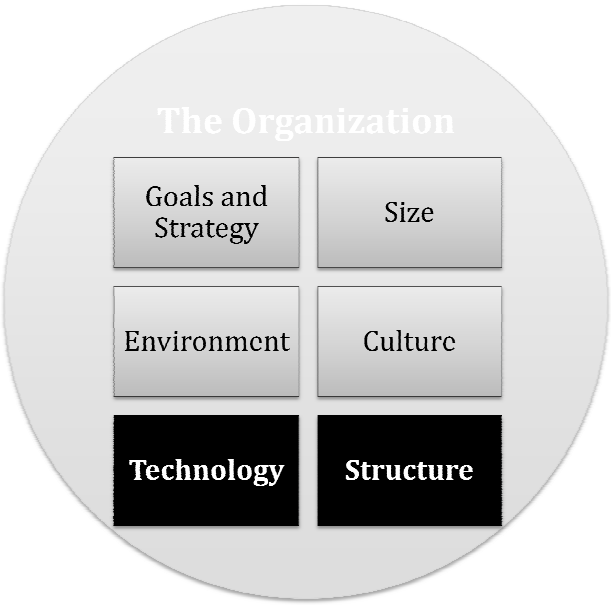

Figure 2 - The Organization and its elements[2]

The following sections will discuss some of the specifics of each of these contextual factors and go into detail regarding Technology and Structure.

2.2.1 Size

Size has been used quite often (e.g. Ettlie, et al. 1984) as a measure in organizational literature. And as we will see later, it is used as a measure when addressing the topic of IT. When looking at size as a contextual factor describing the organization, academics have used several measures, including: sales volume, number of downstream partners, net assets, as well as number of

[2] Source: Adapted from Vetschera lecture slides

members or participants (e.g. employees) (Daft, 2004). Physical capacities, volume of inputs or outputs, as well as discretionary resources have also been used. Size is probably one of the most ambiguous measures of the firm, and researchers have tended to create individual measures. Thus, at times it is difficult to compare research focused on size, though researchers have found correlations between the different factors.

2.2.2 Environment

Environment or external environment refers to forces not directly influenced by the organization (Daft, 2004). Key is that these forces are present and not controllable. Most of the time this factor is measured by its degree of stability: Is the environment of the organization subject to a high or low rate of stability and/or change? Some environmental influences on the organization include: Clients and customers, complexity, competitors, suppliers, government and regulatory agencies, etc.

2.2.3 Strategy/Goals/Mission

Strategy, goals and mission are 'factors which define the purpose of organizational existence.' (Brodar, et al., 2009, 245) They are the agreed upon ends and priorities toward which the organization is striving, and they can be seen in mission statements, strategic directions, letters to shareholders, etc. There is no requirement that they be written down, thus at times there may be a conflict between stated and latent goals and strategies in the organization. This can cause the organization's members to work against the stated goals.

As an example the Defender Strategy strives for organizational stability and as such utilizes high division of labor, formalization and is highly centralized; whereas the Analyzer looks for more flexibility with less centralization and looser control over new projects. These descriptions will be further explained in section 2.3.

2.2.4 Culture

According to Edgar Schein (1990) from his work from the 1980s, the values and beliefs shared by members in the organization are generally referred to as organizational culture. There are three elements of culture generally referred to in the literature: Artifacts (observable: technology, art and visible behavior), values (non-observable: stated versus operational), and assumptions (non-observable, deepest held).

Culture can also relate to IT, though this will not be directly addressed in this research. There have been studies on how open an organizational culture is to the introduction of new technologies (e.g. IT), as well as studies on how the introduction of IT influences culture (Liker, et al. 1999). The figure below shows how the different elements of culture fit together, and how they are visible to the outside: Generally only artifacts are visible to non-organizational members, while values and assumptions are only internally apparent.

Figure 3 – Schein's culture model[3]

2.2.5 Technology

Technology as a contextual element refers to the means and the tools through which the organization attempts to achieve its goals (e.g. convert inputs into outputs, Brodar, et. al, 2009). This does not refer specifically to technology in the common usage (e.g. assembly line, manufacturing technology, IT), though it does include them, but refers to the unique combination of tools/practices used to

[3] From http://agelesslearner.com/intros/elc.html

complete organizational tasks such as: accounting practices, finance tactics as well as other mechanisms. Information Technology, the focus of this paper, can be regarded as a part of this contextual factor. Generally this is a difficult factor to compare between organizations, as it is challenging to contrast technologies which either evolved out of or were implemented into different environments. Different researchers have used different types of technologies in their research on Organizations such as Manufacturing Technologies, Innovation Technologies, and Information Technologies and have also proposed ways in which to categorize these technologies and their sub groups. Technology will be further addressed in a later section.

2.3 The Organization: Structural Dimensions

According to Galbraith (2002, 11), the structural dimensions of the organization '[determine] the placement of power and authority in the organization.' Most researchers (Daft, Galbraith, etc.) agree the on the following dimensions (some argue that there are more e.g. work organization, professionalism): Formalization, Specialization, Standardization, Configuration (Levels of Hierarchy, Personnel Ratios), Centralization, and Coordination.

2.3.1 Formalization

'Formalization denotes the extent to which rules, procedures, instructions, and communications are written.' (Pugh, 1968, 75). Simply put, how much organizational information is written down, and how much is not. Formalization deals with the following questions: Do organizational members carry out their roles based on written procedures, are the procedures 'known' but not written, or do individuals have a degree of freedom in completing tasks? Is strategy written, or is it more informal? This dimension can include goals and mission statements, strategies and tactics, standard operating procedures, job roles and responsibilities, etc. 'Fundamentally, formalization speaks to the desire for less ambiguity and more efficiency.' (Dewett, 2001, 329)

2.3.2 Standardization

> *Standardization of procedures is a basic aspect of organizational structure, and in Weber's terms would distinguish bureaucratic and traditional organizations from charismatic ones. […] A procedure is taken to be an event that has regularity of occurrence and is legitimized by the organization. There are rules or definitions that purport to cover all circumstances and that apply invariably.*
> Pugh (1968, 74)

Standardization deals specifically with the amount to which specific tasks are regular and repeatable. In a standardized work setting there is little need for specialists as tasks are relatively predictable and explainable.

2.3.3 Specialization

According to Pugh, et al. (1968)

> *Specialization is concerned with the division of labor within the organization, the distribution of duties among a number of positions. […] A second aspect of specialization is the extent to which specialist roles exist within each of the sixteen functional specializations, that is, role specialization.* (72)

Pugh here is referring to 16 categories of specialized functions he developed, for example (with updated terminology): Public relations, Advertizing, Human Resources, Accounting, Finance, etc.

The literature refers to Specialization and the degree to which specialties such as those above - the list has changed since Pugh's article - are autonomous to the others. Questions such as the following are used to determine the degree of Specialization: Are divisions responsible solely for customer marketing or for advertising and public relations as well? Do individual workers have broad undefined roles, or are they responsible for a specific well-defined role?

In general, the greater the number of specialties, the better the subtask performance. But specialization also makes it difficult integrate subtasks into the performance of the whole task.

Galbraith (2002, 18)

2.3.4 Configuration

Configuration is the 'shape' of the role structure. Its data would be contained in a comprehensive and detailed organization chart that included literally every role in the organization.

Pugh (1968, 78)

In order to map configuration one looks at both levels of hierarchy and span of control as described in the following subchapters.

2.3.4.1 Levels of hierarchy

This structural dimension seeks to understand how many personnel levels there are between the bottom-most employee and the top-most, or 'the extent of authority levels (Weber, 1946)' (Travica, 1999). How this can be measured in an organization can vary. Some organizations assign numbers to their employees denoting their level. Some organizations give codes to each position in order to denote its place in the organization, for example the United Nations uses a civil service numbering system with three categories and multiple levels: General Staff (G1-G7), Professional Staff (P1-P5) and Diplomatic Staff (D1-D2)[4]. The easiest way to understand this is through a simple tree level hierarchy: Level One – CEO and directors, Level Two - Management Level, Level Three – General Workers. Different organizational forms have differing amounts of hierarchy, some with very few levels (flat structures) and some with many (hierarchical).

2.3.4.2 Span of control / Personnel ratios

Span of control refers to how much area is under the control a specific manager has in his or her area (e.g. how many subordinates a manager has). This can be

[4] Source: http://www.un.org/depts/OHRM/ - August 2011

measured by looking at whether the manager has few or many subordinates, or manages one or multiple teams/groups, etc.

2.3.5 Centralization/Delegation

> *Centralization has to do with the locus of authority to make decisions affecting the organization. Authority to make decisions was defined and ascertained by asking, 'Who is the last person whose assent must be obtained before legitimate action is taken even if others have subsequently to confirm the decision?'.*
>
> Pugh (1968, 76)

Centralization deals with how decisions are made. Researchers ask questions such as: Are decision rights distributed to lower level workers, or do management or executives have to make decisions? Centralization may be measured based on several factors: the number of decisions made, the importance or impact of these decisions, and/or the autonomy connected to these decisions.

Pugh (1968) created a paradigm to work with describing levels of hierarchy in different industries:

		Examples		
Score	Level	Metal manufacturer	Chain of retail shoe repair shops	Local education department
5	Above chief executive	Board of group	–	City council
4	Whole organization	Managing director	Chairman	Chief education officer
3	All workflow activities	Production manager	Sales manager	Assistant education officer
2	Workflow subunit	Plant manager	Area manager	Headmaster
1	Supervisory	Foreman	Shop manager	Head of department
0	Operating	Direct worker	Repairer	Teacher

Figure 4 - Centralization: Levels in the hierarchy[5]

[5] Source: Pugh, 1968, 77

2.3.6 Coordination

Coordination refers to the amount and types of interactions within the organization. Mintzberg (1979) identified six coordination mechanisms: mutual adjustment, direct supervision, standardization of work processes, standardization of outputs, standardization of skills and knowledge, and standardization of norms.

Malone believes coordination is 'the management of dependencies among independent activities'. Coordination can occur through many methods, for example: personal (e.g. liaison roles)/impersonal coordination (e.g. control systems, policies and procedures), lateral/vertical linkages, through procedures plans and schedules.

2.3.7 Theoretical Organizational Structures

2.3.7.1 Functional

Functional structures are perhaps most pervasive known in small to medium sized organizations. These structures create specific working groups out of common functions such as Human Resources, Finance, Sales and Marketing, Product Development and Research, etc. (Stanford, 2005). It is generally best for companies with a single product/service line.

For companies choosing this structure there are several advantages,

> *[f]irst, gathering together all employees of one type […] allows them to transfer ideas, knowledge, and contracts among themselves. Second, it allows them to achieve a greater level of specialization. […] Third, […] pooling the workers allows the company to present a single face to vendors and exercise buying leverage. Fourth, […] the company can afford to buy an expensive piece of test equipment and share it along product lines.*
>
> Galbraith (2002, 23)

Galbraith sums up his description by outlining the ability to scale and specialize departments as well as the ability to reduce duplication of functions.

This, however, is not the best choice when a company has a variety of products, services, customers and/or channel partners. 'This kind of variety overwhelms the decision-making capacity of the general manager and the functional leadership team.' (Galbraith, 2002, 24)

2.3.7.2 Process

This type of organization traditionally is focused on efficiency in the processing of its resources. Thus 'processes cut across an organization and represent the flow and transformation of information, decisions, materials, or resources to serve customers'. (Galbraith, 2002, 32) Generally such organizations place a high degree of value on efficiency. One could say that Ford's assembly line setup when constructing the Model T was such a system. Value was placed on speed and output.

2.3.7.3 Product, Market, Geographical

These structures focus on one (or more) of the three areas in an attempt to get closer to their customers. Functional roles such as Human Resources and Finance are either shared among the division or are integrated as parts of the divisions. Each division focuses on its product/service line in order to best serve their customers. The drawback, of course, is the replication of roles and responsibilities among the divisions as they operate with some degree of autonomy. (Galbraith, 2002)

> *The biggest challenge of the product structure comes from customers who buy from more than one product division. […] [T]oday customers want sourcing relationships, solutions rather than standalone products, […] a single point of contact, and one invoice.*
> Galbraith (2002, 27)

To that end, today we see hybrids of this form where the sales or consulting organization is responsible for creating a single point of contact for global/important accounts in order to better service their most important customers.

2.3.7.4 Matrix

The Matrix Organization seeks to combine both the Functional and the Product Structures. This is done through the reporting structure. Each member reports to both a functional manager for their function, e.g. Operations, Sales, Marketing, Finance and Human Resources (etc.) questions, and to a product manager for their product/service line. (Stanford, 2005) This can lead to conflicts relating to allegiances and work/resource distribution.

2.3.7.5 Boundaryless, Virtual or Network[6]

This organizational form does not adhere to any specific structure. It takes on the roles and requirements needed for task completion, but is not bound to keep any structure. It is a loosely related set of autonomous (and sometimes legally unassociated) teams or units that come together to complete specific projects. There may be an organizational core and strategy, but no clear definition in terms of roles and responsibilities.

2.4 Theories on Organizing

2.4.1 Bureaucracy

Max Weber (late 19th and early 20th centuries)[7] believed that the best way to organize would be a highly planned bureaucratic management system. Such a system, he believed, would create efficiencies. A bureaucracy, quickly described, is a system with a clear hierarchy of roles and responsibilities for the organizational members, with clear specialties and clear rules governing practices and decision-making.

2.4.2 Scientific Management

Fredrick Winslow Taylor (early 20th century) believed that the proper way to manage an organization was to create sets of highly specialized tasks to be performed by organizational members. By removing ambiguity from a task it

[6] Source: Lecture notes – Vetschera, 2009

[7] Source: Lecture notes Betriebswirschaftssoziologie – Cyba, 2009

would be much easier to predict outcomes. This also reduced the amount of training the individual worker would require, and thus made labor cheaper (though less skilled).[8]

Taylor's (1911) four principles of Scientific Management are: Create tasks based on scientific study, scientifically select and train each worker on said task (leave no room for ambiguity), follow up on workers to ensure proper execution, divide planning and execution between managers and workers.

2.4.3 Human Relations School

The highlight of George Elton Mayo's discoveries in the Hawthorn Studies (1930s) is that workers are not motivated merely through economic means or work conditions. There are a variety of factors that influence a worker, including both intrinsic motivators such as acceptance or status, as well as extrinsic motivators such as salary, bonus or vacation days.

2.4.4 Contingency Theory

Scott (1998) summarizes Woodward and Thompson's writings on the Contingency theory:

> *Contingency theory is guided by the general orienting hypothesis that organizations whose internal features best match the demands of their environments will achieve the best adaptation.* (96)

This theory begins with the premise that there is no best way to organize. Rather, based on each organization's constellation of contextual and structural factors (as described earlier), it will choose a unique organizational structure. The job of management is to ensure that this structure indeed fits those factors. Improper fit leads to reduced efficiency and effectiveness.

[8] Source: Lecture notes Betriebswirschaftssoziologie – Cyba, 2009

2.4.5 Galbraith's Star Model 1977

In the 1960's Jay Galbraith began to develop his framework for organizational analysis commonly called the Star Model. This model identifies five main factors that an organization should consider when making design choices. These five factors are: Strategy, People, Structure, Rewards and Process. A result of the specific constellation of these factors is organizational behaviors that then translate into performance and culture.

Figure 5 - Galbraith Star Model (1977)[9]

Galbraith (2002) defines the five factors as follows:

- **Strategy** – the specific goals and objectives to be pursued, or 'the basic direction of the company' (10)
- **People** – Human resources policies and structures
- **Structure** – 'The structure of the organization determines the placement of power and authority in the organization.' (11) Structure's four areas: Specialization, Shape, Distribution of power, Departmentalization
- **Rewards** – Alignment of employee and organizational goals through the use of specific motivation tools and incentive schemes
- **Process** – The way in which information and decisions are made within the organization and how they are transmitted

[9] Source: http://www.jaygalbraith.com - 20 Aug 2011

Galbraith has published his findings from over the years on JayGalbraith.com where he identifies several specific implications of this framework:

1. Organization design is more than just structure
2. Different strategies lead to different organizations
3. For an organization to be effective, all the policies must be aligned with one another

3 Information Technology

'The simplest definition of IT is one word: algorithm.' (Eischen, 2000, 9) An algorithm is a set of directions solving a problem or accomplishing some task. Information Technology, according to Eischen, stems from the study of logic by Aristotle and the later mainstreaming of algorithms by Leibniz in the 17th century. In his paper *Information Technology: History, Practice and Implications for Development*, Eischen (2000) further tells us that Leibniz believed the world could be modeled based on algorithms.

> *As such, real-world processes could be mapped using mathematical symbols, if the underlying algorithms could be identified. This opened the theoretical possibility of modeling both the social processes of bureaucracies and the basic sequence of DNA, among others, as mathematical abstractions.* (9)

Information Technology is '[t]he technology involved with the transmission and storage of information, especially the development, installation, implementation, and management of computer systems within companies, universities, and other organizations.' (American Heritage Science Dictionary, Reference: 'Information Technology')

Eischen (2000) describes how the increased processing needs during the Industrial Revolution along with the high degree of human processing error first created the 'need' for mechanized computational devices. However, it would not be until the end of the 19th century that an actual computational device would be widespread, despite earlier devices e.g. the Pascal line was developed in the 1600s, 'Herman Hollerith developed a mechanical system for processing census data that was implemented in the US in 1890.' (10) Hollerith later established the Tabulating Machine Company the precursor to IBM (Eichen). According to Eischen, during this period machines processed data rather than modifying or creating new data. E.g. placed data into reports or into storage rather than doing analytics and prognoses based on the data. Today we could separate these distinctions into two areas:

(1) Processing basic data such as inputting, organizing, storage and retrieval.
(2) Advanced functions such as data transformation – aggregation, validation, summarization.

This may be the birth of mechanized computation, however the basis of computational, communications and storage systems can be traced back to ancient times. We may think of a computer as the basis of IT, but what is a computer? It is nothing more than a device that can make computations through the use of algorithms and store their results. In fact the earliest modern computers did not in fact store the data internally, but rather on punch cards, externally. Users did not read results on screen but rather on blocks of paper printouts.

The following sections will go into greater detail on information, the history of technology and IT, as well as dealing with IT and the organization.

3.1 What is Information?

What is information and why is it important when studying the organization? Webster defines information as 'the communication or reception of knowledge or intelligence'. This definition clearly tells us that information deals with knowledge and that unshared information may not actually be information. Picot, et al. (2008) identify several characteristics of information:

- *Information is an immaterial good that is not consumed after multiple uses.*
- *Information is consumed and transported via media – if required – at the speed of light.*
- *Information is transmitted in an encoded format and requires common standards to be understood.*
- *Information reduces uncertainty, yet its own production and utilization are tainted by uncertainty.*
- *Information is compressible and yet expands during utilization.* (51)

Picot, et al. also discuss the production of information and identify two separate processes: 'new' and 're-production' (51). This was briefly touched upon earlier,

new data is information not previously captured digitally, newly inputted into a system. Re-production is old data either modified, or reused for new functions. Note however that there is no mention of information spoilage. They note that although IT has vastly reduced the cost of transmission and re-production of information, the cost of new production of information remains high. However, even today, we can see that the IT companies are delving into ways to create new information more cheaply and to codify previously untapped sources of information like tacit information (collaboration suites).

One issue with information as a raw material in an economic context, as with any input, is that one must weigh the utility of the information with the cost of acquisition. Optimal is when the value of information is equal or grater than the cost of acquisition. The reduction of search and identification cost is one of the reasons organizations look to IT.

3.2 History of Information Technology[10]

Computers and technology were born with the invention of organized language, alphabet and writing, from the simplest cuneiform languages to the complex languages of today around 20,000 B.C. Input technology began with the invention of carving onto stone, or writing onto papyrus, while storage technologies started as libraries of these carvings and books. Calculation devices (perhaps the earliest mobile devices) can be seen in the form of the abacus (around 3500 B.C.). Storage technologies began around 290 B.C. when libraries began to emerge.

Technology and IT has always existed in organized societies, and thus we should acknowledge, that while perhaps the number of data has increased, the drive and ingenuity to organize and process information is much older. Of course today's technologies are much more complicated using circuits, wiring and chipsets, however, their basic functions remain the same.

[10] Dates and timeline in this section are provided by Reily (2003) as well as Eichen (2000)

3.2.1 Hardware

The move toward more complex devices emerged in the 1400s to 1600s with the first computing machines such as Gutenberg's printing press (around 1450) and Leiniz's counting machine (1673). Loom technology and agricultural technology also became more complicated.

Modern IT began to emerge in the 1800s. Communication and transmission technologies boomed. Inventions and innovations like Morse code (1835), the telegraph (1844), AC electricity transmission and distribution (1886), and radio (1901) were discovered; all of which are key precursors to many of today's technologies.

Following these came the development of actual computers, first through punch card computing, then paper tape computing and later through vacuum tubes.

The 1900s saw the introduction of storage in computers as well as a monumental increase in the speed and volume of items processed. It also saw the inventions of circuits, transistors, semiconductors and software.

'I think there is a world market for maybe five computers.' A quote attributed to Thomas J Watson, founder of IBM (though may be a false quote).

By the 1970s a computer no longer filled rooms, but rather could be placed on a desk (1972). There was still the need for large processing rooms for large batch processing, but the computer had taken a step in the direction of personal computing.

By the 1980s both Apple Computers (1977) and other manufacturers had developed Personal Computers (PCs) and were running versions of software called operating systems, first developed in 1958, the most famous of which is Windows. Other software programs were also developed and designed to operate within these OS environments.

Large computers, 'servers' continued to exist, however, these were primarily relegated to processing, analysis and storage functions, while PCs were used as the primary input and output devices. There are several constellations which have been used over time when it comes to the server/PC model, but this discussion is more related to a study of actual implementations of hardware in organizations.

As the PC became more ubiquitous, portable computers (laptops) became a business standard. And within the last five years portable (mobile) devices are beginning to once again force a market shift. The introduction of these devices has changed the software landscape as well as the telecommunications landscape. A discussion on mobile technologies follows in the epilogue.

3.2.2 Software

On top of the hardware side, software has developed into simple and complex tools which help individuals and decision makers within organizations to complete routine and complex tasks. Business suites have been developed for codifying, manipulating and presenting data to aid in business decision-making. The ubiquity of the tools in the organization has caused the elimination of certain functions and roles within the organization and the development of others. It has also, in certain organizations, forced a shift in locus of control between different operating units and departments. Hardware was originally "hard-coded" to perform one specific task at a time, von Neumann, in his paper *First draft of a Report on the EDVAC*[11], proposed a system in which the algorithmic programming was stored versus modified through hard circuitry. The invention of this type of native software has enabled vast improvements in multitasking as well as using the same hardware to perform new before unseen tasks.

3.2.3 Networks and the Internet

One type of Information Technology has been (obviously) left out of this discussion thus far: the Internet. The Internet was a development of the early

[11] von Neumann, J. (1945). The First Draft Report on the EDVAC.

1960s and 1970s, but only came into popularity use in the late 1980s and early 1990s. The Internet consists of a set of technologies (not a single technology) based on the transmission of data over networks of computers. This transmission is generally done through the use of telecommunications standards.

The idea of a network is important in order to understand the Internet. A network refers to two or more computers connected to one another through some setup, enabled, to some degree, to share data or resources (storage, processing power, etc.). Most organizations (universities, companies, etc.) leverage a network in order to effectively manage the mountains of data their activities produce. The Internet is a set of hardware (transmission lines, routers, hubs, etc.), which enables many individual networks to connect and share with one another. This sharing can happen at variety of levels, the most commonly referred to being email and the World Wide Web. (Information based on the author's work experience at IBM.)

A history brief of the Network[12]

'Ethernet changed that equation, by enabling small clusters of workstations and, later, PCs to work together effectively.' (291)

Although mainframes were in themselves networked computers, generally they were all performing one function by the use of scheduling software. The first instance of independent networked computers was in the 1960s at ARPA, the US Department of Defense's Advanced Research Project Agency. As described above a network is a system over which information can be share between computers or between users. In early cases this was used in order for researches to share processing power, files and printers over a closed network.

[12] All dated in this section are from Ceruzzi (1998) unless otherwise noted.

According to Ceruzzi (1998) early networks were not very effective as some hardware and software (i.e. MS-DOS, Intel processors) were not well suited to support the interconnection. (293)

Early implementations of networks came in the form of Local Area Networks (LAN), and these were then connected to other LANs. (294) The drive towards large networks was then pushed by the explosion of PCs and office software during the late 80s and early 90s. (294)

This new era of networking enabled the birth of the browser and the world wide web (www) in the 1990s, a collection of LANs (public and private) managed by open software standards (TCP/IP). Originally distributed among military (.mil), education (.edu), government (.gov), commercial (.com), net-related (.net), and non-profit (.org). (296) Ceruzzi believes that the Internet has given rise to a new economy.

The Internet consists of several independent technologies File Transfer Protocol (FTP), Email and the World Wide Web (WWW). Though, FTP and file transfer were original functions and later email emerged as its own software. The WWW is a collection of hierarchical "pages" written in open standard programming languages. (299)

In 1994 Mosaic (Netscape) became the first "browser" able to effectively read and navigate the WWW pages. (303) With its success came a rush on such technology in the 1990s and 2000s. Culminating into the major browser and software package developers today: Google, Mozilla, and Microsoft, SAP. Count these among the most prominent infrastructure providers such as IBM, Cisco and Oracle.

3.3 Information Technologies in use in Today's Organization

Brodar, et al. (2009) show us that there are a four areas that ICT compliments employed today and each have specific effects on organizational 'values' (248).

(Figure 6) These areas align well with the afore mentioned selection of popular technologies installed in today's organizations e.g. CRM = workflow, ERP = horizontal/vertical communication. In his categorization (Figure 6) he shows how specific technology types (e.g. Horizontal/Vertical Communication yield specific business, in his words, values or effects. Workflow technologies enhance efficiency, effectiveness and coordination (digital documents, e-portals, etc), Horizontal communications yields flexibility and coordination effects, Vertical yields Coordination and improved decision making effects, and Automation also affects efficiency, effectiveness and coordination.

Horizontal communication	Vertical communication	Work flow	Automation
Organizational flexibility Coordination	Coordination Organizational culture Decision making	Efficiency Effectiveness Coordination	Efficiency Effectiveness Coordination

Figure 6 - System type and their business values[13]

3.4.1 Planning systems (Vertical/Horizontal Communication, workflow, automation)

Systems falling under this category have a variety of functions. For the most part they are focused on the appropriate calculation and distribution of the organization's resources. Some examples of these include production-planning systems, enterprise resource planning systems (ERP), logistical planning systems, and human resource management systems, among others. Over the past twenty years the integration of these systems has exploded for all sorts of organizations.

> *In 2003, it was estimated that 30,000 companies around the world had implemented ERPs (Mabert et al., 2003). The significance of the ERP 'industry' is such that the worldwide market for these applications grew to*

[13] Source: Brodar, et al., 2009, 248

> *US$79 billion annually by 2004 (Gefen and Ragowsky, 2005).* Grant, et al. (2006, 3)

Major suppliers of such systems are IBM Cognos, SAP, and Oracle. Trillions of dollars have been spent in order to integrate these systems into organizations. Some of these systems are all encompassing, including a complete portfolio of planning systems, while others work like an a-la-carte menu allowing organizations to choose those modules which fit their individual needs and can be added to should business needs change.

3.4.2 Customer relationship management (Horizontal communication, work flow)

Customer relationship management systems are those systems dedicated to servicing the customers. These systems may include customer information management, prospect management, customer marketing systems, and customer service systems, among others. SAP, Oracle, and Salesforce.com (among others) provide these types of solutions. These systems have enabled customer-facing employees to service ever increasing portfolios of customers without a decrease in service levels.

3.4.3 Communication and collaboration Horizontal/vertical communication, automation, work flow)

Communication and collaboration systems have become as integral to today's organizations as the CEO. These systems enable communication and collaboration between the organizational members and external partners and customers. This communication can be vertically and laterally as well as internally and externally enabled. Major providers of these systems are IBM and Microsoft. There are several key components in today's systems: Email, Telephony including Voice over IP (VOIP) and Video Calling, Chat, Forums, Blogs and Team Spaces.

Although these are just three of many IT software technologies available today, they represent a major portion of recent IT-spend. Thus are germane to this research as they explain what current IT technologies might be affecting the

organization. The epilogue briefly deals with up-and-coming technologies still in their infancy.

> *In our soon-to-be-completed technology trends survey, we are already seeing signs of increasing interest in expanding ERP systems, replacing legacy systems, and new investments in CRM, supply chain management, business intelligence, and mobility applications.* [14]

Zammuto, et al. (2007) that though there is a breadth of IT on the marketplace today, such as the examples listed above, still there are some consistent 'affordances' offered to organizations:

(1) Visualizing the entire work process – Zammuto explains how the emergence of visualizing tools and the fusion of business rules and outcomes with technology enables the creation of dashboards and real time visualization of the complete organizational process.

(2) Real-time/Flexible Product and Service Creation – Here Zummato, et al. discuss the ability through software to create when the industry has dubbed a Service Oriented Architecture (SOA). This is the ability to quickly develop or combine existing capabilities into new ones to support customer (internal or external) needs. They feel that this 'could help organizations maintain alignment in the face of constant [environmental] change. […] This affordance makes many new structures and practices possible now, and in the future promises to facilitate further possibilities.' (755)

(3) Virtual Collaboration – one of the affects of this affordance is the potential for organizations to extend their boundaries temporarily, experimentally, or permanently.' (756)

(4) Mass Collaboration – The ability to communicate many-to-many. The effect of this feature, according to the authors, is the ability to create temporary or rapid organizations such as Wikis, video collaboration sites,

[14] http://www.cloudave.com/13799/the-it-spending-recovery-and-implications-for-enterprise-software/ visited 12 Feb 2012.

etc. Again, this impacts organizational literature by enhancing the range of organizational types.

(5) Simulation/Synthetic Representation – The ability to simulate results prior to enacting changes. This affects the organization, in that the organization can simulate multiple change possibilities prior to enacting any change.

Clearly Zammuto, has seen the potential impacts IT can provide in the organization.

4 IT and its integration into the organization

As discussed in the previous section Information Technology has been a part of the organization since its earliest days. IT today consists of a wide variety of products comprised of hardware, software and services (and staff). The IT industry employs tens of millions of people worldwide and is responsible for trillions of dollars spent annually[15]. IT staff and services are provided by both external parties to the organization as well as internal staff.

IT in organizations today generally falls into several areas, integrating both software and hardware, in data storage solutions, planning systems (e.g. ERP), customer relationship systems, web portals and communication systems. All of these systems installed onto a hardware solution including storage devices, processing units, personal computers, mobile devices, and communication infrastructure (e.g. telephony, switches, etc.). All of these systems have become integral to the way that business is conducted today in a global marketplace. Additionally, in order to support the IT infrastructure in organizations, IT departments – whether internally or externally managed – have become a standard part of the company's structure.

There have been many theories as to IT's effect on the organization. Some postulated that it enabled greater centralization (Dewett, 2001); others argued that it enabled greater diversification and decentralization (Bryjolfsson, 1998). Still others stated that it enabled global expansion, while others argued that IT had none of these effects and that changes in the organization could be better described through other factors.

Additionally there is literature discussing the source of change in the organization: Does IT strategy follow structure, does IT enable structure, or do they inform one another?

[15] Gartner Says Worldwide IT Spending to Grow 4.6 Percent in 2010. http://www.gartner.com/it/page.jsp?id=1284813

On a basic level Huber (1990) identifies two groups of characteristics he believes are responsible for the changes IT effects in organizations. The first he calls 'basic characteristics' (49), these include data storage capacities, transmission capacities and processing capacities. 'Advanced information technologies, largely as a result of their digital computer component, usually provide higher levels of these basic characteristics' (49).

The second group he calls 'properties' (50), these are: Communication, Decision Aiding. These are those properties which in the end affect structural dimension. We can see the synergy between, for example, decision aiding and hierarchy. These are those properties that in the end will result in efficiency, or effectiveness. Without these basic properties of IT there would be no advantage to integrating IT into processes.

It is clear that the goal of all IT systems is to create more accurate, more complete information and to transmit and disseminate said information in an effort to create better decision making. These systems have enabled much greater information visibility at all organizational levels. Thus the pertinent question of this thesis: does this ability affect the way we organize? The following section goes into more detail on theories surrounding IT and the organization, and attempts to create some clarity on the state of the research.

4.1 Models of Information Technology and Structure

Over the past thirty years of study into the relationship between technology and structure there have been several models that emerged, attempting to explain this relationship. Researchers such as Woodward, Markus and Orlikowski have worked on trying to find robust explanations for the relationship. This section attempts to review some of the prominent theories and findings in order to form a basis for future research.

4.1.1 Early Models

In order to understand Information Technology and structure, one must first understand technology and structure. Woodward (1958) (From Daft, 2004) was

one of the first researchers to examine this topic. Her research showed that, as the complexity of production technology increased, so too did the complexity of the organization structure that surrounded it. She created a model that created three levels of technical complexity: low, moderate and high. Each of these related to a type of production: small batch, large batch and continuous production.

Though her original premise was that structure influenced performance, her findings concluded that the complexity of the organizational structure directly correlated with the related production types which she refers to as organizational technology. These findings are early examples of research identifying technology as a structural influence.

According to Travica (1999), Woodward also found that

> *[F]irms within each of these systems of production were similar in terms of the span of control of the CEO's control, the length of line of command, the ratios of managers to total personnel, the number of management levels, and management roles and functions.* (37)

Further Travica tells us that Woodward believed that the relative technical complexity dictated the type of structure adopted by the organization: large batch adopted more mechanistic rigid styles, and small batch more organic forms. (37)

Though Woodward's research focus was production technology, a similar study focused specifically on IT

> *[Ahituv, Neumann, and Zviran [1994]] examined the relationship between their [IT] typology and their categorical measurement of corporate decision making and concluded that centralization of processing is directly related to centralization of decision making. Organizations with the most centralized decision-making structure had a centralized IT structure and organizations with a decentralized IT structure had the most decentralized decision-making structure.*

Fiedler, et al. (1996, 17)

This finding is a similar finding to Woodward's study of production technology, and showcases some kind of link between IT structure and decision-making [organizational] structure. Fiedler, et al. (1996) postulated that centralization of system would correspond to centralization of organization structure. Through the use of surveys they found that three predictions were at least partially supported: a distributed structure such as a matrix would have a correspondingly distributed IT; a product focus would yield to decentralized IT, and functional structures would correspond to centralized IT. The takeaway of course is their finding that there is a correlation between IT and organization structure.

Although many studies have only studied different types of technology (e.g. Production, Information, etc.) as an organizational factor, one must not over extend the relationship. What can be taken from these studies is that research has shown some link between deployed technology and the organization and its structure. That link having been established, other researchers began to study this link further and examine more concretely the nature of this link that its implications.

In 1957 Thompson and Bates published their research into technology and organization focusing on several different industries: mining, manufacturing, hospital and university. In Thompson and Bates' view each organization was assigned a degree of goal flexibility which related directly to the adaptability of the associated technology, and the mechanization versus professionalization of the technology.

They concluded with the following findings (342-343):

- An organization whose technologies (processes, structures, etc.) are too focused on a specific goal (i.e. inflexibility) may lose its stature when competitive/replacement technologies are implemented by competition due to inflexibility.

- As the use of specialized technology in an organization increases, its flexibility to concentrate on other activities decreases.

- As technology becomes more complicated, barriers for new entrants increase. Only very large, or organizations at the edge of the technology frontier, will be able to effectively compete.

- As technology reaches the top of its innovation curve, organizations will become more reliant on specialists, partnerships and contractors, which again decrease flexibility.

- Organizations at the edge of the technology frontier will be faced with the need to continuously adjustment as current procedures and strategies may not adequately address new issues. 'Hence improvisation and constant learning will be characteristic of such organizations.' (343)

- An organization concerned with technological innovation will invest more in specialists and decrease flexibility to move into other strategic directions.

In the 1960s another study conducted by the Aston Group at the University of Birmingham in England studied the relationship between organization size, technology and structure. In this study they came to the controversial conclusion that in the presence of other contextual variables such as size or culture, technology took second place. (Aldrich, 1972) This perspective, however, has been criticized by several researchers including Aldrich (1972) and Child (1972). Aldrich (1972), in fact, concluded that technology is worth studying as an independent variable in organizations (Travica, 1999, 38), a view also supported by Perrow (1967).

Because of this disagreement two schools of thought emerged when discussing technology and organizations: the Aston view of technology sub-ordinance, and

that postulated by Aldrich of technological independence. Travica (1999) however tells us that a third path has emerged, namely those researchers (i.e. Carter, 1984) who see technology as an independent variable but who also admit that 'size can intervene between independent and dependent variables and can moderate the effects of the former.' (39)

There have been several models put forward by researchers over the last thirty years describing the structural effects of technology. Researchers like Orlikowski, Markus and Robey, and Pfeffer (to be discussed in this section) among others have proposed theories. Although all of the following models have faced criticism from fellow researchers (e.g. Orlikowski criticized Markus and Robey) these are the building blocks for current and future research.

4.1.2 Technology Imperative

The first model to discuss is called the Technology Imperative Model. This model postulates at its simplest level that the introduction of technology affects organizational dimensions. According to this model, however, technology's effect is unidirectional, meaning there is no feedback from either the organization or its actors; technology works independently of other influences. (Orlikowski, 1991a)

> *The essence of the technological imperative is conveyed by the word 'impact.' This perspective views technology as an exogenous force which determines or strongly constrains the behavior of individuals and organization.*
> Markus and Robey (1988, 585)

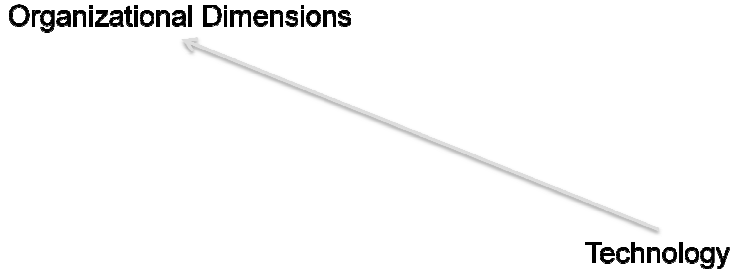

Figure 7 - Technology Imperative Model[16]

Pfeffer and Leblebici analyzed a similar stream of thought in 1977 in their paper *Information Technology and Organizational Structure*.

> *The […] reasoning is that information technology substantially alters the mechanisms and the nature of organizational coordination and control, and, therefore, has direct causal effects on the structure of the organization.* (247)

Grant, et al. (2006) found that although there is a lot of propaganda promoting the idea of Technological Determinism - technology determining organizational characteristics - there is little proof of this in the cases studied.

4.1.3 Organizational Imperative

A second grouping of literature is what Markus and Robey (1988) identify as the Organizational Imperative Model. This model shows that the organization's context influences decision makers who then, in turn, influence technology design and implementation to support their interpretation of context, promoting the idea of organizational and technological fit. In this case as well, Orlikowski (1991a) tells us that the influence is only seen as unidirectional; Technology, in these scenarios, provides no feedback (i.e. technology is the dependent variable).

Pfeffer and Leblebici (1977) also discuss a similar stream of thought: '[…] both information technology and organizational structure are caused by the organization's environment.'

[16] Source: Orlikowski, 1991

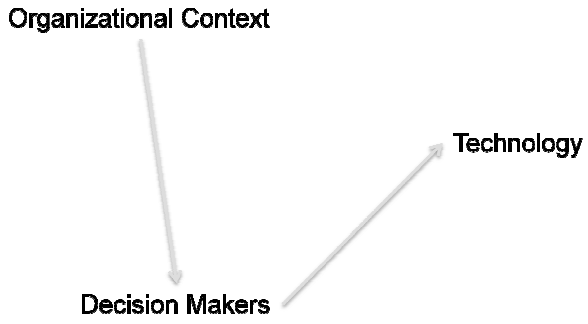

Figure 8 - Strategic Choice Model[17]

As the model shows, organizational decision makers create their strategic decisions regarding technology, based on their interpretation of the current organizational context (e.g. Environment, Size, Culture, etc.). Technology holds no special power. This school of though, in fact, as discussed above, tends to regard technology as subsidiary to the contextual elements.

Markus (2010) counters that until the 1990s organizational change in the US was mostly the product of either a changing economic landscape or regulatory systems rather than IT. The move towards conglomerates, for example, was due to financial disincentives (e.g. tax law, tariffs, regulations) to contracting with external partners, which was later turned around by the deregulation of the Reagan and Bush administrations.

> *My contention is that simple descriptors such as IT, enterprise systems, or corporate databases do not really capture the nature of the information processing capabilities required to manage today's most complex organizational forms, and that, furthermore, those capabilities have only recently become widely available. This observation suggests that more organizational design changes may be on the way.* (22)

Systems developed in the 1990s 'were the cumulative result of the entire IT trajectory [to that point].' (21) But they were not sufficient in his view to meet the strategic needs of decision makers, thus, because the needs of the

[17] Source: Orlikowski, 1991

organization were greater than current technology, there was a pull from the organization, making technology contingent on organizational demands.

Markus still contends that the strategy-structure paradigm must be settled before the introduction of IT. In other words, IT is dependent on (and supposed to support) existing, or at least, planned structure. 'Organizations that cannot set up information systems to operate complex management schemes are doomed to fail or at least to ratchet back their strategic ambitions.' (28) Markus, however, does allow for the possibility of feedback: if the organizational form is not providing the appropriate level of support for structure, because of lacking capability or any other reason, the structure (and thus strategy) must also change. She does not contend that emerging IT is the driver for new business forms.

4.1.4 Strategic Alignment

Henderson and Venkatraman (1999) developed a model which seeks not only to "fit" IT strategy with the internal strategy, but also to ensure that these strategies fit the current IT market situation. They argue that the traditional managerial view of IT, that IT is not an integral business expense, rather only a support function, is misguided in an era when IT

> *emerges as a critical enabler of business transformation with capabilities to deliver firm level advantages. […] [Thus] I/T strategy should be should be elevated from its traditional internal focus to address external issues of how well the firm is positioned in the fast-changing I/T market- place.* (475)

Their two theses are as follows:

- Economic performance is dependant on the ability for management to 'create a strategic fit' (473) between the organizational structure (including IT) and the market conditions.
- This is a dynamic relationship, not a one-time event. Thus the organization must be ever vigilant and prepared to adapt.

'We […] argue that the fit between external positioning and internal arrangement is equally relevant within the IT domain.' (474)

When addressing IT specifically the authors contend that it is not the technology itself that creates a competitive advantage, but rather a structure that is attuned to 'exploit' (473) IT on a continuous basis.

In order to address these theses the authors developed the Strategic Alignment Model, whereby four areas - Business Strategy, IT Strategy, Organizational Infrastructure and Practices and IT Infrastructure and Practices - are treated as equal parts of the strategy equation, thus enabling any of the four areas to be the catalyst for change in the organization. Key to these factors, however, is that they do not exist independently of one another, but rather, if one changes it should set off changes in the others. Another important fact is that the strategy factors deal specifically with the external environment, and the other two with the internal environment, placing both internal and external factors on equal footing. Thus, the concept of fit becomes all the more important when having a balanced plan.

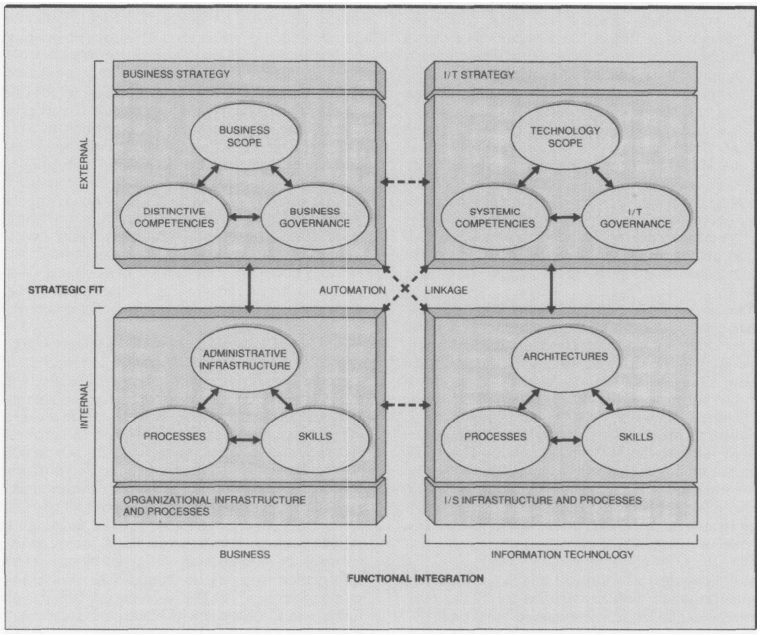

Figure 9 - Strategic Alignment Model[18]

[18] Source: Henderson and Venkatraman, 1999

Henderson and Venkatraman (1999) argue that previous studies focused specifically on the internal fit between strategy and IT lack comprehensiveness. Their model, however, allows us to add an additional variable, the external IT environment. Their argument furthers the idea that IT itself is a driver of change, but that change may come from the organization or from IT.

Strategic "fit" is a major stream of current research when it comes to IT and Organization Structure. Its main goal is to show how a proper fit between the two elements creates the proper environment for firm performance. This is one of the first models which introduces the idea that one can influence fit, and that in the end there is some economic impact. Until this study theorists had mainly concerned themselves with the "how" and "why" and had not questioned the economic impact.

4.1.5 Technology-Triggered Structural Change

This set of literature, Models of Technology-Triggered Structural Change, identifies before and after images of organizations. This model portrays technology 'as an intervention into the relationship between human agents and organizational structure, which potentially changes it.' (Orlikowski, 1992) Orlikowski tells us that these studies suffer from the fact that they only allow a limited set of users to have any effect on the interactions with the technology, and thus from a lack of credibility. Orlikowski (1992) uses Barley (1986, 1990) as an example of these studies,

> *Within his frame of reference Barley posits a role for technology, not as material cause, but as a material trigger, occasioning certain social dynamics that lead to anticipated and unanticipated structuring consequences (such as increased decentralization in his study).* (66)

Barley (1990) however argues that previous studies have suffered from poor construction and further make assumptions based on evidence from different levels of analysis. (66).

Barley (1986) earlier found in his research of the introduction of CT scan technology to suburban versus urban hospitals that the same technology led to differing results in terms of internal organization. One tended to be more centralized, and one tended to move toward decentralization. Thus he argues that technology creates an occasion for change, but does not have a prescriptive effect, and thus models should only strive to map the pre- and post-technology structures. 'Technologies do influence organizational structures in orderly ways, but their influence depends on the specific historical process in which they are embedded. To predict a technology's ramifications for an organization's structure therefore requires a methodology and a conception of technical change open to the construction of grounded, population-specific theories.' (107)

Further he argues (Barley, 1990) that most studies have one of several fatal flaws: ambiguous terminology, (i.e. different definitions of the word technology or structure), distant knowledge (i.e. lack of long-term observation), inferential leaps between levels of technology, and non-social concepts. Barley instead argues that a role-based approach should be undertaken. His argument being that as organizations are by nature social constructs, inserting technology into such constructs will inherently create a variety of outcomes no mater the similarities between the organizations.

According to Orlikowski (1991a) these studies are less interesting in that although they explicitly exclude technology as a cause for change, they tend not to identify other possible sources. As seen in the figure below, we merely see two snapshots of the organization, one prior to the introduction of technology, and one after its implementation. We are to only identify the changes in the organization itself, but should not assume that technology acted as anything other than a catalyst for whatever change occurred. Plus, these studies explicitly note that the results are unique to each situation.

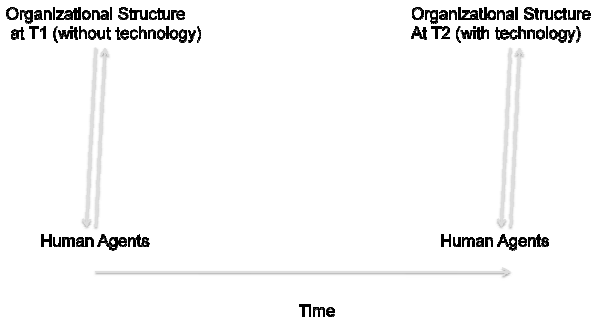

Figure 10 - Technology-Triggered Structural Change Model[19]

4.1.6 Structuration

Orlikowski (1991a) also presents her preferred model, a Structuration Model of Technology. Based on the work of Giddens, in this model Organizational Structure and the human agent influence technology while technology provides feedback. Technology cannot only be influenced, but also influence behavior and structure. This model allows for contingencies from all sides to be factored into the research.

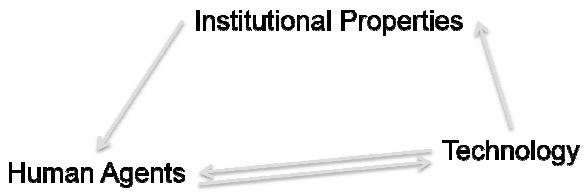

Figure 11 - Structuration Model of Technology[20]

Structuration at its heart is a way for 'subjective' - technology as a product of social interaction – and objective –technology as an independent change agent – to coexist. In Giddens' original theory he

> *proposes what he calls the* duality of structure*, which refers to the notion that the structure or institutional properties of social systems are created by human action, and then serve to shape future human action* […] *yet on the other hand* [human action] *can be seen to be constituted by institutional properties.*
>
> Orlikowski (1991b, 147)

[19] Source: Orlikowski, 1991

[20] Source: Orlikowski, 1991a

In other words, although technology is the product of human social interaction, technology itself has properties, which in the end can influence our social interactions. This attempts to combine both original views, technology as a driver for organizational behavior (i.e. structure), as well as the view that the external properties influence social interaction, which are the drivers for how technology is integrated into the organization.

4.1.7 Agency in IT – Actor Network Theory

Another interesting component of IT research deals with agency. Rose, et al. (2005) have recently argued that there is an inherent agency problem when discussing organizations and IT (they call it IS). In their research they define agency 'in Giddens' terms [as] "the capability to make a difference" (Gidddens, 1984)' (Rose, et al., 2005, 134) To them an agent must merely instigate some action, it need not be sentient of its action. In their view both of the previous view – IT as the independent variable and IT as the result of social action – deal with the agency problem.

> *In the social determinist account agency lies with humans (having consequences for the technology), whereas in the technological determinist account agency lies with the technology (producing effects on the humans).* Rose, et al. (2005, 134)

While noting the conflict with traditional agency models – namely, agents must have their own goals – Rose, et al. (2005) they hold to the notion that agency need not only relate to human actors.

As we know from literature, the inherent problem with agency is the fact that there is imperfect contracting (i.e. incentives) and imperfect information transfer (e.g. withheld information). In the normal transaction relationship one cannot always anticipate the circumstances under which the transaction or activity is carried out, and thus one cannot create a contract that sufficiently covers the relationship. This imperfection can cause mismatches between the expectations

for the principle and the results produced by the agent. It can also create a situation where the agent takes advantage of the inefficiency of the contract.

Though in the past agency was only attributed to human actors, there is an emergent opinion that IT and mechanical processes should also be included in this area.

> *In this emergent process, machine and human agency can be found inextricably intertwined: a double dance of agency. Humans base their actions on complex interpretations of past actions and present conditions, and on attributions of agency to machines.*
> Rose, et al. (2005, 146)

Though the authors acknowledge that the idea of non-human agency is a radical departure from previous literature (i.e. Giddens), they point out that it has been shown in other fields including the physical sciences, and in research on the Internet, that non-human actors have been attributed some *power* in the relationship. Further, they criticize the structuration model as a model on the fringe of the social construct view. If the Technology does have the power to effect change in and organization, it must – in their view – also be able to work under an agency view. 'In actor network theory, on the other hand, whilst technology becomes an independent actor in its own right, no distinction is made between the agency of technology and humans.' (Rose, et al., 2005 139)

> *In as much as machines can act, and do so increasingly autonomously, and in as much as those actions have intended and unintended consequences, they do possess agency. Many of those actions, but not all, are either intended or at least anticipated by the machine's designers.* Rose, et al., (2005, 146)

There is, however, still need of improvement in this area. Rose, et al. (2005) note the IT agency problem as follows:

> *Machines facilitate and enable some parts of the human exercise of agency, but constrain other parts. Seen more from the standpoint of their own agency, they accommodate some human purposes, but resist others. Humans try to marshal the agency of machines to serve their own purposes, but cannot always anticipate or control the consequences.* (147)

Bodreau and Robey (2005) identify an additional agency problem, namely: Once IT has been implemented there is no way, in the short-term, to ensure that the human actors leverage the system in the foreseen manner. In fact the human actors may find ways to either avoid use, misuse, or enhance the use of IT and thus may lead to a 'reinvention' of the technology and lead to unintended organizational consequences. This view is an extension of the previous paper by Barley (1987).

4.1.8 Mahr's integrative model of IT Fit

Recently Mahr (2010) proposed an integrative model of IT aligning not only contextual and internal factors of the organization, but IT factors as well. In his model he argues that he

> *consider[s] all IT complements that have been analyzed in existing studies, that Is, a firm's organizational structure, HRM practices, environment, strategy, and culture. I do not consider complements such as technical and managerial skills or top management commitment, which are not specific to IT. Note that I distinguish between horizontal and vertical IT complements, that Is, complements that determine an organization design's information processing capacity and complements that determine an organization design's information processing requirement*. (31)

His research attempts to combine previous models, while adhering to the idea that IT effects are manageable and one should leverage known effects (communication accuracy/speed etc.) in order to form an appropriate structure. Thus, neither IT nor structure are dependent, rather they are complimentary elements. Only with the appropriate mix can one achieve 'success'. His research

is an extension of previous strategic fit models and is very concerned with the productivity of the organization post implementation.

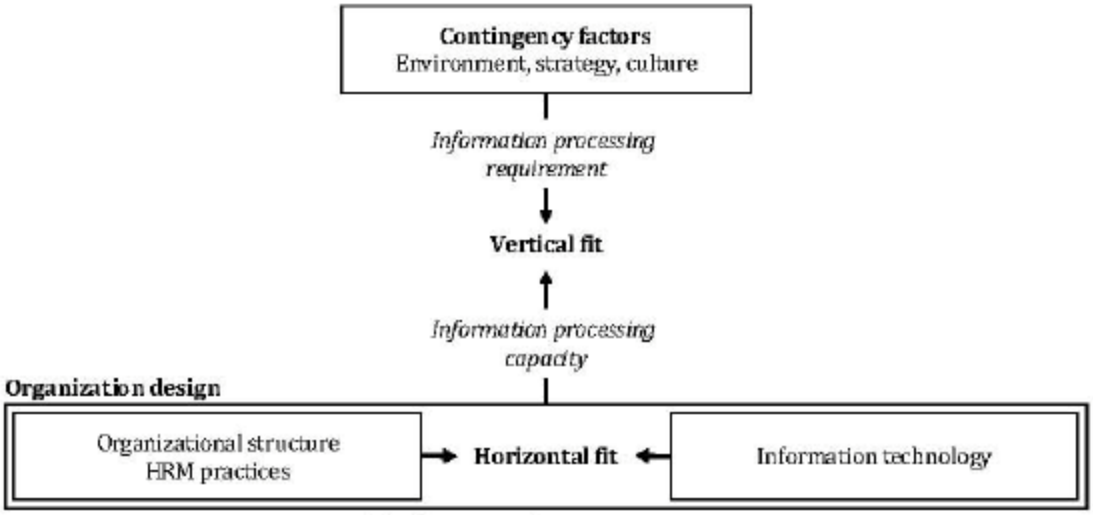

Figure 12 - An integrative model of IT compliments[21]

Unfortunately, despite much research over the past thirty years, we are no closer to a universal theory of the Organization and IT. What we have seen is the emergence of two dominant schools of thought, and several deviations from these schools; the two major schools being the Technology Imperative and the Organizational Imperative Models. These two models represent the two sides of the pendulum, in between these two we can place Orlikowski's Structuration Model, The Strategic Choice Model, the Barley's Technology Triggered Change Model, Rose's Technology Agency Theory and Mahr's Integrative model. Reading more current literature (Rose et al. 2005, Paré, et al. 2008, Boudreau and Robey, 2005) it is clear that the field is no closer to recognizing a dominant view, rather research is continuing on all of these tracks. The following section will discuss more concrete effects of IT integration on the Organization as found in the literature.

4.2 Specific Organization Changes as Identified in Research

Galbraith was one of the first to argue that IT integration would cause structural changes to the organization (Sor, 2004). Using Galbraith's model as a guide

[21] Source: Mahr, 2010, 31

Gerwin (1981) argued that IT would affect organizational structure in four key areas: complexity, formalization, centralization, and configuration. (Sor, 2004)

Fulk and DeSanctis (1999) agree that there are some generally accepted features IT imparts on the organization; however, these can be used in many ways and by no means are prescriptive of any sort of outcome.

> *In general, however, most observers would agree that at least five features of new communications technologies offer important advancements for organizations. The first is the dramatic increase in the speed of communication, with high volumes of data moving from one location to another at rates unimaginable even a decade ago.* (7)

The second feature is the decrease in costs associated with these technologies through economies of scale and penetration (7). 'Third is the sharp rise in communication bandwidth, with more information of multiple frequencies travelling simultaneously on a common communication line.' (7) Bandwidth referring to the amount of data able to be processed at any given moment, versus speed of transfer referring to the amount of time it takes for data to move from one location to another. This has enabled multimedia communication. Fourth is the sheer increase in connected devices and individuals. Fifth, is the integration of communication and computing technologies, enabling a richer communication experience. (8)

These changes, in short, show the power of ICT, its ubiquity and availability, and its penetration in the population.

Pfeffer and Leblebici (1977) present us with a diagram of their understanding of Information Technology effect in the literature.

> *[T]he greater the extent of the use of information technology, (1) the greater the vertical differentiation, (2) the greater the horizontal differentiation, (3) the more decisions will be decentralized, (4) the less formalized will be the*

organization, and (5) the more performance will be reviewed by detailed statistics or in writing, with correspondingly less oral review. (248)

In their view, more ICT would yield greater decentralization and less formalization. And though there have been studies which have supported this conclusion, we need only look to our next study to see a different conclusion.

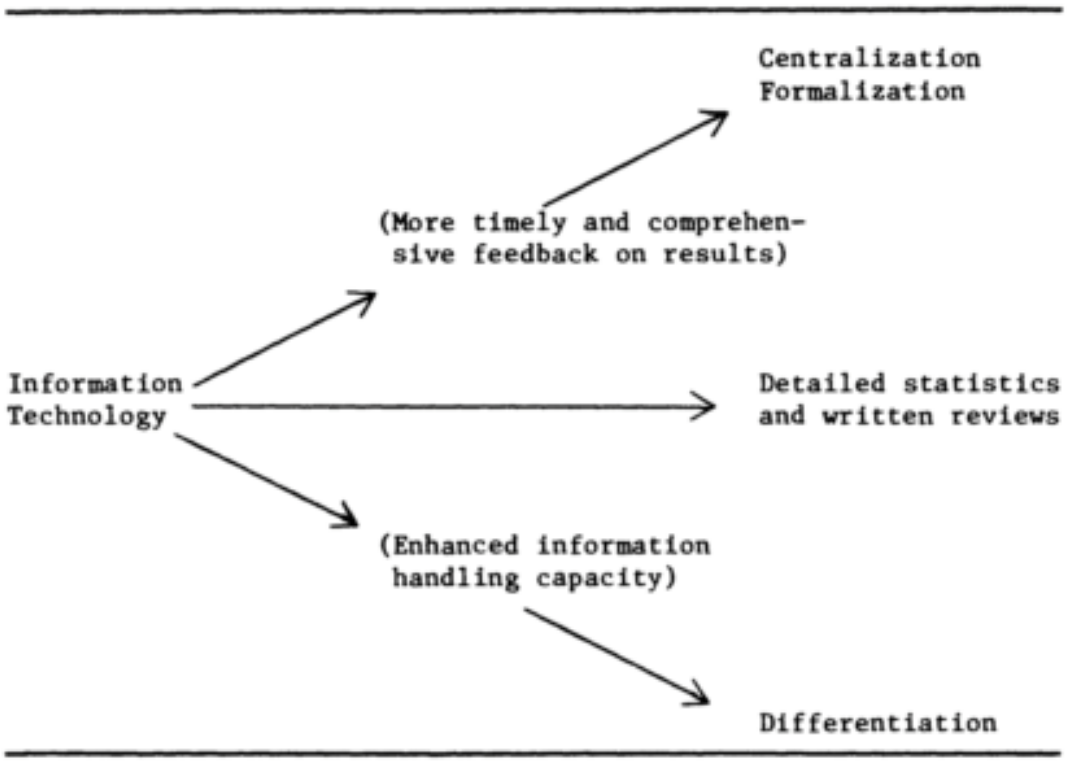

Figure 13 - Pfeffer and Leblebici: Direct Effect of Information Technology on Structure[22]

Fulk and DeSanctis (1999) see a more consolatory relationship between the organization, organizational form and technology as evidenced in Figure 14. The question is how decision makers either use existing technology to fit current structure, how to mold existing structural dimensions to fit current technologies, or how to modify existing technologies in order that they fit context.

[22] Pfeffer and Leblebici (1977, 249)

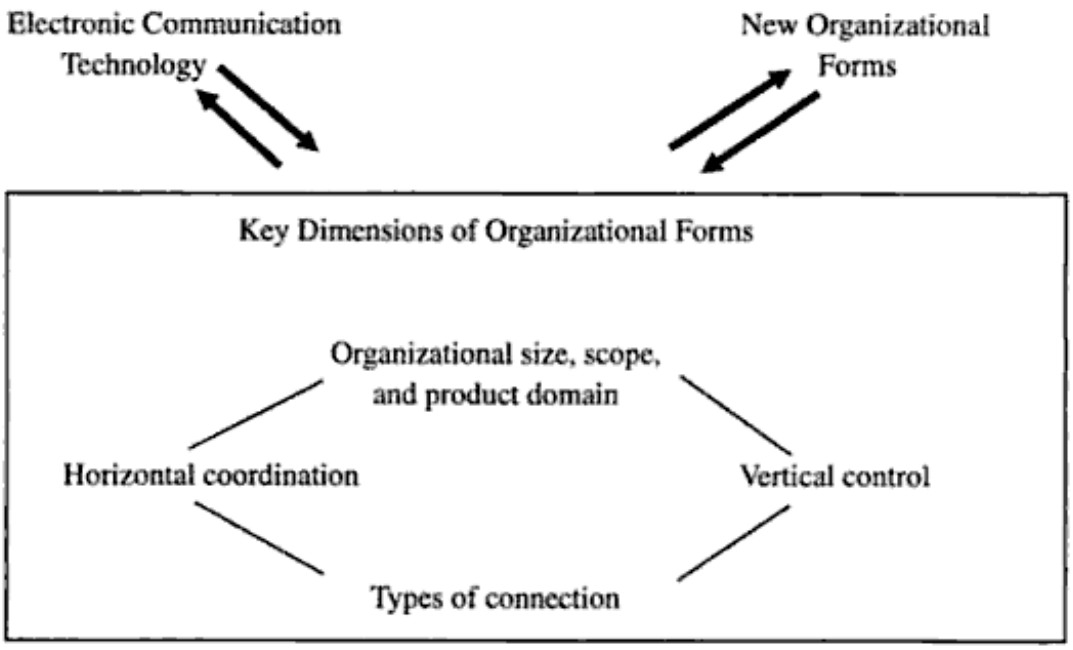

Figure 14 - Articulation of Communication and Organizational Form[23]

It would be nice to conclude this research showing concretely how organization and ICT interact. The fact is, that the research over this period has shown quite contradictory results. It is clear that we have a lot of research to draw upon, but there are still several schools of thought when it comes to this relationship.

> *For instance, researchers have found that IT both empowers and oppresses employees, both increases and decreases organizational hierarchy, both downsizes and upsizes staff; it has even been shown that technology can simultaneously enrich some employees while it deskills others in an organization (e.g., Pinsonneault & Kraemer, 1997; Robey & Boudreau, 1999). In a similar sense, IT has been shown to have negative or insignificant impacts on firm productivity, profit, and consumer surplus in some studies – known as the 'productivity paradox' – while having positive and significant impacts on others, substantiating the 'value of IT' (Attewell, 1994; Barua et al., 1995; Kohli & Devaraj, 2003).*
>
> Paré, et al. (2008, 404)

[23] **Source:** Fulk and DeSanctis, 1999, 26

The following sections will show how different researchers have addressed the IT-Organization Structure question through the lens of the hypotheses put forth at the outset of this thesis. Though there is no comprehensive theory of IT and there have been some interesting findings when looking at specific cases.

4.2.1 Hypothesis 1: Information Technology is an enabler rather than the agent of change in the organization structure

4.2.1.1 Collaboration, Communication, and Information

Dewett (2001) put together the results of over 20 of studies, all focused on organizational outcomes of IT integration (Orlikowski, 1995; Barua, 1995; Yates, 1999, etc.) from leading journals (Academy of Management Journal, Academy of Management Review, Administrative Science Quarterly, Journal of Management, Organization Science, Strategic Management Journal) in order to draw conclusions on organizational effects including those relating to organizational collaboration. He implies that IT's greatest affect on the organization is its ability to create efficiencies (for the individual) and synergies (between colleagues) both vertically and laterally in the organizations, allowing for much more effective coordination, information access and sharing, as well as teamwork.

Fawcett, et al. (2011) studied the effects of IT on communication in the organization. They implied that although at its most basic level IT enables created communication/collaboration etc. if an organization's culture was not aligned, these effects, though still present, could be mitigated. The most successful organizations also had sharing cultures. They also found that IT today still has a greater effect on the productivity side and less effect on worker satisfaction.

Both agree that the increase in ICT has enabled greater movement of information and enables grater communication and collaboration, though they would also note, that the extent of the effect is more a product of context and internal factors than merely the introduction of ICT.

4.2.1.2 IT effects on Structural dimensions

Using Gerwin (1981) as a starting point we should first look at IT's effect on the structural characteristics such as: specialization, formalization, and centralization.

4.2.1.2.1 Specialization

According to Dewett (2001), higher degrees of specialization tend to reduce the individual workers' ability to understand the complete organizational picture. However, 'IT can mitigate this tendency by providing greater information access to specialists[.]' (328) By providing employees with access to broader amounts of information they are better able to make decisions while taking into account organizational impacts. This enables individual employees to focus on a broader amount of areas, thus reducing specialization.

In the Varazdin County study done by Brodar, et al. (2009), they found that although high levels of formalization existed in the organization, that there was little effect, neither positive nor negative, on specialization with ICT implementation. Nor was there a significant effect on employment.

Huber (1990) however notes that

> *advanced information technology can either lead to the addition of job categories (e.g., computer programmer) or the deletion of job categories (e.g., book- keeper), and, therefore, will affect the degree of specialization within the organization.* (62)

Pinsonneault and Kraemer (2002) found that although there is the elimination of some employment, many employees shift focus (e.g. move into sales or marketing roles) rather than get downsized. Thus, there is only a marginal net-loss of jobs due to ICT introduction.

As one can see, although specialization can be enhanced by IT, specialization is typically enhanced by IT only when other factors (e.g. strategy) are present.

4.2.1.2.2 Formalization

'IT facilitates the recording and retrieval of information about organizational events and activities making the control of behaviors and processes through formalization more viable (Huber, 1990).' (Dewett, 2001, 329) Additionally, according to Dewett (2001), IT can mitigate the costs associated with formalization, for example, search costs.

Pfeffer and Leblebici (1977) argued that there was little correlation between the introduction of IT and the formalization of the organization, thus implying that although formalization may occur due to IT, it is not necessarily a dependent relationship.

Brodar, et al. (2009) found, in their investigation of ICT in Varazdin County in Croatia, that increased levels of Formalization in an organization corresponded to high levels of ICT use. In their survey of 12 of the county's organizational units, they found virtually all employees had ICT access and that over 84% (of their work was done using ICT (250).

Formalization is perhaps the one area where most researchers can agree that there is an organizational effect. One need only look at the technology on the market to see how technology companies are attempting to formalize all areas of the firm and create effective methods of sharing this data throughout the firm. The rise in e-learning (e.g. in order to teach regulatory requirements and internal procedures), and team software (in order to record previously unrecorded procedures and codify hidden knowledge) alone as well as the ease at which simple instructions can be transmitted (i.e. digital document, email, etc) shows the penetration of formalization. One could even argue that new technologies such as SMS, Instant Messaging, Message Boeards, Blogging, etc. are methods of formalizing information once hidden within the organization. Computer software itself was first created in order to "teach" machines repeatable formal procedures, which had previously been done by individuals.

4.2.1.2.3 Centralization

This structural dimension seems to be the most ambiguous when looked at in combination with IT implementation. There is research showing that IT can support both centralization and de-centralization of decision-making. Dewett (2001) tells us that

> *[s]cholars seem to agree that the use of IT allows organizations to place decision making authority across a greater range of hierarchical levels without sacrificing decision quality or timeliness. […] The effect is to move authority towards that part of the organization where the pertinent information is to be utilized to make informed decisions[.]* (330)

In a study of French and British firms, Acemoglu, et al. (2007) found that certain other factors both internal and external (i.e. how close to technological frontier, environmental heterogeneity, firm age) led to the decentralization of the firm. They found that

> *[Our] model predicts that as the amount of publicly available information about the optimal implementation of new technologies increases, firms should become less likely to decentralize, whereas firms dealing with new (frontier) technologies should be more likely to decentralize. We also showed that firms in more heterogeneous environments and young firms are more likely to choose decentralization.* Acemoglu, et al. (2007, 1796)

In their study they found this to be the case as the manager had better information than the principle on the implementation of new technology. But as the information became more ubiquitous, the principals were better able to manage by themselves. Thus showing us that technology can enable decentralization of the firm, but may not be the only factor taken into consideration. In fact

> *In our model, firms delegate authority to managers, that is, "decentralize," in order to use the manager's superior information about the implementation of new technologies. Because the interests of the manager*

and the principal are not perfectly aligned, such delegation entails a costly loss of control for the principal. (ibid.)

Showing us that organizational factors also play a role in this decision.

Bloom, et al. (2008) agree that technology enables decentralization, but add that technologies can also empower more centralized decision making due to increased communication flow. He argues that

> *[…] ICT is usually lumped together as a single homogeneous mass. We argue that this is a serious error because the impact of ICT on the organization of firms […] will be quite different depending on the type of technology used. For example, falls in communication costs will tend to generate increased centralization, lowering the autonomy of those further down the hierarchy, whereas falls in information costs will have exactly the opposite effect.* (24)

Brodar, et al. (2009) found that there was little effect on centralization with ICT use, although in the same thought they do identify a high communication flow throughout the organization due to ICT, thus even the lowest levels of the organization have access to greater amounts data. This suggests that perhaps the design decision to be centralized is one of strategy rather than one of organizational capability.

Gustafsson, et al. (2009) found in their case study that of a manufacturer that the introduction of IT changed decision making in one significant way: the distance between the decision maker and the process has shortened, thus indicating that there is greater decentralization.

In their working paper Mahr and Kretschmer (2010) note that

> *[e]xisting studies find that the contribution of IT to firm performance is increased by complementary investments in the dispersion of decision rights and in HRM practices that endow the employees that are given more decision rights with the necessary skills and incentives to make high quality decisions (Bresnahan et al. 2002; Brynjolfsson et al. 2002, Hitt and Brynjolfsson, 1997).* (3)

They however note that the decentralization / centralization decision is one of strategy rather than being determined by IT or the organization. In their study they note that IT enables an organization to become more de/centralized depending on whether they are following an explorer vs. exploiter strategy.

The authors argue that IT is able to do this by increasing codification of information, while at the same time enabling faster and greater vertical or horizontal transfer of information. As the processing of information becomes both more rapid and more accurate, both horizontal and central decision makers can be enabled depending on system design.

Finally, Dewett (2001) argues that IT inherently increases the amount of formalization in an organization and thus can enable 'controlled' (330) decentralization. This control allows employees further down the hierarchy to act with more freedom. 'Support for this notion is found in the increasing incidence of flat, empowered, organizational structures with virtual organizations being an extreme case of low-cost organization that has begun to materialize.' (330) This means that IT is enabling resources at lower hierarchical levels to have greater decision-making power. He seems to also to support the idea that this enables the flattening of the organization, however, his original point is that there is a shift in the location of decision-making.

Clearly, although IT has caused some structural changes in organizations, it cannot be assumed what these changes might be. Bloom (2008) argues this is because of the unique effects different technologies have on different organizations, while Acemoglu, et al. (2007) argue that other factors such as the age and technology friendliness of the organization have an effect. In the end one must perhaps look at the decentralization argument and realize that information technologies may be able to have different effects depending on the needs of the organizational strategy and the technologies employed.

4.2.1.2.4 Hierarchy

Even in early literature on the subject there was a stream of thought that IT reduced hierarchy. Pfeffer and Leblebici (1977) tell us how Whistler (1970) noted that 'the number of levels in the hierarchy is reduced.' (245) Pfeffer and Leblebici argue however, that though Whistler's findings support his hypothesis, the phenomena might be better explained using other contextual dimensions, namely environmental complexity. They note that because of this complexity and change to the organization's environment, the organization is more prepared to introduce new IT in order to create a sense of control.

Pinsonneault and Kraemer (2002) found that most studies on causality were 'oversimplified'. Their study produced three findings:

> *First, Technology per se does not seem to be a determinant of organizational downsizing. Rather, IT is an enabler and its effects depend on the context in which technology is used and how it is used.* (203)
>
> […]
>
> *Second, the interplay between IT and downsizing is more complex than originally thought. Downsizing can be an IT-enabled, multilevel, and multistage process*. (203)
>
> […]
>
> *Third, more than technology, adverse environmental conditions seem to be the cause of downsizing.* (203)

Their findings seem to indicate that although IT can enable downsizing, and as others have shown in the managerial role of the hierarchy (e.g. Fiedler, et al, 1997), some of this can be explained either by task modification and reassignment, or by changes to other factors which then necessitate downsizing. Thus the hierarchy shrinks as individuals take on other types of roles. IT itself is not the cause of the downsizing and shrinking hierarchy, rather an enabler when necessary.

Brodar, et al. (2009) found in their study of Varazdin County, Croatia, that there was little effect on hierarchy with the use of ICT. (250) Their study however was

rather localized and is perhaps not the best representation of findings. It does however reinforce Pinsonneault and Kraemer's theory that simple implementation of ICT may not necessarily yield a hierarchy change, but rather strategy must also be present.

4.2.1.2.5 Standardization

Mahr (2010) notes that

> *Standardization and IT may be complementary, as IT can enhance the benefits of rules and procedures by facilitating the monitoring of their implementation […] For example, ERP systems provide a clear view of the relative performance of different parts of the organization. […] As IT may be complementary with distinct forms of standardization that advance either a centralized power distribution or a decentralized power distribution, the complementarities between standardization and IT have to be taken into account if the complementarities between the power distribution and IT are to be adequately examined*. (39)

4.2.1.3 Contextual Dimension: Size

In 1994 Brynjolfsson, et al. published a study in which they claimed showed a strong correlation between the increase in IT and the decrease in firm size. The measure they used to describe firm size dealt with personnel in groups and in the organization as a whole.

Their argument is, that the availability of 'increasingly powerful and inexpensive IT […] might change the relative viability of small and large firms.' (1631) They discuss further whether the implementation of IT creates a labor substitution situation, or whether it enables a 'make versus buy' situation. Labor substitution, meaning IT, performs functions previously conducted by humans, and 'make versus buy' referring to outsourcing certain portions of the production process in order to concentrate on core functions because of reduced transaction-costs.

In the end Brynjolfsson tells us that 'there is substantial evidence of a relationship between increased levels of IT investment and in firm size. […]

However, our findings should not be interpreted to apply to all industries and all time periods.' (1641) He specifically believed that firm size would decrease as IT integration increased.

Cudanov, et al. (2010) support Brynjolfsson's conclusion, but add that one must look at the organization's original size. Micro-organizations have been empowered through the use of ICT, whereas small and mediums sized organizations have seen smaller amounts of change. The greatest potential, they propose, is with large organizations with high ICT usage, these trended toward more a more medium size.

Dewett (2001) contradicts the idea that IT creates smaller firms by noting the fact that IT has enabled organization to expand their activities and their reach. He does note, however, that it may be taking fewer resources to accomplish this growth as in the past.

> *On the other hand, recent literature examining the effect of IT on firm size (Huber, 1990) combined with an examination of modern industry trends towards merger and acquisition of even the largest companies, […] suggests that IT may allow organizations to become bigger without any sacrifice of efficiency or innovativeness. […] There has been little or no research into these issues, and future research needs to take into account the fact that in some instances although firms may be growing larger in terms of the number and scope of their activities so that the number of internal decision making units increases; the size of the units themselves may be shrinking because of the effect of INEs noted above.*
>
> Dewett (2001, 331)

Brodar, et al. (2009) found that technology had a relatively weak effect on organization size, implying instead that size is dependent on other factors of the organization.

An interesting related study conducted by Bajwa and Lewis (2003) examined the idea that IT adoption was higher in larger organizations than in small organizations. It had previously been argued that only large organizations have resources to mitigate the risk associated with IT adoption, although the authors show that studies were contradictory.

> *While some innovation studies suggest a positive relationship between organization size and adoption behavior (Moch and Morse, 1977; Kimberly and Evanisko, 1981), a negative relationship between size and adoption behaviour has also been observed (Mohr, 1969; Globerman, 1975).* (32)

Unfortunately we see a common theme in regards to size and information technology as has been seen in the other categories as well. Some streams of literature support the idea that information technology can help increase an organizations size (Brynjolfsson, 1994), while other claim that it shrinks the organization (Dewett, 2001), while others have found that there is relatively no effect (Brodar, et al., 2009). It becomes difficult to draw conclusions about specific effects when there are so many conflicting results.

4.2.2 Hypothesis 2: Information Technology can be used to support any organizational form

Extending the argument from the previous section one can see that if organizational forms yield themselves to varying configurations of the structural factors, then each for should be a viable one.

Our previous section has shown us that ICT can support high and low formalization. High and Low specialization, high and low levels of de/centralization, and high and low levels of hierarchy. Thus any configuration would be possible.

What have been enabled to a greater degree by IT are two new forms, namely Virtual and Network organizations. The Virtual organization as described previously exists completely outside of a physical environment. Rather only

through technology. More interesting perhaps is the idea of the loosely coupled network.

4.2.2.1 Transaction-Costs and loosely coupled organizations

Transaction-Cost Theory tells us that

> *firms and individuals seek to economize on transaction costs […] [u]sing markets is expensive (Coase, 1937; Williamson, 1985) because of costs such as locating and communicating with distant suppliers, monitoring contract compliance, buying insurance, obtaining information on products, and so forth.* Laudon and Laudon (2010, 90)

Transaction-Costs, the costs listed in the second part of the quote, are said to be reduced through the use of IT.

> *As it was argued by Ciborra (1993), information technology can be used for reducing the cost being associated to transactions. This argument is based on the idea of using information technology to make more information available to decision makers, thus contributing to the reduction of uncertainty.*
> Cordella and Simon (1997, 828)

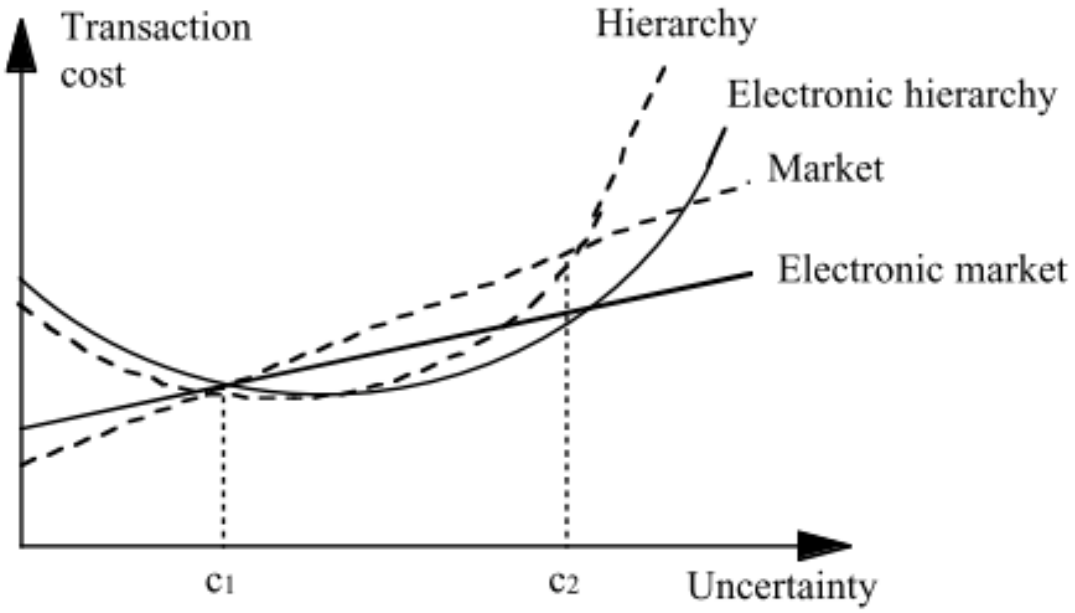

Figure 15 - IT-impact on coordination and transaction cost[24]

Looking at the figure adapted from Cordella and Simon (1997) we can see that although the introduction of IT yields higher upfront costs, it leads to a reduction in uncertainty leading to a reduction in coordination and transaction costs. With a reduction in costs and uncertainty, Cordella and Simon argue that an organization would be open to a less hierarchical style, and more open to a market based approach.

> *As we can see in the model, the reduction of uncertainty due to the introduction of IT basically results in a reduction of both coordination costs and transaction costs. However, due to the investments in infrastructure and technology, higher fixed costs are generated initially.* (829)

Cordella and Simon see two organizational strategies as a result of this fact: 1. The organization does not undertake any structural changes, rather, benefits from the reduction in uncertainty costs (as long as these are higher than the IT investment costs); or 2. The organization leverages the reduction of uncertainty and coordination costs and *flattens* the organizational structure – namely, a transition from a hierarchical to a more horizontal structure. This is due to the

[24] Source: Cordella and Simon, 1997

fact that IT provides alternative coordination mechanisms and can eliminate both levels and spans of control. As also supported by 'Ciborra (1996) and Brynjolfsson an [sic.] Malone (op.cit).'

> *As a consequence of the adoption of IT, the number of possible contacts and communication channels drastically increases. IT networks are organized so that it is possible to have easy contact with all the users of the technology. The result is that the number of possible interactions is almost unlimited and the cost of interacting is negligible.* Cordella and Simon (2001, 857)

Yamin and Sinkovis (2007) find that the implementation of ERP systems, centralized decision-making is reinforced, thus there is more of a tendency to move toward/keep more centralized structures.

Sahaym, et al. (2007) however would disagree, their research shows that because of the reduction of TC an organization can exist through loosely coupled relationships with external partners while having tight integration. They also suggest that the form an organization takes is, in part dependent on contextual factors such as the degree of asset specificity, industry standards and the like.

> *We argue that IT investment promotes both loose coupling and tight integration by providing strong coordination both within the firm and between a firm and its partners outside the firm.* (875)

4.2.2.2 Orman's Market vs. Hierarchy Analysis

Orman (2002) took a closer look at the idea that ICT seemingly supports everything and nothing at the same time. In his research he proposes that instead of a generic "ICT" label, ITs should be separated into two distinct categories, namely 1. Communication, and 2. Information processing technologies. By separating these two we are able to create a scale of either by which the appropriate structure can be chosen (in Orman's research either Hierarchical or Market based).

> *For very small communication costs, pure markets are optimum. […] Further rise in communication costs causes a switch to hierarchies as the optimum structure.* (223)
>
> […]
>
> *Similarly, for very small processing costs, hubs are optimum. As the processing costs rise, hierarchies deepen, leading to long chains of middle management position. Further rise in processing costs causes a switch to markets as the optimum solution.* (223)

Orman's research further reinforces the idea that IT does not create one structure, but rather, depending on the type of technology and its cost (or even the organizational strategy employed) either markets or hierarchies may be employed.

It is popular to think that every firm will move towards the Virtual organization, but even technology firms with the most up to date technologies struggle with appropriate structure and at times move between market and hierarchical models take Google, born with 2 employees, now has over 19,000. Google is today purchasing new technology companies and integrating them into their structure. Or IBM as a counter example to the idea that all organizations will move to the market. IBM is a leading provider and user of both Communication/Collaboration technologies as well as data processing technologies. From this author's experience at IBM it is clear that with over 100,000 employees IBM struggles with market vs. hierarchy. In some divisions tending more toward market (e.g. manufacturing) and hierarchy in others (e.g. consulting and development).

4.2.3 Hypothesis 3: Information Technology enables organizations to expand globally

> *The experience with telegraphy provides a useful example for assessing the likely impact of the Internet. The telegraph also decreased communication*

> *costs dramatically and allowed for more complex information to be transmitted over greater distances and at greater speeds.*
> Globerman, et al. (2001, 763)

The Globalization of the firm is by no means a new phenomenon, however, there is some evidence that IT has enabled this phenomenon at much greater levels and at faster evolutionary speeds as previously seen. The moniker "born global" is now being affixed to many new organizations, and there seems to be an enormous amount of companies (especially in the innovation and technology space) which are no longer bound by a single market, but rather are able to simultaneously exists in multiple markets with little or no overhead cost.

> *Globalization can be understood as the process of increasing convergence and interdependence of economies and liberalization of trade and markets. The concept internationalization refers more to the process of increasing cooperation between states or to activities across state borders, but reflects a world order in which nation states still play a central role (Scott 1998).*
> Thune and Welle-Strand (2005, 595)

> *ICT and particularly the Internet, is considered to facilitate internationalization due to its ability to overcome space and time boundaries, thus enabling distributed units to work as a 'unit in real time' (Castells 1996).* Thune and Welle-Strand (2005, 598)

Traditional globalization literature follows the idea that there is a natural evolution in how a firm goes global. First and organization is domestic, then exports, later multinational and finally global. The Organization uses a variety of structures to do so: Exporting, Licensing, Limited Partnership, Wholly Owned Subsidiary, Headquarters, etc.

Today however additional forms are emerging: Loose Networks and Virtual Organizations. The appearance of these forms has been closely related to the growth of IT in the organizations. The following section will address how IT

today may be aiding greater amounts of globalization through the use of new or at least modified organizational forms.

Adding on to the discussion of transaction costs in the previous section we can extend that argument to show that the same effects that ICT lends to support greater market based structures, also support market based structures in the multinational enterprise (MNE). Rangan and Sengul (2009) list these as: the leavening of asset specificity, the increase in observability and contractibility and the reduction of coordination costs. They further argue that the main concern of the MNE is no longer the need to protect one's assets, but rather leverage ICT in order to reduce not only transaction, but also production costs.

> *[C]ongruent with transaction cost and incentive theories of exchange governance, the modern MNE is elaborating its transnational governance architecture to take advantage of the emergence of ICT. In particular, where the use and deployment of ICT are greater, the centrality of internalization in the modern MNE is declining.* (1508)

Additionally,

> *whereas the conventional MNE was duly concerned with the mitigation of transaction costs in cross-border exchange, enabled by ICT, the modern MNE organizes international exchange to also push down production costs. ICT has reduced asset specificity, made quality more contractible, aided decentralized coordination, and shifted outward the tradeoff frontier in exchange relating incentive intensity (effort) and cooperative adaptation (alignment).* (1509)

Clemmons and Simon (2001) argue that the best way to internationalize is to do so with IT in mind (specifically ERP systems) in this way the organization can take advantage of the attributes of the IT system, while still retaining enough flexibility and control in the local markets.

> *The idea behind this new hybrid model is to accommodate the move to electronic commerce. Assuming under this new model that orders, customer, and supplier interaction (for the most part) will be conducted via electronic means, a regional data center would house the ERP systems for those applications as well as the applications that schedule and monitor production […] this system improves both control and coordination and, in theory, at a much lower cost per transaction.* (214)

Furthering the idea that ICT affects MNEs, Yamin and Sinkovics (2007) write how the implementation of ERP software into MNEs has reinforced the centralization of control over their international operation. ERP have cheaply created a codified visibility, not only into "own" operations but also into those of supply partners.

Zuurmond (2005) shows us the Nolan S-Curve to show the stages of scope in ICT integration into the organization, and he adds his final two stages, Nationalization and Globalization of the ICT. This addition to the S-Curve seeks to set not only inter-organizational ICT standards, but to also create intra-organizational standards, followed by national and global standards. Thus enabling the organization to collaborate easily across organizational and national boundaries.

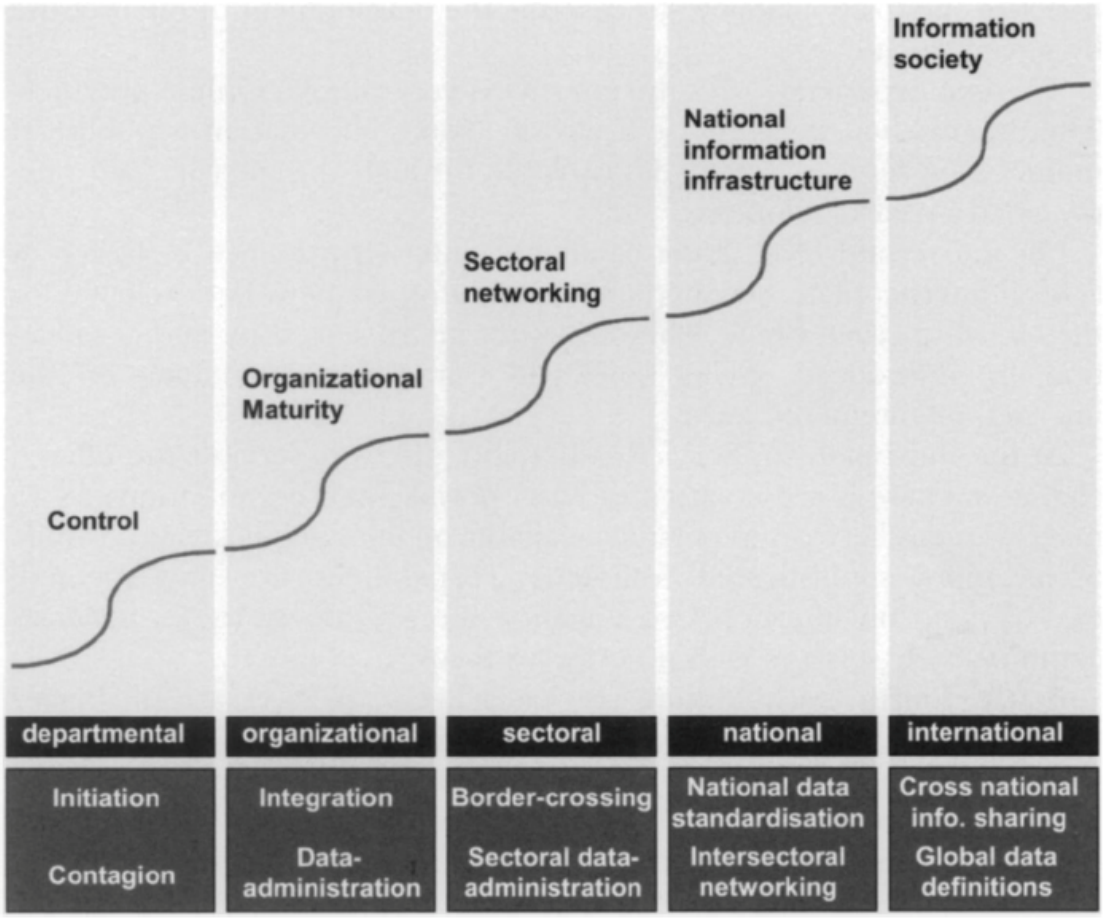

Figure 16 - Nolan ICT S-Curve[25]

Although mainly advocating the use of the Virtual Organization as a means to 'go global', Boudreau, et al. (1998) give us a list of technologies they feel have enabled firms to expand over greater geographical terrain. These are:

- Electronic Data Interchange – systems linking buyers and sellers
- Interorganizational Systems – transaction coupling software
- Electronic Commerce over the Internet
- Language Translation Software
- Mass Customization Technology
- Extranets – Software allowing approved external parties access to internal systems
- Groupware – Email, Virtual workspaces, Communication
- Intranet

[25] Source: Zuurmond, 2005, 137

- Organizational Memory Systems.

Perhaps most interesting in this list are not the components themselves, but rather the impression the authors leave, that choosing to be a virtual organization is, in fact, a matter of choice and not a by-product of implementing technology. This fits well with Mahr's (2010) idea of Organizational-IT "fit" as opposed to the previous cause-effect models.

According to the authors, the virtual organization is best suited for the transnational organization, although they also state that there must be IT-strategy fit in order for effectiveness. They claim that IT has enabled these organizations to effectively manage alliances and partnerships, achieve relative spatial and temporal independence (i.e. no need for a physical office), and achieve flexibility of resources base on market demands.

The global enterprise is not a structure per say, what is interesting is how IT is enabling organizations to adopt structures enabling global expansion. IT can, however, support the matrixed and other hierarchical organizational forms.

> *[T]he virtual organizational form is not the only design for an organization that can work for the transnational organization. Other, more traditional structures can be employed if adequate care is given to communication requirements and coordination needs among the parts of the traditional structure.* Boudreau, et al. (1998, 127)

Globerman, et al. (2001) looked into the effect of increased e-commerce (communication and processing technologies) on global business in the consumer financial sector, they found that the introduction of these technologies in this sector had accounted for an increase in competition, and a decrease in costs. They also interestingly found that many of the new entrants were foreign entities, this fact prompted US based companies to have to invest abroad. This side effect of IT seems very interesting and might also have application in other sectors.

> *E-commerce does appear to be contributing to a more globalized industrial organization of brokerage activity at the wholesale level. In particular, a consolidation of listing and processing capabilities at the exchange level heralds an increase in international trade in related listing, processing, and transaction clearing services. There is also a movement toward specialization of exchange activities on an international basis.* (763)

Forsgren and Hagström (2007) did a brief survey of "born global" Internet startups and found that they used a sort of ad-hoc process to organize when entering markets. The authors note that such companies tended to not follow typical means of internationalization (in this case the Uppsala Model) and instead followed their own schemes. They also found that due to the inherent scalability of technology, there were few barriers to this action, rather they need only focus on market conditions, competition and financial issues.

In the end all of the previous papers have shown that ICT has become an integral element of the decision to go global. In that respect there are a variety of strategies and organizational forms ICT can support.

5 Discussion

Although this research has utilized many different researchers' results in order to form a better understanding of the current research, it should be reiterated that there are conflicting opinions on many of these arguments. From the Author's perspective, there is a very good set of literature available in order for one to analyze the evolution of the study of IT and organizations.

Picot, et al. (2008) argue that with the boom in IT, they way we organize will evolve as well,

> *[t]his is due to the new information and communication technologies blurring the formerly clear boundaries between the market and the firm. This is especially true in respect of a number of new organizational forms*

that only become feasible as a result of the improvement of information and communication technologies. (61)

Although older research such as Pfeffer and Leblebici (1977) argue that there is a causal relationship between IT and Structure, even accounting for external forces such as environment, later studies have not found the same (e.g. Dewett, 2001). As we have shown, although there is agreement that changes in an organizations structure are enabled through the use of IT, there is no normative structure/process one can expect when implementing IT.

Picot, et al. however, merely note that IT has allowed the organization a choice; a choice between markets and hierarchy (as illustrated in Figure 17) (62). Thus he believes that that 'market-like and hierarchical organization mechanisms intermingle'. Keeping this argument in mind it becomes and organization's choice as to which changes in structure they would like to enact.

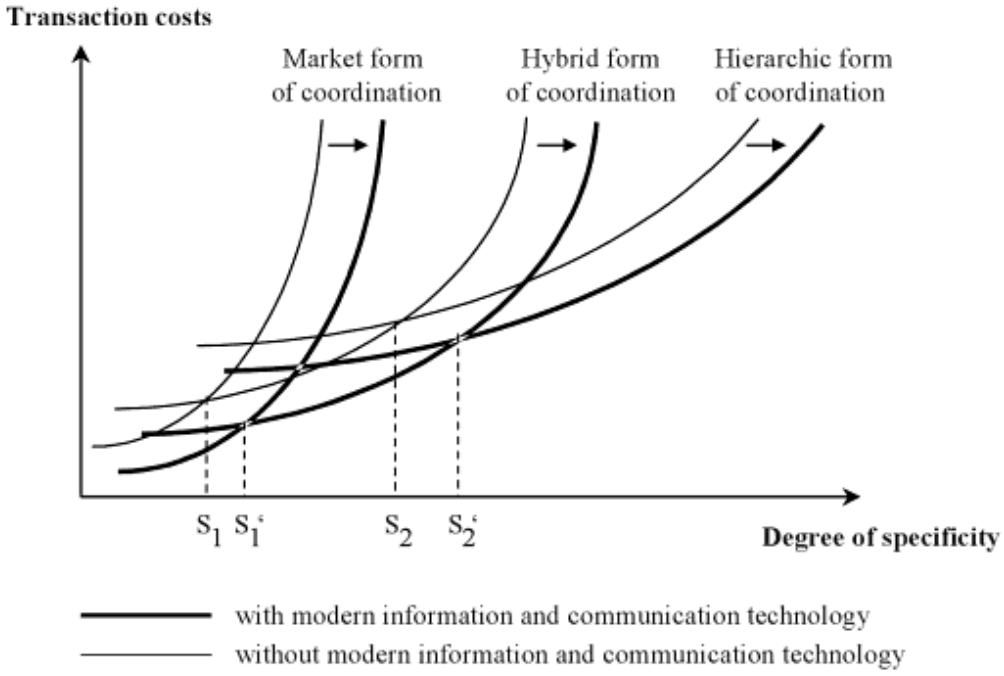

Fig. 2.14. Move to the market due to decreasing transaction costs (based on Picot / Ripperger / Wolff 1996, p. 71)

Figure 17 - Move to the market due to decreasing transaction costs[26]

[26] Source: Picot, et al., 2008, 60

This paper has shown researchers arguing that factors such as environment and market factors are the source of change in the organization, and that IT merely enables greater degrees of these changes. It has also shown that IT has been used as a source of change to fulfill some other purpose.

Looking at the first hypothesis - Information Technology is the enabler rather than agent of change in the organization structure – We have shown arguments from various researchers, some arguing that IT forces change, others arguing IT has no specific effects, and still others which have argued that forces besides IT cause the change.

Delving further into this hypothesis we have shown that studies show specific effects are possible through the use of IT. Examples include greater Formalization, the ability to create either a more Centralized or De-Centralized structure, and the ability to reduce specialized roles. However, many of the results from the researchers show that all changes are possible, and thus the result of the introduction may be more a cause of the desired strategy, than from the technology itself.

The fact that researchers have found evidence supporting both extremes supports the hypothesis that IT can enable changes in the structure, but does not necessarily cause them.

Thus organizations which desire less hierarchy due to any factor, will introduce IT which may enable this strategy (Business analytics, communication technologies). Organizations needing higher amounts of Formalization will do the same (e.g. data repositories). But this becomes a business decision, and not merely a side effect.

On the second hypothesis - Information Technology can be used to support any organizational form – we have shown that despite the introduction of new technologies there remain matrix, product-based and virtual organizations.

Although we see the growth in certain types of organizations (e.g. virtual, market-based), there is no indication that all organizations are moving in a certain direction. Technology can be used as a method to either support, or to change the existing structure. What has not been shown is the idea that IT operates best under one specific type of structure. On the contrary, information technologies today seek to support any type of organization; it is once again a question of a conscious strategy.

On a more operational level this paper hypothesized that Information Technology enables organizations to expand globally. Although this argument may seem out of place in the paper, nonetheless it is important as it deals specifically with several topics mentioned in this topic, namely structures and properties necessary to manage such an organization.

This paper has noted one opinion from Boudreau, et al. (1998) that with the emergence of the virtual organization because of the increase in information technology "going global" is a possibility for far more organizations today than had been in the past. This fact comes due to ITs ability to create linkages over distance and time, as wells as the ability to instantly share information.

Earlier, the multinational was a staged process starting with exporting, to franchising, to subsidiaries, etc. Today a company can be "born global" by leveraging IT. This unique relationship between IT and global business is an interesting development which should be further examined by researchers, as has been started by researchers like Knight and Cavusgil (2004).

Looking at these three hypotheses it is clear that they are supported by the literature. Though the literature may ascribe deeper meaning to their findings, it is clear to see that there is a connection between IT and structure, IT can affect change, but strategy seems to play an important part. One must decide which changes one wants to effect (e.g. better communication, more formalization) and then decide which technologies can provide. One must decide which Structure to have (e.g. Matrix, virtual, etc.) and then choose supporting technologies.

6 Conclusion

> *Unfortunately, the literature on information technology and organizational change does not currently support reliable generalizations about the relationships between information technology and organizational change.* Markus and Robey (1988, 583)

Unfortunately we must end on a sour note. Leaning on our quote from Zammuto, et al. (2007) at the beginning, there still does not exist a good framework under which this type of research should operate.

Information technology has now been a part of organizational life for over thirty years. It entered slowly at first, but has since grown exponentially and is now integral to all aspects of an organization. It is easy to look at the anecdotal evidence presented by the IT industry and services industry as proof that the introduction of technology has had distinct effects on the way we organize, however, taking the word of a salesman without additional research is a foolhardy act.

It should be clear however, that every paper used (and in fact all papers reviewed for potential use in this research) hedged their arguments by either saying that the results may not be replicable, or they only apply for the firms studied. Additionally, there has been and is still today wide agreement among researchers that the study of the relationship between IT and Organization has been neglected and in fact is not robust at this time. (Zammato, et al., 2007; Markus, 2004; Paré, et al., 2008)

Rather than focusing on the bleak state of the research, it is interesting to identify those areas where researchers have come to some agreement. As shown earlier, researchers have found that the increase in ICT has enabled several changes in the organization. The use of the word 'enabled' is not used as indication of causality, rather, it is used to denote a loose correlative

relationship. IT has presented the organization and additional choice for decision makers.

One of these choices seems to be the ability to choose a market based or hierarchical structure based on strategy and contextual reasons, rather than merely on available technology.

When looking into the idea that technology enables smaller firms, evidence presented has been mixed. Although firms are able to do the same work with fewer employees, mostly due to increased efficiency by the individual employee when employing IT, evidence also exists showing that firms use this agility to grow in other areas. Thus firms may be reducing their workforce at a department level, but they are extending their overall reach and increasing their size in other ways.

Although in the past there was quite a bit of focus on the idea that either IT determined Structure, or that Structure determined IT, the argument seems to have shifted in the research. In her structuration model, Orlikowski is open to the possibility of a system, whereby all elements influence each other to yield a final resulting structure. Other researchers have discussed the idea of fit between IT and Structure, and still others have argued that structure and IT are a byproduct of outside forces. Researchers do seem to agree that all organizational forms can be supported by IT.

Additionally, it seems there is agreement between researchers that IT does create efficiencies. It can enhance productivity and make each individual worker more productive. The argument early on was that this effect would cause organizations to become smaller. Though there is some evidence that organizations have taken advantage of this effect, it is by no means applicable in all circumstances. In fact, many researchers have seen organizations expand because of these efficiencies.

Evidence has also been presented that the emergence of certain technologies has enabled organizations to expand globally whether it be through better control mechanisms over agents, better communication among departments, or lowered costs of transacting.

Though, no researcher has been able to show a concrete causal relationship between IT and the organization or the other way around, there is enough evidence to support the fact that the emergence and integration of IT and the evolution of the organization are somehow correlated. This fact alone should motivate researchers to further study how, as well as the distinct effects of IT on certain organizational factors (e.g. size, formalization, etc.) and vice-versa.

Clearly there are many opportunities for further studies on IT and Organization. It the existing literature is any indication this cannot be completed through the work of only one discipline (e.g. Organization, Decision Sciences, etc.). Though the goal should result in a simple, transferrable model, it must be robust enough to span time, and the variety of Organization, and IT forms which exist; a prospect to look forward to.

7 Epilogue: New Technologies and the Organization of Tomorrow

As the 1990s and 2000s saw the rise of the Internet, so too are we today experiencing a revolution in IT. This revolution is coming in at least four areas: Mobile, Social, Analytics, and the Cloud. These new technologies are once again changing the way individuals relate to one another, the way organizations relate to individuals, and the way organizations relate to each other. As these technologies develop and are integrated into organizations - there is a lot of industry evidence showing that these are all becoming part of the IT portfolio of many organizations - it will be important to see what new changes occur in the organization. Questions will have to be answered, such as: Will the ability for employees to be completely mobile further promote the network structure and the move to the market? Will social technologies change the way organizations create work groups or how they relate to partners and customers? Will the move to cloud computing affect total IT spending and thus development?

7.1 Social

New technologies allow the promotion and sharing of preferences and information at a single click. This also 'democratizes' content as its quality is judged as well as the author. In addition it creates an individual 'social credibility', decided upon by individual users and not pushed by any organization as in the 'news' model.

By allowing users and receivers to instantly and publicly judge content (through the use of technology) we have changed the role of and the information available to the decision maker. Will this in turn allow new forms of organizing to emerge based on the changed role of the decision maker?

Businesses are weary of introducing these technologies, as they are fearful that these tools may be misused and create inefficiencies due to less work and more play. IBM among other companies has shown (albeit with their own data), that

these technologies, when properly implemented and managed, create efficiencies. One challenge however is getting employees to actually use the new technologies.

7.2 Advanced Analytics

The emergence of new technologies has also led to an industry that captures, analyses and presents data. Never before has so much data been available, never before has there been so much demand for this data.

Although reports have been widely available forever, the ability to create new types of reports, from disparate (and sometimes non-internal sources), very quickly and display them in a manner which adds value to the business may have significant effects on the roles which exist in the organization. There may no longer be the need for armies of analysts, rather the programming function may become more important. This may also enable decision making at higher levels.

7.3 The Cloud

Due to the ever increasing need for scalability as well as storage (backup) and processing capacity the newest fad in IT is now emerging. Software as a service (SaaS) or 'cloud computing' is quickly becoming an enormous industry, serving global organizations as well as individuals. The 'move to the cloud', as it is being marketed, is enabling organizations to create highly scaled, precision systems with very low infrastructure investment.

Security has become the biggest concern for businesses in this area. On the one hand the security that the data will be accessible when needed and will not be lost. And also the security that the data and the accompanying descriptive information will remain private from (1) the host and (2) hackers.

Implications in terms of organizational structure may be seen from a transaction cost perspective. Organizations selling Cloud Services generally offer them as a partnership; however, cloud services can also be managed as an internal

department. It will be interesting to see which organizations deem security as too big a cost.

7.4 Mobile

The first foray into mobile IT began just after the introduction of the PC. Apple computers introduced a portable PC in the late 1980s (Reily, 2003). Though the technology existed, it did not catch on until the introduction of portable devices which were convenient to transport while still having the computing power of a normal PC. Peripheral devices were introduced in the 1990s, but were not useful alone, they required a PC for syncing, software, etc. The 2000s have seen the development of devices beyond the laptop/notebook as mainstream tools. The devices in use today include Smartphones and tablet computers, among others. In some industries, handheld devices have become the norm for specific tasks, such as inventory management, service level management, etc. The existence of these devices, however, is not evident that this is a trend, but rather the amount of revenue being generated on independent software for these devices. Traditionally mobile devices contained an internally developed set of applications. However, these new devices are supported by hundreds of thousands of independently developed applications available both through proprietary and independent marketplaces.

A criticisms of these devices and the organization deal with security concerns, both software and physical. The software does not seem to yet enable robust enough security measures against hacking and other threats, plus the devices are not easily secured and prone to theft. Additionally, because these are not widespread in industry, it is still rather expensive for IT departments to service the devices.

The ability to have robust tools connected to the organization from anywhere is an incredible change. Previously workers were chained to desks for report writing and research. Today all of these capabilities are available from anywhere on devices the size of a palm. We already see trends in large companies like IBM where workers are asked to work remotely versus from an office.

Are these technologies going to change the marketplace as the Internet did in the 1990s or the PC in the 1980s or even the mainframe computer in the 1960s? Will they support current organizational forms, or we will see new entrants arise such as the bureaucracy at the turn of the 20th century or the conglomerate in the mid 20th century, or the virtual organization at the turn of the 21st century. Time will grant us these answers, but if we are lucky will also present us new questions for further research.

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Appendices

A1: Abstract

Information technologies have permeated modern business and organizational culture. In the past 25 years researchers have studied this trend and attempted to explain the relationship between these technologies and the organization through the IT and the Organization Studies lens. This research attempts to create an overall picture of this research and identify areas of interest and of weakness.

Over this time two major schools developed to explain this relationship: a technology driven change school, and a human choice driven school. These two schools have collected some very interesting perspectives over the same period. One key to this are of study however, is that there is still no consistent model to describe the relationship despite considerable study.

Despite this fact there have been some agreed upon results of the relationship identified in the literature, which in turn have yielded specific business effects. These are outlined in this research.

As technology continues to evolve and integrate into human systems, this study will continue to be a point of interests for researchers. Hopefully as IT goes beyond the realm of the Organization scientists and begins to touch other realms, new perspectives will emerge and these will increase our understanding of this interesting relationship.

A2: Zusammenfassung

Informationstechnologien sind heute ein wichtiger Bestandteil jeder Organisation. Während der letzten 50 Jahre haben sich viele Forscher mit der Beziehung zwischen Technologien und der Struktur von Organisationen auseinandergesetzt und diese aus der Perspektive der IT- bzw. Organisationsforschung analysiert. Die vorliegende Arbeit versucht eine Überblick über den Forschungsstand zu vermitteln.

In der zweiten Hälfte des 21. Jahrhunderts haben sich zwei verschiedene Schulen etabliert: die eine Richtung basiert auf technologiebezogenen Änderungen während die zweite auf Strategieänderungen beruht. Trotz der unterschiedlichen Erklärungsversuche von beiden Seiten gibt es heute immer noch kein klares Model um die Beziehung zwischen Technologie und Organisationsstrukturen zu erklären.

Technologien werden sich weiterentwickeln und mehr und mehr in Organisationen integriert werden. Daher wird die Beziehung zwischen diesen Komponenten auch in der Zukunft eine relevante Forschungsfrage bleiben (Zammuto, 2007). Es bleibt zu hoffen, dass diese Forschung aus mehreren Perspektiven betrieben wird, um bald ein besseres Beziehungsmodell zu entwickeln.

A3: Lebenslauf

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Geburtsdatum	05.02.1982
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Staatsbürgerschaft	US-Amerikaner, mit unbeschränkter Arbeitserlaubnis in Österreich
Familienstand	Verheiratet
Ausbildung	
10.2007 – dato	Internationale Betriebswirtschaft: Magisterstudium, Universität Wien voraussichtlicher Abschluss: 2012
09.2003 – 05.2004	Auslandsstudium, Institute for the International Education of Students (IES) Wien
09.2000 – 05.2005	Bachelor of Science in Business, University of Minnesota Schwerpunkte: Marketing, Operations Management, Management Information Systems (EDV-Management) Minneapolis, Minnesota, USA
09.1999 – 06.2000	High School Diploma, Highland Park Senior High School Saint Paul, Minnesota, USA
Berufserfahrung	
12.2011 – dato	Sales Manager Siliken USA, New York, USA
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09.2008 – 12.2010	Lotus Channel Marketing and Communications (CEE) - Werkstudent IBM Zentral- und Osteuropa (CEE) GmbH, Wien
	Regionaler Marketingkontakt für Geschäftspartner; Kollaboration mit regionalen und lokalen IBM Verkaufs- und Marketingabteilungen. Implementierung von globalen Initiativen z.B. Marketingpläne, Training, Produktvorstellungen
06.2008 – 09.2008	Office of Internal Oversight Services - Praktikum UNO - Organisation der Vereinten Nationen, Wien
	Fokussierte Recherche für aktuelle Untersuchungen; Überarbeitung von Dokumenten und Gesetzestexten; Aufbau einer digitalen Bibliothek juristischer Beschlüsse
08.2005 – 12.2006	Sales Relationship Representative Wells Fargo Financial, Inc. (Finanzbank), Des Moines, Iowa,

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	Kundenberatung und Betreuung (Finanzierungsteam)
04.2001 – 08.2005	Sales Representative, Warners' Stellian, Inc. (Handelsunternehmen), Saint Paul, Minnesota, USA

Weitere Qualifikationen

Sprachen	Englisch	Muttersprache	Deutsch	verhandlungsfähig
	Spanisch	Muttersprache	Französisch	Anfänger
EDV-Kenntnisse	Microsoft Office Product Suite, IBM Lotus Software			
	Erfahrung mit HTML, ASP.net, VB und SQL			
Organisationen	Leadership-Programm bei Wells Fargo Financial			
	H.O.L.A – Wells Fargo community Netzwerk			
	Toastmasters International			
Interessen	Klettern, Laufsport, Gitarre, Fußball			

Michael Crantes

New York, 31. März 2012