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The Emergence of the Multidimensional Organization

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ABSTRACT

A field research, commissioned by the Dutch Foundation for Management Studies, on the state of the application of the concept of business unit-organization (M-form) in the Netherlands, has produced some noteworthy results. Through interviews with 36 organizations, most for-profit companies (including Dutch subsidiaries of multinationals), two non-profit institutions and two government agencies, the following was found. The concept of unit management, that is to organize the firm in a number of self-contained business units as profit centers, is still very strong in the theory-in-use of managers and as a basis for accounting systems. However virtual no business unit any longer is self-contained organized, contrary to the definition of the M-form. All business units, in varying degree, depend on resources outside the unit to achieve their objectives. In at least five cases the mental anchoring to the unit-concept has resulted in debilitating problems with respect to account management and with project management, organizational entities which are needed to satisfy the Chandlerian criteria of fit-to-market and fit-to-strategy.

A small number of companies have overcome this problem and similar dilemmas by defining accountability for turnover and profit & loss simultaneously over multiple dimensions (product, region, account, market segment, industry), for each dimension a separate manager is accountable, contrary to what is assumed in the literature on economic organization theory, accounting theory and management control. Examples of firms doing so are ABN AMRO, IBM, Microsoft, ASML, PwC and some others. Those companies have commensurate multidimensional management reporting, management information, and coordination & control processes, and are successful companies (except ABN AMRO which is unbundled by three other banks). The reason to operate a multidimensional organization seems to be the emergence of multidimensional markets, to need to exploit economies of scope, especially with respect to knowledge, to have higher effectiveness in management control, to be more flexible, to reduce resource biased risk averse target setting, and to appropriate more value from the market in the case of network industries.

The concept of the multidimensional organization was presaged by Ackoff (1977) and Prahalad & Doz (1979) and Prahalad (1980) but has virtual disappeared from the literature since then. Its present emerging can be explained by using Arrow's (1974) *The Limits of Organization*, especially Arrow's prediction of the consequences of a fall in costs of information for the agenda of the firm.

This paper will describe the multidimensional organization as an empirical phenomenon, explaining its workings and its *raison d'être* in operational terms. In addition to that, using Williamson's efficiency hypothesis, the efficiency of the multidimensional organization is discussed whether the multidimensional organization is more efficient as is the M-form. This paper does not in the first place aim, as is common, to make a contribution to existing literature. Its first purpose is to report on a new empirical phenomenon.[1]

[1] The book resulted from this research is published in Dutch: Strikwerda, J. (2008). *Van unitmanagement naar multidimensionale organisaties*. Assen - Den Haag: Van Gorcum - Stichting Management Studies. Its executive summary is available from the website of the author: www.strikwerda.org.

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Introduction

The M-form, also called the multidivisional form or business unit organization, is widely acknowledged to be the most successful organization form of the twentieth century (Williamson, 1985: 279). The multidivisional form has been applied widely in both the USA and in Europe (Fligstein, 1985). "In terms of its impact, not just economic activity, but also on human life as a whole, the multidivisional organizational design must rank as one of the major innovations of the last century." (Roberts, 2004: 2). The characteristics of the M-form are:

1. The M-form, especially its divisions or business units, is based on distinct markets. Markets can be defined by geography, by products, by customers, by distribution channel, etc. To coordinate the activities of the division or business units in the market, it is sufficient for head quarters of a M-form firm to set the business scope of each of the divisions by defining their markets (Sloan, 1962/1986).
2. The manager of a division is delegated accountability compared to that of the manager/owner of a firm: to maximize the economic value of his division. Within the business scope set to him, apart from financing his operations, the manager of a division can make all trade offs in production factors, strategies and tactics, to achieve his objectives.
3. The manager of a division is delegated all the resources and the control over these resources as needed to achieve his objectives. The manager of a division thus can respond

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to all requirements of the market assigned to him, without the need to cooperate or to coordinate with other divisions or headquarters.

The M-form firm not only is a production function, it is also a governance system (Williamson, 2000). Expressed in terms of governance the M-form can be said to have the following characteristics:

1. The turnover of the firm is the sum of the turnovers of the divisions, corrected for internal deliveries; income of the firm is the sum of the incomes of the divisions, minus the costs of headquarters. Each division is an investment project in itself.
2. The executives of a firm deploying an M-form type internal organization manages its own internal capital market.
3. The resources are allocated unequivocally to the divisions or business units, usually except for resources like research & development, thus minimizing the need for coordination by headquarters. Headquarters controls the M-form by setting a strategic direction and approving financial and non-financial objectives to be achieved, setting the business scope, financing the operations, appointing, assessing, remuneration and dismissal of managers, controlling performance against objectives, capabilities and market developments and setting some corporate policies.
4. The efficiency of a firm operating an M-form for its internal organization is judged by the break up value: the value of the firm must be higher than the sum of the values of the divisions. This is achieved by exploiting some synergies, provided these synergies do not breach the quasi autonomy of the division managers.

Since about 1990 the M-form, for reasons to be explained in section 1, appears to dissolve in a complexity of entities: account management, shared service centers and cross division projects. Goold & Campbell (2002: 177) distinguish eight different unit roles (Table 1).

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Type of unit	Type of responsibility	Main accountabilities
Parent	Obligatory and added-value parenting	Corporate bottom line
Business unit	Market-focused	Bottom line
Sub business (also Line of Business)	Market-focused (disaggregated)	Bottom line
Overlay unit (or account management unit)	Corporate customer(s)-focused	Effectiveness in serving target customers (customer profitability)
Project unit	Project focused	Project delivery (Project profitability)
Core resource unit	Resource focused	Resource development and utilization
Shared service unit	Service-focused	Service cost-effectiveness
Business function	Functional	Functional effectiveness and contribution

Table 1. The different roles of units in the modern firm (adapted from Goold & Campbell, 2002).

Managers see or feel a need for these multiple unit roles to create synergies and leverage, and adapt the organization to the market. At the same time these managers feel not at ease with the resulting complexity of accountabilities, relationships, reporting lines, coordination issues. This complexity makes managers question the effectives of their control over the firm they are responsible for. Despite the wide application of shared services (APQC, n.y..; Bergeron, 2003; Kagelmann, 2001; Quinn, Cooke, & Kris, 2000; Strikwerda, 2003), counting houses, account management and other synergy mechanisms, the M-form still dominates the professional literature with respect to supposed organization forms for management control (Anthony & Govindarajan, 1995; Merchant & Van der Stede, 2003).

As a result there exists uneasiness with Dutch executives how to move on with their organization. Many of them experience severe problems with the multiunit organization: too high costs of staff, internal fights for resources, lack of standardization, lack of cooperation, loss of market opportunities. At the same time they don't see any viable alternative to the multiunit organization to solve these issues. Their feeling is, expressed through the board of the Foundation for Management Studies, which is composed of executives of Dutch firms, non-profit institutions and government agencies, that someway they want to understand, without being too explicit, how to proceed with the unit organization in view of the need to exploit synergies. It was agreed to conduct a field study on basis of the following question:

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What is the situation in the Netherlands with respect to the application of the concept of the unit-organization (M-form), in relation to contemporary issues of strategy and management of operations? Related to this main question, sub questions were phrased like: What alternative organization forms are used, in view of new strategies, market developments, technological developments, demographic developments? What trade-offs executives make in pursuing new organization forms or sticking to familiar organization forms? Academics may be tempted to observe that this is not a properly phrase research question. The way an executive or group of executives phrases a question, concern or curiosity should be appreciated as a fact in itself and be subject of decodification and interpretation, not of arrogant academic condemnation.

Although the field research is restricted to the Netherlands, its results may be relevant for other economies as well for two reasons. The first reason is that Dutch based subsidiaries of foreign multinationals, e.g. IBM and Microsoft participated in the research, as well multinationals which are headquartered in the Netherlands, e.g. Philips and DSM. The second reason is that the Dutch economy shows some remarkable performances. The Dutch purchasing power standards in 2004 ranked third of the OECD countries and its purchasing power parity ranked seventh (due to a low degree of labor participation (Centraal Bureau voor de Statistiek, 2007). GNP growth in the second half of 2007 was above 4%. Although the Dutch economy does not well in terms of growth of labor productivity.

The Board of the Foundation for Management Studies, based in The Hague, is composed of practical men and women, all being executives, there are no academics, consultants or staff professionals member of its Board. Subsequently these members are interested in new, proven practices, not so much theory. Cases and stories are preferred they and their audience can relate to in terms of lessons to be learned, what questions to be asked with respect to their own situation and what decisions to make or not to make. The responsibility of individual boards of firms and institutions is emphasized, therefore apodictic or prescriptive stories on organization forms ('managers must ...') neither unique solutions are not appreciated. Theoretical insights are appreciated as far these can be helpful to understand new developments and thus may be useful in managing change. Therefore this paper primarily is focused on empirical developments, not on developing a new theory. However the author feels a need to discuss the question whether the multidimensional organization is an efficient organization compared to the M-form in particular. As we will see the empirical phenomenon of the multidimensional organization raises questions

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on the present economic organization theory, especially the contracting theory underlying the explanation of organization forms as proposed by Williamson (1975).

A specific issue to be addressed in an empirical research (through interviews) is how to formulate questions to avoid answers based on *espoused theory* of executives whereas answers are sought based on *theory-in-use* (Argyris & Schön, 1996: 13). This is especially important to discover possible new organization forms. The psychology of *espoused theory* may imply that whenever a manager, operating a new organization form, is asked the question what organization form is deployed, he tends to give an answer that makes him look good with his peers and with shareholders and other providers of capital. It may happen, as was detected in this research, that managers deploy a new organization form, without having a label for it. Also it may happen that managers have a reason to label their organization form different from what deployed for as a cloak to hide sources of competitive advantage.

The task of the researcher is to decompose the concept of organization form into a number of questions with respect to factual practices in organizations, and from the answers to these questions the researcher should conclude an organization form, independent from the way the managers label their organization.

Two categories of definitions for organization form can be discerned. The first category consists of the definitions from the sociological field, extending into the resource based view of the firm. A representative example of this category of definitions is provided by Miles & Snow (1994: 37), the organization being: "an internal arrangement of resources … ready to receive and act on a set of inputs in a predictable sequence of steps". This definition typically is a description of the M-form. A second category of definitions is to be found in the economic organization theory. A representative example for this category of definitions is provided by Jensen (1983) and quoted by e.g. Brickley, Smith & Zimmerman (2001). Jensen defines an organization form to be:

1. The partitioning and attribution of decision rights among individuals in the internal organization of the firm.
2. The system for rewarding and punishment of individuals.
3. The system for measurement and evaluation of performance of both individuals and departments (business units) of the firm.

Note that in the definition of Jensen there is no mention of resources. Also, in this definition the firm is supposed to be managed on basis of economic profit, not on accounting profit (Grant,

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2002: 43; McTaggart, Kontes, & Mankins, 1994). With that Jensen's definition of organization form is more abstract compared to the definition provided by Miles & Snow. Miles & Snow's definition implicates a criterion (fit-to-market), whereas Jensen's definition is more descriptive. For instance Jensen's definition does not state a criterion on basis of which the decisions rights are to be partitioned. Therefore it was decided to base the research on the definition of organization form proposed by Jensen, to generate interview and survey questions. Based on this choice of definition, the research interest was to chart the degree of vertical integration and functional integration of divisions or business units, respectively how firms cope with adverse effects of multiunit organizations, especially doubling of costs of staff departments, account management and such.

The interviews revealed that most common is that divisions and business units are based on one dimension: a region, a product or a market segment, or a product-market combination. In some cases a division is based on a distribution channel, e.g. intermediaries in the insurance industry. One exception to this basis of organizing is the lesser known split business chain, in which development and manufacturing is globally organized (divisions based on products) and marketing, sales and services are regionally organized, e.g. de case of Philips Medical Systems, and in the past deployed by Matshusita.

It is know from various sources that, apart from deverticalization, the concept of the M-form is prone to two developments. The first is the emergence of shared service centers; the second is corporate account management. Next to the question on what dimensions a firm has based its divisions or business units, questions would be asked on decision rights, tradeoffs to be made, control over resources, fit-to-market, synergies, reward system, required skills, knowledge and attitude, type of control, which units are profit center, type of profit center, costs center and or investment centers, management information, etc. From the information thus gathered it was assumed that it should be possible to concluded what actual organization forms are deployed, irrespective how these are labeled by the managers themselves.

Specific a priori interests at the outset of the research were whether firms could be identified with successful and effective forms of account management at corporate level (to create negotiating power vis-à-vis customer and or to create customer synergies) or whether platform organization could be identified, this is an organization form in which virtual business units operate on a set of infrastructures for delivery, sales transactions, HR-transactions, management information, IT-services, etc.

As it turned out, this research tactics worked well, as it has, unintended and unanticipated, identified a number of working examples of firms with a multidimensional organization. The

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concept of the multidimensional organization has been written about by a number of authors (Ackoff, 1977; Ackoff, 1994; Galbraith, 2005; Prahalad, 1980; Prahalad & Doz, 1979; Reber & Strehl, 1988). However none of the other publications on organization forms, especially Williamson (1985) do mention the multidimensional organization (and neither of the so much discussed matrix-organization). Apparently the concept of the multidimensional organization has got lost in the literature. As we will see the concept of the multidimensional organization throws a critical light on Williamson's contracting theory as a basis of organization forms.

1. The rise, greatness and dissolution of the business unit organization

The success of the M-form usually is explained by the following factors (Strikwerda, 2005). Each division in an M-form is focused on a specific market. The resources in an M-form are organized per dedicated market and with that arranged and ready to receive inputs from the markets and respond to these independent from other divisions. The M-form creates an internal capital market which, at least in the first half of the twentieth century, was more efficient compared to the public capital market. The M-form created opportunities for individuals to develop themselves into entrepreneurial general manager without the need to provide capital. With this the M-form makes a better use of human capital compared to the functional organization form. The M-form is based on a double control loop (the executive board having the right and the powers to conduct operational audits in the divisions) resulting in low agency costs between the headquarters as investor and the management of the division. By separating strategizing (a task of headquarter) and economizing (a task of the divisions) it is ensured that strategizing is not restricted by the operations to grasp market opportunities (Williamson, 1985: 282). In terms of management accounting the M-form is a simple organization. Even in those cases a functional organization in itself is scalable, it can not handle product differentiation as the M-form is capable to do. The M-form has the capability to exploit some synergies (economies of scope) cross markets and cross products, for e.g. finance, research, and (functional) standards, although this always has been a difficult and sensitive issue.

Despite its success in the twentieth century, the M-form became criticized since the eighties of the twentieth century (Bartlett & Ghoshal, 1993). From an investors perspective the added value or parenting value created by headquarters was questioned, both with respect to the businesses of its portfolio and for the investors themselves (Copeland, Koller, & Murrin, 2000;

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Goold & Campbell, 1987). In many case this could be demonstrated objectively through the application of the concept of the break up value.

Apart from the factors which explain the success of the M-form, its working is based on a number of assumptions especially with respect to the underlying economic model of the firm. In the M-form a first premise is that the resources of a specific division cannot be alternatively deployed in other divisions. Either this is for reasons of asset specificity (Williamson, 1985: 32) and or for reasons of coordination costs (and in the case of regional divisions, costs of transportation). Generally this is the case for conventional technology. Suppose a firm operates an internal organization with three divisions, and suppose these divisions are based on distinct product-market combinations (the most common basis of divisions). The relationship between resources (r_i) and products (p_i) can be represented in a simple input-output table as in Figure 1.

	p_1	p_2	p_3
r_1	1	0	0
r_2	0	1	0
r_3	0	0	1

Figure 1. The relation between specific resources r_i and products p_j

Figure 1 expresses that all output by resource r_i is consumed by product p_i. Different from what Williamson (1985) assumed, divisions are not based on specific resources, divisions, at least as originally thought of by Sloan (1962), were based on specific group of consumers. Therefore the M-form also assumes a specific input-ouput relation between products p_i and consumers c_i. Because, but thit has changed in later periods, in the original M-form the markets for each of the divisions were well separated, no opportunities for cross selling existed, and neither did opportunities for system integration of products from different divisions. The relation between products p_i of divisions i and customers c_i of divisions i can be represented as in Figure 2.

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	c_1	c_2	c_3
p_1	1	0	0
p_2	0	1	0
p_3	0	0	1

Figure 2. The relation between the consummation of products p_i by customers c_j in a pure M-form.

A third assumption underlying the M-form is that each of the divisions or business units can achieve on basis of the size of its assigned markets and achievable market share, and thus its maximum output, the lowest average total costs per unit of production or product.

With respect to the relation between resources and products three developments are changing the input-output relation depicted in Figure 1. The first is that due to pressure of the capital market since 1990, unrelated portfolio's of product-market combinations (=divisions) e.g. through swaps like in the chemical industry, have been changed into related port folio's of product market combinations. This has reduced the asset specificity between the divisions. However the benefits of sharing those assets or resources, especially those who's lowest average total cost only can be achieved on basis of the combined output of two or multiple divisions (e.g. the development and production of the platform of a car), did initially not outweigh the additional costs of coordination required for that. In the case of information technology based business functions like logistics, IT-services itself, sales transactions, the U-shape of total average costs has changed into a L-shape, changing the balance of benefits of sharing versus coordination costs. This is where a second development manifests itself: the falling costs of information (Jorgenson, 2001). Falling costs of information, e.g. through e-mail, internet, intranet, digital communication in general, re-engineering processes, standardization of interfaces, lowers coordination costs. More in general, e.g. in the car industry, chemical industry, computer industry, generic activities like e.g. assembly are shared cross divisions and even cross different manufacturers. Some activities, e.g. electronic funds transfer have natural monopolies, as a result of which all banks in the Netherlands co-own one national center (Equens N.V.) for electronic money transfer. A third development that affects the concept of the M-form is the shift in the economy from exploiting codified knowledge towards exploiting specific, non-codified, personal knowledge (Boisot, 1995). Knowledge, at least to a certain extent has a public nature, knowledge is not consumed when applied, its owner does not loose the knowledge in exploiting it and due to low reproduction costs, and knowledge can be applied cross multiple products, markets and customers simulteneously. This possibility creates a pressure (by investors and entrepreneurs) to exploit knowledge on basis of a multiplier profit model, that is that the same knowledge,

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expertise or concept is exploited through multiple platforms or division, as e.g. in the case of Walt Disney. These three developments result in an input-ouput table between resources and products, as suggested in Figure 3. Some resources will remain product specific (r_1), some resources (r^b_i) can be shared, but consuming products compete for its total output, some resources (r^k_j) can be shared among multiple products without exclusive competition for its output, as e.g. in the case of generic application software.

	p_1	p_2	p_3
r_1	1	0	0
r^b_i	0,5	0,2	0,3
r^k_j	1	1	1

Figure 3. Three types of resources in the modern M-form.

In the relation between products (services) and customers (Figure 2) a number of developments take place as well, albeit of a different nature. To save selling costs and or to increase bargaining power with customers, in case cross-selling opportunities exist, firms with an M-form type internal organization decide for establishing (corporate) account management. Account management then being an accountable entity (financial responsibility center) in the internal organization, carrying profit-and-loss responsibility (Although the research revealed that many firms have problems with granting corporate account management the status of profit center, as it is assumed that this takes away the responsibility for profit from the units). As in the relation between products and resources, also in the relation between products and customers some products (physical products, service time) cannot be alternative deployed (p^b_i), whereas knowledge based products can (p^k_j) be alternative deployed due to their public nature. This development implies that at least in a number of cases divisions no longer have disjunctive sets of customers. This is why the input-output relation between products and customers as represented in Figure 2 needs to be redefined as in Figure 4.

	c_1	c_2	c_3
p_1	1	0	0
p^b_i	0,5	0,2	0,3
p^k_j	1	1	1

Figure 4. Three types of relations between products and customers.

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Related to this is that in stead of selling separate products (system components) from different divisions or business units to the same customer, firms will tend to, depending on the preferences of the customer, to integrate these products themselves into one system to be sold and thus appropriating more value in doing so. An example of this is IBM. However IBM has no total power over the market and therefore has to ship products that are integrated by customers themselves, other customers will make use of an intermediary firm to integrate IBM's products and for a third category of customers IBM may integrate products and services into solutions itself.

It therefore was hypothesized at the outset of the research that, as an amendment to Williamson's contracting scheme for alternative organization forms (Williamson, 1985: 33) the M-form is developing as suggested in Figure 5, respectively that the choice of the form of the internal organization depends on the combination of the different input-output relations between resources, products (services) and customers.

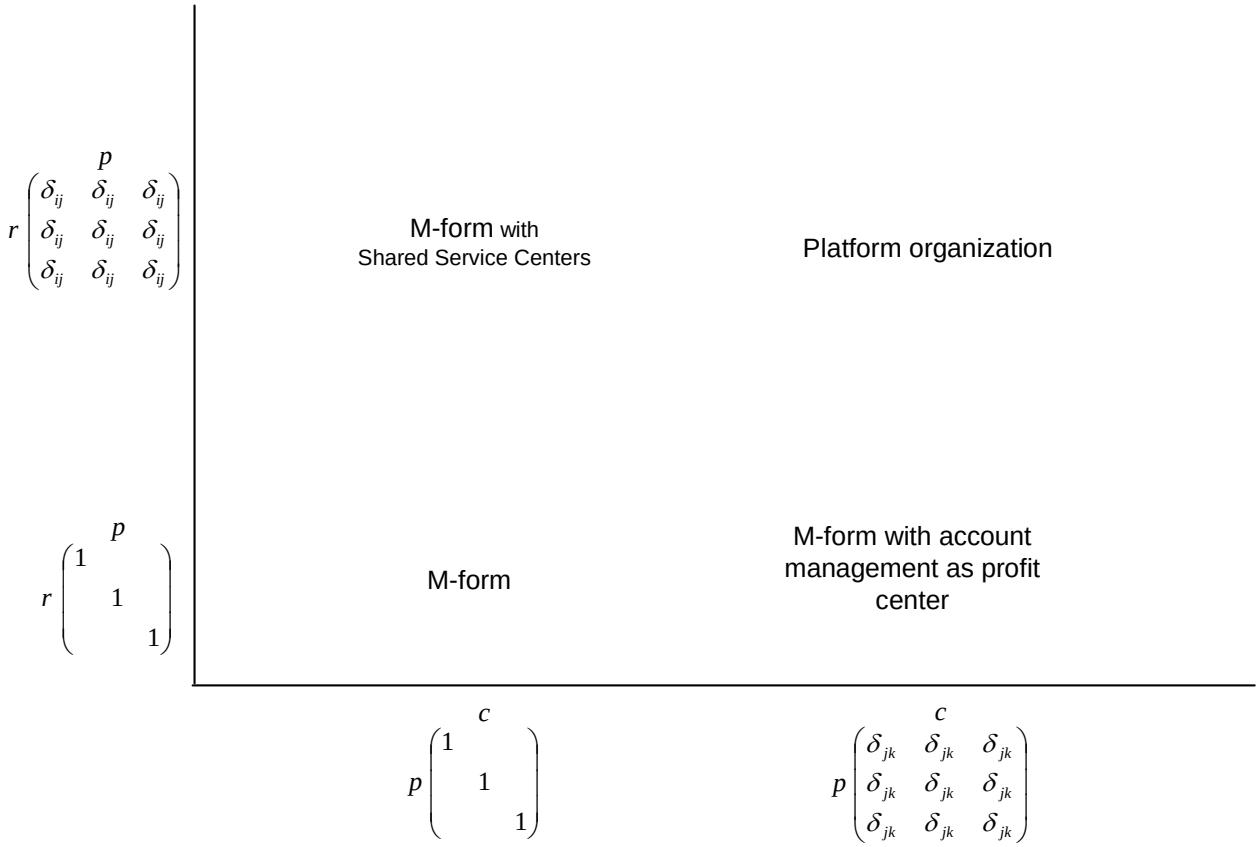

Figure 5. A possible development of the M-form due generic and alternatively deployable resources and products ($0 \leq \delta_{ij}, \delta_{jk} \leq 1$).

In the field research a number of problems were identified in the application of the M-form. In a number of cases, e.g. the globally operating engineering firm Arcadis and the financial

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services firm Cordares, it was found that its management wrestles with the question how to organize cross unit account management to serve corporate accounts. A corporate account is a customer who is serviced by multiple units or divisions. Especially the dilemma for many firms is to decide whether a corporate account manager should have profit-and-loss responsibility or not. Attributing profit-and-loss responsibility to an account manager is opposed by business unit managers, as this reduces their status, power and autonomy. Other dilemma's generated by the unit-form are the accountability for and control of large projects, e.g. in the construction industry. These projects are the profit centers in the business model of a construction firm, yet at the same time there is a need to monitor the profitability of each of the business units, delivering goods and services to the projects in addition to serve their own unique external customers as well.

The M-form has as doctrine that profit-and-loss responsibility is assigned to divisions or business units only and the M-form has difficulty to deal to alternative lines of profit-and-loss responsibility, due to social conventions. The M-form is based on the assumption that it is possible to segment the market completely on basis of one dimension, e.g. income brackets or life styles of customers or by regions. E.g. insurance firms, banking services, IT-services operate in markets in which customers demonstrate buying behavior along multiple dimensions. E.g. a global customer of Arcadis operates cross all the regions in which Arcadis has organized is profit centers. The delivery of services is by regions, but contracting and defining services to be delivered both parties want to conclude at global level.

Under pressure of the capital market, there is a need for exploiting synergies, or economies of scope, cross units (Grinblatt & Titman, 2002: 425). In the M-form synergies usually were restricted to financial synergies and some synergies in research & development and management development. In the eighties of the twentieth century, as part of the corporate finance revolution, the added value of corporate headquarters vis-à-vis both the units and the shareholders, was questioned (Goold & Campbell, 1987). Especially the unrelated portfolio strategy was questioned as being in competition with the portfolio strategy of investors. The issue of the added value of corporate headquarters, or parenting value (Goold & Campbell, 1987) was answered in a number of ways. A first strategy was to change from loose control to tight control (combined with a better business understanding at headquarters) to have management of divisions perform better as either in the case of loose control, or if these units would have been independent firms or the units being owned and monitored by another parent. A second strategy was down scoping the portfolio to either a related portfolio or to the (original) single business firm (Hoskisson & Hitt, 1994). A third strategy was to swap divisions with other firms, as e.g. in

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the chemical industry, to create a related portfolio of business, whilst maintaining size of the firm but increasing the market power of the firm. Related to this third strategy, especially to increase market power, is the exploitation of customer synergies, internal process synergies) and learning & growth synergies (Kaplan & Norton, 2006a). Customer synergies are created through corporate account management and through integration of products, services and systems for specific customers. Internal process synergies are achieved through shared services (Strikwerda, 2003). Learning & growth synergies initially were tried to be achieved through knowledge management and knowledge management systems, but no reports exists confirming their effectiveness. The lack of effectiveness of knowledge management (systems) can be explained by the fact that knowledge with the turn from the economy of the second industrial revolution into an informational or content economy is an issue of ownership (Jensen, 2000). The initial approaches for knowledge management (Nonaka, Toyama, & Nagata, 2000) simply assumed the firm to be the owner of all knowledge present in the firm and thus knowledge management, like scientific management, was focused on codifying tacit, personal knowledge so it could be controlled by the firm. Specific, personal knowledge is the property of the worker. Understandably workers opposed knowledge management systems as an attempt to expropriate that property, at least without proper indemnification. At the same time creative workers, experts mastering uncodified expertise either know or sense that the value of their expertise increases with the size of their personal market. That is, if their expertise can be applied in as many as possible products, projects, services, markets and with customers will result in a maximum value of their expertise. The maximum value of their expertise is not determined by the size of the turnover or market of the unit they are part of. However, in the traditional unit organization the deployment of personal expertise cross as many as possible units is hampered by two factors. The first is that this cross unit exploitation conflicts with the values of the traditional unit manager, who wants to exert complete control over the resources allocated to him, including the experts based in his unit. 'His' expert exploiting his expertise in other units beyond his control (because, as we will argue later on, it is not a transaction) is perceived as challenge to his authority and status. The second problem is that if the unit manager allows the expert to contribute to other units, he wants an indemnification in the form of a transfer price. But to settle for a fair indemnification is difficult and thus expensive due to problems with measuring input and output of the applied expertise, apart from coordination costs that arises. As a result the expert feels demotivated if not restrained in maximizing his personal market. This not only is injurious for the individual, but also for the firm and the economy.

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Concluding we see three issues with respect to the multiunit organization. First is that its principle of self-contained organized units, due to amongst other shared services, no longer holds. Second is that the concept of multiunit organization is conceptually flawed to create and exploit customer synergies. Third the concept of the multiunit organization is not a proper institutional environment to exploit personal knowledge to the fullest.

2. Some cases.

As explained in chapter 1, we asked a number of firms, in most cases through their executives, the question on what dimensions the internal organization of their firm is based, region, product, market segment or another dimension. In most cases, 25 out of 35 executives gave one dimension (region, product) as the basis for their internal organization. In a limited number of cases executives gave as an answer that the responsibility for turnover and results simultaneously is organized over a regional dimension, product dimension, accounts, and or distribution or market segments. These firms are IBM, Microsoft, ASML, ABN AMRO, Sabic Europe, Albert Heijn Company, Price Waterhouse Coopers (table 1).

Firm	# Dimensions	Dimensions	Industyr
IBM	4+1	product/solution, regions, accounts, distribution channels and functions	Information technology services
Microsoft	4	products, regions, applications, market segments	Software
ASML	2+1	products, accounts and functions	Equipment for the semiconductor industry
Albert Heijn Company	8	Time, place, formula, category, customer's loyalty card, receipt, regions, branche-store	Food retail
Van Hattum & Blankevoort	2	business units and projects	Construction
ABN AMRO	4+1	regions, global clients, market segments, products and functions	Financial services
PricewaterhouseCoopers	2+1	industries, professional services and functions	Professional services
Evean Group	4	Regions, care-line, funding, functions	Care
Royal Cosun	1	Operation company (product-market combination)	Food

Table 2. Overview of firms with a multidimensional organization as identified in the research. Royal Cosun is one of the examples running a traditional multiunit organization, in their case for good reasons (Strikwerda, 2008).

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These are firms which participated in the research; it is very well possible that outside our sample other firms exist that deploy a multidimensional organization.

IBM is a well known firm and subject of many business studies and case studies. That IBM deploys a multidimensional organization until now has been overlooked by researchers. IBM pursues a *network-centric computing strategy* with a globally integrated enterprise (Palmisano, 2006). This strategy is based on five S's: servers, standards, software, services en solutions. IBM has defined its market to be:

- Global accounts;
- Regional accounts;
- Midsized customers which can be grouped by regions;
- Discrete products (e.g. servers), which are applied in multiple accounts, regions and in *solutions*;
- Industry-specific *solutions* (that go beyond regions);
- Distribution channels.

To pursue its strategy in its defined markets, IBM deploys a multidimensional organization. IBM has defined the accountability for profits, market share, and results simultaneously on the dimensions: regions, products/solutions, accounts/industries, and distribution channels. For each of these dimensions a manager is made accountable and held accountable. Still the profit center in the internal organization of IBM is neither one of these dimensions; the profit center is the customer. The task of each of the managers on each of the dimensions is to optimize the position of IBM with its customers. This only can be achieved through cooperation and teamwork between these managers and their subordinates. This cooperation is based on:

- One corporate mission and set of values (no mission per dimension)
- The customer as the profit center
- A number of managers who understand the whole working of the organization of IBM as an economic system and who identify with IBM as a whole, and do not care for having hierarchical control over resources;
- Management information from one *trusted source*, ownership of transaction data rests with Corporate Finance & Accounting, one general ledger, transactions which are recorded with multiple attributes according to the dimensions, cost allocation on basis of a kind of activity based costing, absence of information asymmetry, both vertical and horizontal, absence of transfer pricing (the managers of the various dimensions are made available the same sets of information, each therefore knowing its contribution to the profit on complex, multidisciplinary projects).
- A control system which is partly horizontal due to absence of information asymmetry and the hierarchy not only making those decisions which befall the category of executive action, but also monitoring that decisions are made timely.

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In the planning & control system of IBM the products are the dimension with which the target setting process starts, to be challenged by the other dimensions on basis of their view on the market opportunities.

It is to be judged by the performance of IBM as reported in their annual statement, whether this organization form is efficient.

A second case is PwC - Netherlands, the professional service firm for accounting, tax and management consulting. Their internal organization exists from three axes: industries, including key accounts, professional services and support services. The managers responsible for PWC's position and performance in the industries have virtual no resources under their control. Resources are organized in the business units based on professional services. The managers of the industry- or market segments (including account management) have top-line responsibility: turnover, market position and customer retention. To perform their targets the market segment managers depend on the managers of the business units, who have a bottom-line responsibility as they control the resources. It is not however that the market segment managers are dealing and wheeling with the business unit managers to agree on targets, available resources, etc. The issue is that in this case, as in the other cases of multidimensional organizations, market opportunities are organized separately from resources. Deliberately the conflict between market opportunities and resource utilization is brought to the table of the executive board to reduce satisfying, risk averse behavior from resource managers, by confronting them with market opportunities identified by the industry managers (and confronting the possible immoderate judgment of industry managers with a top-line responsibility, but no responsibility for resource utilization, with the limitations and risks of resources). In this way the executive board simulates the requirements of the capital market (without PwC itself being a public firm) to maximize the performance of its firm. Again, the efficiency of this organization form has to be concluded from the performance of the firm as reported.

3. A description of the multidimensional organization

The multidimensional organizations identified differ according to their industry, size and dominant technology, but have a number of characteristics in common:

- They pursue a strategy of integrated offerings of their products and services, based on one corporate mission, but allow for servicing customers that want to arrange the integration themselves or through third parties;

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- They operate in a market which cannot be segmented on basis of one dimension, their customers have multiple characteristics and options, and or the market has the nature of a network industry (according to the definition of Shy, 2001)
- Multiple dimensions in the market have been identified that in conjunction are critical to the market position and the success of the strategy of the firm. Decision rights are partitioned and attributed according for each of the identified dimensions. Managers first are held accountable for their contribution to the overall performance of the firm, second for the performance of their own dimension.
- The profit center in the internal organization is the customer, although the profitability of each of the critical dimensions is managed and reported, this latter information is instrumental to optimizing the position and performance of the firm with the customer.
- Transaction data, both internal and external is corporate owned (that is: not owned by regions or product BUs) and transactions are recorded so that either physically or through interoperability there is one general ledger with transactions recorded with multiple attributes, according to standardization set by corporate, allowing for multidimensional and also for non-financial consolidation of performance.
- A cost allocation system is in place to the effect that coordination of internal activities is based on the final profitability of tradeoff and allocation decisions, not on internal transfer prices.
- Information on the performance and position of the firm on each of the identified critical dimensions is reported simultaneously with a monthly or weekly frequency at multiple levels in the organization.
- There is absence of both vertical and horizontal management information, at least at the level of key managers. Reporting is not so much on performance, as this information is in the management system, but on identifying and solving issues for the firm, and that decisions are made timely.
- Market opportunities and resources are organized separately; the reconciliation between grasping market opportunities and resource utilization is made a corporate issue, visible for all. Resources are allocated opportunistic, either to dimensions or in shared services, whatever produces a highest return on investment.
- Managers are selected for their motivation based on building a reputation due to making a visible contribution to the firm, managers whose motivation is based on occupying a position first and performance second, are deselected.
- Remuneration is based on corporate performance predominantly.

In short, the multidimensional organization form might be defined as: An internal organization is said to be multidimensional if the performance of the firm, this is turnover and profitability, simultaneously is reported over at least two dimensions (e.g. region, product, accounts) at multiple levels in the organization, as part of and as part of the usual cycle of the management reporting in the organization and if for each of these dimensions a manager has been made accountable for turnover, market/wallet-share, profitability, with commensurate decision rights who is held accountable for this performance and is judged on this performance, within the frequency of the standard management control cycle. With this definition the multidimensional organization differs fundamentally from the matrix organization. The matrix organization has usually both regions and products as profit centers, there is no shared information, and the

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matrix organization is based on the economic model of the unit organization, not on the multiplier exploitation of intangible assets.

4. Possible explanations for the emergence of the multidimensional organization

What explains this emergence of the multidimensional organization? From the papers published by Prahalad & Doz, Prahalad and by Ackoff, it can be concluded that the issues which are solved by the multidimensional organization exist for a long time, but often were addressed ineffectively under the label of the matrix organization (Bartlett & Ghoshal, 1990; Davis & Lawrence, 1978). Especially the question has to be asked why the proposals and descriptions of the authors Ackoff, Prahald and Doz did not result, then back in 1980s, in the multidimensional organization.

Three possible levels or areas of discourse are to be discerned to explain the phenomenon of the multidimensional organization. The first is the discourse of organization design and theories of organization design. The question might be asked whether the multidimensional organization is the result of application of existing methods and models for organization design, because of a change in the value of their parameters. An example of such a parameter might be costs of coordination. A second possible discourse of explanation could be the falling costs of information, based on the work of Kenneth Arrow predicting the effects the fall of costs of information on the firm. The costs of information have declined over the past fifteen years, but does that provide an adequate explanation for the emergence of the multidimensional organization? The third area of discourse is organization form efficiency. In this discourse it is assumed that firms will adopt new organization forms because new organization forms demonstrably have a higher efficiency compared to presently deployed organization forms.

Is the multidimensional organization produced by any of the methods for organization design?

The body of theory explaining organization form is fuzzy. To day no consensus on nor a dominant method exists how to design an internal organization (Allen & Sherer, 1995; Brickley, et al., 2001; Brickley, Smith, & Zimmerman, 2003; Burton & Obel, 2004; Daft, 1998; Demers, ; Galbraith; Goold & Campbell, 2002; Grandori & Soda, 2006; Harris & Raviv, 1999; Kogut & Bowman, 1995; Nadler & Trushman, 1997; Roberts, 2004; Sadler, 1998; Simon, 1996; Simons, 2005).

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For that reason we start with Chandler's dictum "Structure follows strategy … but the market is the common denominator." (Chandler, 1962: 382-383). Chandler also has documented the role of economies of scale and economies of speed as well the role of the (efficiency of the) capital market on the way firms are organized (Chandler, 1977, 1990). To this can be added Coase's (1937) observations with respect to the influence of market efficiency on the internal organization of firms. Miles & Snow have, in agreement with Chandler (1962) reported that *fit-to-market* is another design criterion for the internal organization (Miles & Snow, 1994). To this corporate finance has added two design criteria, the separation of market opportunities and resources, and the exploitation of economies of scope (Grinblatt & Titman, 2002).

These theories do not add up to a single algorithm how to design an internal organization—respectively what factors define the choice of the senior management of a firm for a specific organization form. Other factors like those mentioned have to be taken into account as well, especially social traditions (Meyer, 1994). A positive model for either explaining or predicting the application of organization forms in specific contexts is summarized in Figure 6.

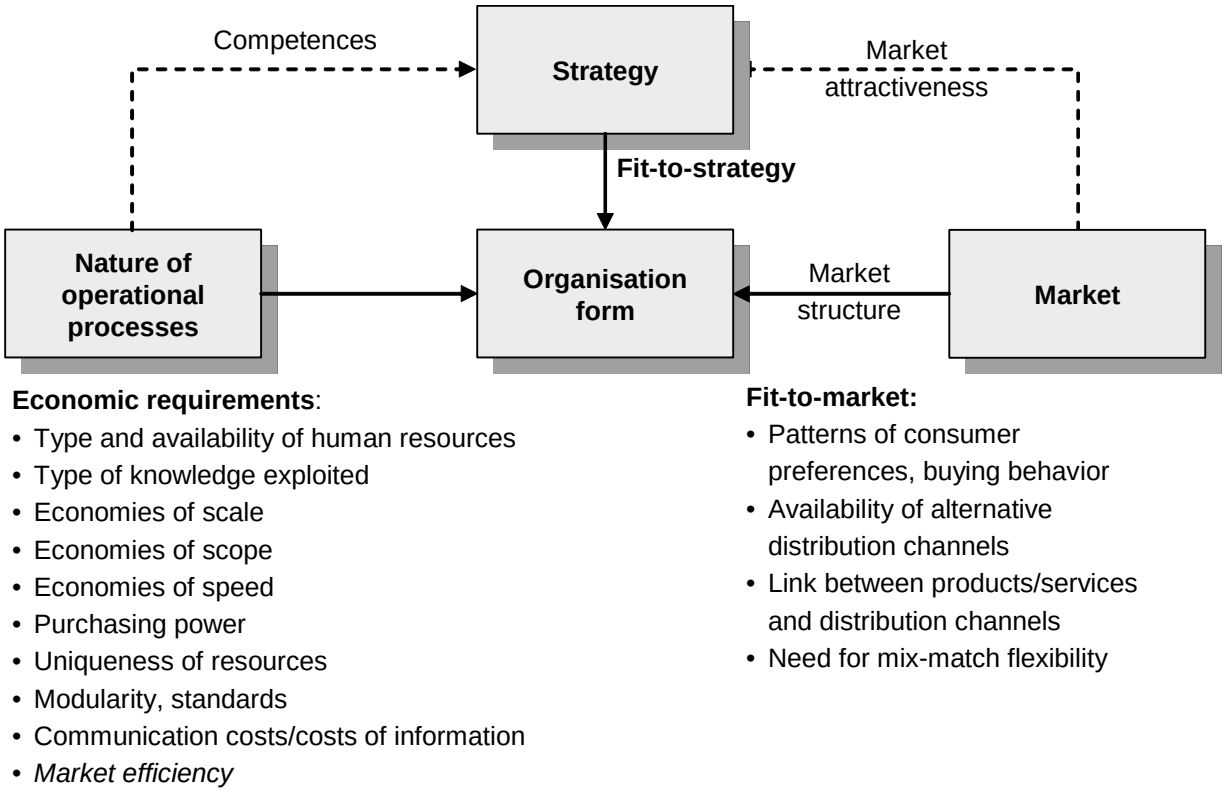

Figure 6. The factors influencing or determining the form of the internal organization of the firm.

With respect to the market one of the assumptions underlying the Chandlerian model in Figure 6 is that it is possible to partition the market complete and univocally in a number of distinct segments, e.g. by geography, income, life style, language, distribution channel, etc. Kotler (2002)

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observes that it is seldom possible to segment a market univocally. A multidimensional market segmentation is needed, but marketeers need to decide from all cubes resulting from the multidimensional analysis in the market which is the most critical, and base their marketing strategy on that single chosen cube as a one dimensional basis tot achieve fit-to-market.

There are four developments that question Kotler's reduction of a multidimensional market segmentation to one single most important dimension as a basis for market strategies and thus as a basis for organization design. The first is that a single customer may pursue different life styles as basis for buying preferences. Income certainly predicts, especially in restrictive way, buying preferences, but since the mid-nineties no longer it is a safe predictor for consumer behavior. In addition to this, the case Albert Heijn Company (eight dimensions) demonstrates that consumers have different sets of preferences on different times of the day, different by place (e.g. the super market in the residential area or in the ToGo shop at the railway station) and between days of the week, especially between utility shopping through the week and fun shopping in the weekend. A second development is the emergence of multi channel marketing & sales. Digital technology and the Internet make it possible to move the richness-or-reach boundary curve (Evans & Wurster, 2000) and that e.g. search for a product or service, comparing, closing a deal and delivery, can be done, and increasingly is done, through multiple, different distribution forms, e.g. the Internet, call center, a physical shop, an account manager. This itself does not create a multidimensional market, although an increase in alternative distribution channels enables customers to live different life styles and corresponding sets of preferences more easily. Multiple channels for one product-customer combination imply that a distribution channel no longer can be a proxy for the customer as the profit center, nor can the product serve as a proxy for the customers as profit center. In combination with cross selling opportunities respectively cross selling strategies, multiple channels for one product-customer combination implies that the firm needs to define the customer to be the profit center in its system of internal governance, respectively accounting system and subsequently in its performance management system. A third development is the emergence of network industries (Shy, 2001). In a network industry the customer (private and professional) purchases components needed for the system he wants (a computer system, a home entertainment system), from multiple independent suppliers and integrates these components himself into the system he values, whereas in a traditional economy the components are integrated by the manufacturer who sells the complete, integrated system. As a consequence the locus of value creation shifts from within the jurisdiction of the company of the traditional manufacturer to the network of the industry it is in. This applies to e.g. industries like construction, computers, IT-services, financial

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services. The case IBM illustrates that IBM wants to play a role in each of the three positions, being a system integrator itself, serving third party integrators, respectively end customers who are served through third party integrators and customers who integrate systems themselves and buy products from IBM through distribution channels. Often the same customer plays all three roles at the same time. This has to do with a fourth development, gaming, especially in the business-to-business market. Suppliers have a strategy to capture more value from the market by operating account management and system integration. Their customers may counter this by signaling that they want to deal with individual product managers only. Another tactics is once a supplier has developed system integration specific for a customer, this customer reverse engineers this system, and starts buying individual components from alternative suppliers, thus shifting the process of value creation through system integration from the original supplier to themselves. This happened e.g. in the early nineties of the twentieth century between Philips as supplier and Nokia as customer.

The combination of the emergence of multiple places of value creation and gaming with respect to negotiating power increases the complexity of a market in terms of number of alternative behaviors of customers. To remain in control vis-à-vis this increasing complexity of markets firms have to increase the complexity of their organizations according to Ashby's Law of Requisite Variety (Ashby, 1956). To remain in control requires that the firm is informed on the behavior of its customers and knows what alternative market or distribution tactics provides most profit, whether it is through system integration / account management, sales of individual products and through which distribution channels. Being informed is not sufficient, more critical is that the firm is prepared to act, either anticipating or in response, to alternative consumer behavior.

What can be concluded is that the implicit assumption underlying the Chandlerian model in Figure 6, that a market can be segmented on basis of one dimension, no longer is tenable in at least a number of industries (IT-services, professional services, financial services, retail).

A second assumption underlying the Chandlerian model is that firms pursue an one dimensional strategy. So the question is: do multidimensional strategies exist? Traditional strategies were low cost, differentiation, single brand, multiple brand, multi-product-market combinations, portfolio strategy, brand strategy, etc. Firms pursuing a combination of low cost strategy and differentiation demonstrate superior performance to firms that focus on only low cost or only differentiation (White, 1986). IBM is an example of a more complex strategy compared to the strategic choices made by Dell and Cisco (Galbraith, 2005: 112). IBM focuses on global accounts, regional accounts, midsized customers grouped by region, discrete products

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(e.g. servers) which are sold to multiple accounts, regions and are applied in multiple solutions, solutions for specific industries (across multiple regions) and distribution channels. Brown & Eisenhardt (1998: 21) have documented that in the computer industry its players deploy six different pairs of strategy. "… global competitiveness increasingly requires the simultaneous optimization of scale, scope, and factor cost economies, along with flexibility to cope with unforeseen changes in exchange rates, tastes, and technologies" (Bartlett & Ghoshal, 1989: 60-61). Although the objective of a strategy may be one-dimensional, strategies usually have multiple dimensions.

To implement a strategy consisting of multiple dimensions requires an organization which has at least a dimension additional to the dimension on which its M-form is based. Kaplan & Norton (2006b) have explained how to implement strategic themes cross existing business units in an accountable way. This requires that cross unit strategic themes are defined as budgets in terms of targets and allocated resources, including accountability for this strategic theme and management control. This strategic theme as an accountability has to be integrated with the rolling forecast budgets of the business units. This results in a two dimensional budget system (actually three dimensions when time as a dimension of rolling forecast budgets is included as well).

This execution of multidimensional strategies implies that the organization form, at least at the level of the internal governance (not necessarily at deeper, operational level of manufacturing, shared services etc.) needs to be multidimensional as well, especially to exploit economies of scope, e.g. exploitation of knowledge across all products, accounts, markets and regions.

So it can be concluded that the Chandlerian model in Figure 6 needs to be rephrased in terms of multiple dimensions. The model can be reinterpreted: A multidimensional market combined with a multidimensional strategy (firms have an option to pursue a simple strategy in a multidimensional market, but forego with that appropriating value from the market) implies a multidimensional organization.

This multidimensional variation of the Chandlerian model, which both can explain the emergence of the multidimensional organization and can be used as a prescription, is a middle-range theory, fitted for practical men who economize on their decision making. It must be noted that the Chandlerian model does not account for all factors that play a role in the deployment of (new) organization forms. Figure 7 provides an overview of factors that, dependent on specific situations, in different configurations by weights, play a role in the choice or design of organization forms.

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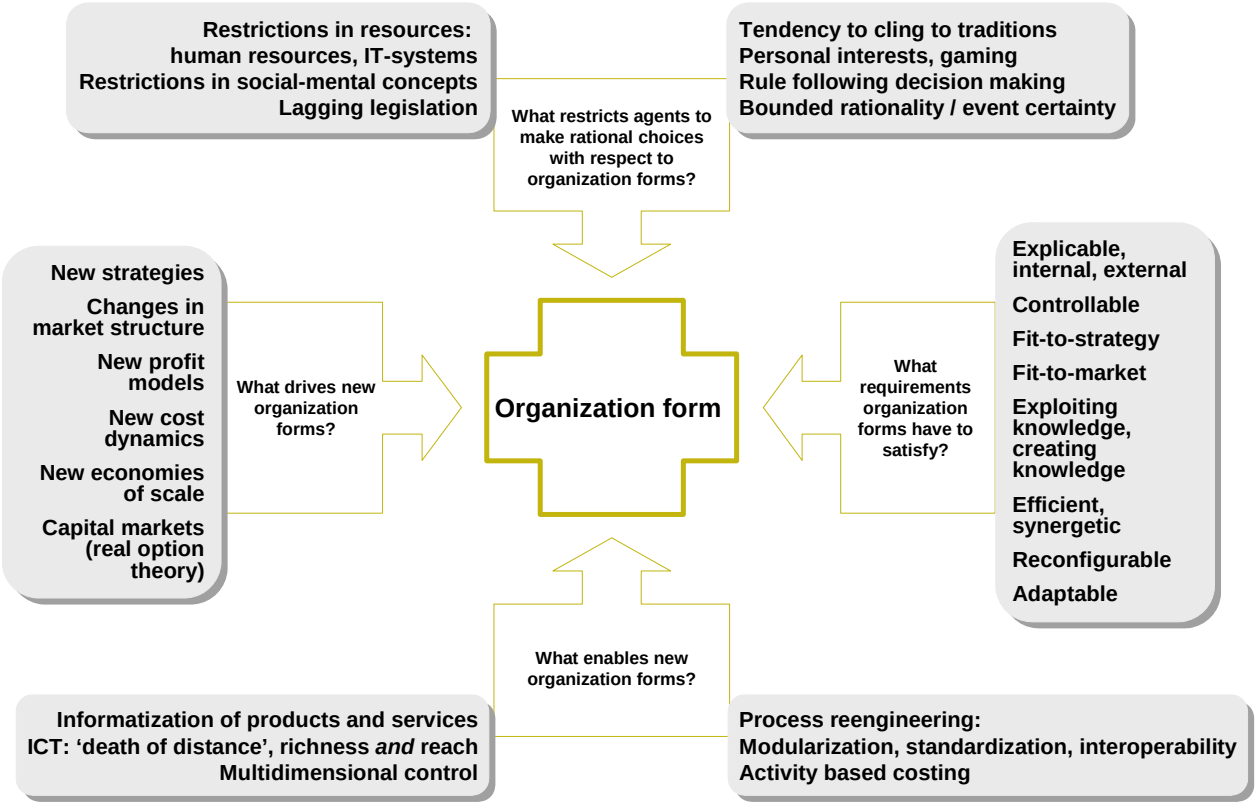

Figure 7. Overview of factors influencing the choice or design of organization forms.

Academic economic theories to explain organization forms have been formulated by Williamson (1975: 132; 1985: 33; 1986: 54) and Jensen (1998). Williamson, based on a contracting theory for the organization, identified asset specificity, frequency of transaction and information impactedness as factors explaining the form of the internal organization. Jensen defines as conceptual building blocs for an organization theory and thus organization form: the nature of human beings and their behavior, the costs of transferring information among players, the agency costs generated by cooperative behavior among individuals, organizational rules of the game including control systems, residual claims related to the nature of knowledge (general of specific). Application of these building blocs result in allocation of decision rights, performance measurement and evaluation, and the system for rewards and punishment. Williamson's theory focuses on explaining organization forms as different forms of contracting, including vertical integration and outsourcing, respectively when to apply such forms. Being based on transaction cost theory Williamson's approach does not provide for those activities in the economy which are not based on transaction of goods, services and knowledge, e.g. the interaction between creative experts (Foss & Mahnke; Grant, 1996). The contractual theory underlying Williamson's theory of organization seems a priori to preclude the concept of the multidimensional organization.

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Jensen has no preoccupation with specific organizations forms but asks the question what corporate behavior, including organization forms, creates the most out of society's scarce resources. This teleological approach to organization seems to be less restrictive with respect to organization forms. Where Jensen defines organization form by partitioning of decision rights, performance measurement and reward-punishment-systems, a preoccupation with specific organization forms is implied. Jensen & Meckling (1999) take for granted that performance measurement systems are built up from entities like cost center, profit center, investment center, etc. These concepts are part and parcel of conventional organization forms, especially their accounting and systems. Even more, Jensen assumes as a condition for the efficiency of organization, the need for co-location of knowledge, decision rights and rights to the capital value of those decision rights. This precludes the firm as teamwork as Jensen's co-location principle assumes individual decision makers, whereas the multidimensional organization typical is the elaboration of the firm as economic team work.

It is unlikely that either Williamson's or Jensen's theories on organization applied in specific situations, will result in the multidimensional organization. A next question then needs to be whether these theories predict the multidimensional organization to be not efficient, either by costs of transaction or coordination, or by producing the highest possible value. We will address that question in section 5 in this paper.

Another range of theories about organization has as its core the effects of costs of information on organization. These effects are at two levels: operational (decision making and coordination) and institutional, ownership and institutional rules. The main representative of this category of theories is Kenneth Arrow.

In this category of theories on organization the core argument is that the strategy of a firm, its development and the actual performance of a firm is determined by its agenda (Arrow, 1974: 47). In the context of the conventional, neo-classical theory this agenda is determined by two sets of – related – factors: (1) the form of the internal organization of the firm (Hammond, 1994: 122-123), and (2) the costs of information and the capital intensity of information (Arrow, 1974). The organization form determines *what* issues are brought to the table of the executive board, it determines what alternative *options* are proposed to the executive board, it decides the *criteria* on basis of which the executive board evaluates and chooses options, and the form of the internal organization determines what executive boards learn form making decisions. In the M-form it is assumed that the executive board makes decisions with respect to (1) what portfolio of self-contained organized units to pursue as investment projects, (2) how much to invest in each of these investment projects, (3) what synergies to exploit.

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This view on how the agenda of the firm is set is based on three assumptions. The first is the concept of the modern business enterprise (MBE), as this came into existence around 1900 (Chandler, 1977; Rajan & Zingales, 2000). The second assumption is the costs of information and the capital intensity of information (Arrow, 1974). The third assumption is that no outsiders have the power to set the agenda of the firm.

The MBE carries a number of characteristics which are pertinent to the form of the internal organization. First, the MBE was well defined by ownership of assets. The legal boundaries of the firm were well defined by the ownership of assets and this coincided with the economic boundaries of the firm. Tied to this ownership of assets are two aspects. First is that imposed coordination by the executive board is based on this ownership, as is the control over the firm. Related to this ownership of assets is that, by absence of open standards, the executive board could impose idiosyncratic standards on its employees and its suppliers and thus could exert economic power over these two production factors. Second, the MBE required more investments and risk-taking than management had available in private resources. Thus outside capital was needed but outside providers of capital could not develop effective control over the firm. In combination with lack of efficiency in the capital market in that time this allowed management to develop and run its own internal capital market. Running its own capital market required that the executive board exert tight control on their business to compensate for the lack of direct disciplining by the capital market to avoid inefficiencies. This tight control was possible on basis of the corporation being the full owner of the assets deployed in its economic system. Third, due to the concentration of power at the top of the corporation the agency problem concentrated in the relation between the shareholders and the executive board. Fourth, the shareholders were fully entitled to the residual claim on the value of corporation. These characteristics of the MBE implied that the agenda of the executive board predominantly was set by the internal organization.

According to Arrow (1974:50) the agenda of the firm can be segmented in three sections. First is an area of issues and decisions which is actively managed by the executive board. Second is an area which is monitored passively and third is an area in the agenda which is not monitored by the executive board although it contains issues which may be important for the firm. The broader the segment the executive board actively manages, the more (strategic) options are generated for the firm and thus the higher the value of the firm, from a perspective of investors. The boundaries between these three segments are determined by two factors, the costs of information and the capital intensity of information. If the costs of information and the capital intensity decrease, the active part of the agenda increases (Arrow 1974:54). Costs of information

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are determined by the costs of information systems and by the degree routine executives and managers have with specific organization forms. New organization forms as required by the market increase the costs of information for the executives and managers as they have to invest in a new understanding and new routines to produce required management information.

Three developments change the nature of the MBE and the process of agenda setting of the executive board. First, the MBE is losing its defining characteristics. The shift from generic knowledge to specific knowledge (which is owned by the worker, not the corporation), implies that ownership of the MBE no longer is defined by its physical assets. Also, due to increased standardization, firms have fewer possibilities to exert control over their employees. As a result the agency costs move from between the shareholders and the executive board to between the executive board and the management of the operations, and even lower in the organization. To this is linked that key personnel, commanding and owning specific knowledge that is critical to the economic system of a firm, may command incomes higher as those of the members of the executive board, as e.g. is the cases with deal makers in the financial services industry. Compared to the traditional MBE this implies that some key staff in a firm have the power to appropriate a part of the residual claim of the firm in competition with the shareholders (Rajan & Wulf, 2006; Rajan & Zingales, 2000). Therefore, the economic value of the firm no longer is identical to the shareholder value. The shift from generic knowledge to specific knowledge implies that the executive board no longer has the possibility to exert tight control over the operations of the firm in order to enforce efficiencies as needed due to lack of the disciplining workings of the capital market (Jensen, 2000). Managers have tried to compensate this loss of tight control with culture programs, or cultural controls (Merchant & Van der Stede, 2003: Ch. 3) or by competence management (Durand, 2004). These solutions deny the institutional change underlying the loss of effectiveness in (tight) management control, especially the loss by the firm of the *ius abutendi* of part of its critical assets (Furubotn & Richter, 2000: 77), and therefore these solutions cannot be effective. The institutional weakening of management control, especially the loss of double loop control in the M-form, implies that agenda setting by the internal organization results in an agenda that serves the interests of the divisions or business units, not the interests of the firm. Amongst others this is visible in the phenomenon of *governance overhang*, that is that the managers of divisions oppose the establishment of a new division, to grasp a market opportunity that cannot not be exploited by one of the existing divisions, for fear of this new division distracting investment funds from their own division.

Second, the MBE, especially in those cases it operated an M-form as its internal organization, was based on an inefficient capital market and thus running its own internal capital

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market. Also, this internal capital market and its corresponding discretion of the executive board to allocate available investment funds was based that funds from that internal capital market invested in research & development, that is innovation, would result in new property rights and growth opportunities for the shareholders. According to Rajan & Zingales (2001) the corporate finance revolution of the 1980s changed this, by investors taking over the ownership of the free cash flow generated by divisions. Investors did so for two reasons. The first was that many executives demonstrated satisfying behavior and suffered a resource based cash flow trap (Jensen, 1993). Due to standardization and a more mobile labor market for scientists, investments by a firm in innovation no longer automatically resulted in new property rights for investors (Chesbrough, 2003). Also investors wanted to increase the value of innovation projects by applying the real option theory, which was possible due to both more easily available capital for venturing and the more mobile labor market. This has resulted in concepts for open innovation and open business models (Chesbrough, 2006a, 2006b). This has created a pressure by the capital market on firms to organize market opportunities separately from their resources, thus moving the traditional risk distribution between market opportunities (exploration) and resource exploitation (March, 1991) to a higher, less risk avers level. To organize market opportunities separately from resources also, in combination with the specific pressure from the capital market to increase return on capital invested, resulted in a pressure to increase alternative use of resource cross multiple products, markets and customers. With this two characteristics of the M-form were broken up: its internal capital market and the self-contained organization of divisions and business units, by resources, products and customers. Perhaps even more important is that the corporate finance revolution has resulted in the agenda of the firm increasingly being set by investors, nut just by the internal organization as assumed by Hammond.

Third, the costs of information are declining (Jorgenson, 2001). This goes for both the internal information and for external information (Internet). Into the nineties it was expensive for executive board to have the profitability of corporate customers analyzed cross its divisions. Usually this would require hiring an external consultancy firm to perform such an analysis. The costs of this might be around one million dollar per analysis. In well organized firms (in many this is still a problem), with the aid of a CRM-computer system, this analysis is performed on a weekly or monthly basis. This may require rather high initial costs to implement a CRM-system, once up and running, the costs of analyzing the profitability of a customer, product or region, become marginal. Usually, as in the cases of IBM and Microsoft, the ownership on transaction data is shifted from operation companies or divisions to corporate, and thus the executive board, at acceptable cost, can increase the part of the actively monitored and managed agenda.

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Also, due to the increase of project management, account management and improved (broader) training of managers, the capital intensity of information with managers is decreasing. That is, increasingly managers are capable to handle multiple alternative organization forms in terms of generating management information for reporting and analysis. Because access to transaction information is separated (by e.g. counting houses) from formal authorities of operational managers, analysis of available data is less dependent of operational management, which makes it less costly to generate alternative analysis and views on the firm. Again, the costs to broaden the agenda of the firm decrease. In the modern organization of transaction information another unbundling is implied. In the self-contained organized unit, information implicit was about transaction information and information needed to develop new products, analyze markets etc. Even to the extent that the way in many firms transaction data is recorded is heavily influenced by the specific business model of the unit. This creates barriers in both cross units analysis of the firm, in the richness of information in the consolidation of management information and in adapting the firm to changes in its environments. By separating transaction data and the way it is recorded in systems, from other type of information, the executive is able to overcome partly the problem created by specific information that is owned by employees. This separation does not shift the ownership of specific data, but a generic, business neutral system for recording (internal and external) transaction makes visible what the contribution is of a creative worker to the total performance of the firm. This enables both parties to write better contracts at lower costs. The value of the specific knowledge of creative workers will increase with the number of products, customers, solutions and regions in which his knowledge can be applied. It is in the interest of the creative worker to know his personal market to assess his value (Rosen, 2004). Vice versa, the executives of the firm want to understand the value of creative workers by assessing his contribution to the profitability of the firm. The interests of both parties, that of the creative worker and that of the firm, can be accomplished by a transaction data base, on which on basis of multiple dimensions analysis can be performed.

The emergence of the multidimensional (internal) organization of the firm can be explained by the disembedding of knowledge and information from institutional arrangements created to serve the economy of the second industrial revolution. The phenomenon of the multidimensional firm not only serves to improve the efficiency of the firm, it also can be interpreted as a response of managers, using modern information technology and digital technology as enablers, to institutional changes in the economy.

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5. The multidimensional organization and efficiency

So far we have dealt with explaining and predictive theories. A different category of theories are those which ignore inputs and concentrate on the performance of firms, especially the efficiency of firms and organization forms. The efficiency hypothesis argues that successive modes of organization represent efficiency advances on earlier modes of organization (Williamson, 1985: 231). If the multidimensional organization is a successive mode to especially the M-form, and in this stage of development of the multidimensional organization statistical evidence is not yet available, but managers need to make a decision to deploy the multidimensional mode or not, a speculative explanation is needed for its higher level of efficiency.

Efficiency of organization form is created in multiple ways. Efficiencies can be created through applying principles of scientific management to eliminate superfluous movements and actions (also labeled process reengineering), elimination of waste in general (e.g. through Total Quality Management), allocation of resources, operational adaptability of the organization to its operating environment, proper incentive systems, economies of scale, specialization, proper techniques for coordination, governance structures, etc. Milgrom & Roberts (1992: 23) suggest that allocation efficiency is to be discerned from the efficiency of the organization itself. This suggests that the outcomes of an organization can be traced back to either allocation of resources or the working of the organization as an instrument for transformation and coordination itself. This will depend on the nature of technology, type of knowledge used and the nature of products and services delivered. Especially in the manufacturing industry it may be possible to allocate the effects of individual efficiency techniques, e.g. reengineering, to lower product costs and subsequently to higher market shares and or profits. The efficiency of the allocation of resources and or the efficiency of the governance structure usually is judged by the break up value of a multi-business firm.

In the economy it is assumed that that people seek efficiency in their activities and in the ways they arrange their affairs (Milgrom & Roberts, 1992: 24), resulting in efficiency being a positive concept, explaining and predicting what decisions managers (with respect to organization forms) will make. Consequently, if a more efficient organization form develops, and becomes known through e.g. publications or other exchange of knowledge about it existence, working, applicability and efficiency, that new organization form will be chosen to replace the existing organization form. At this place we will assume this principle, but knowing that in practice it is subject to March's tension between managing the rationality of consequences versus rule following decision making (March, 1994) and other factors, as listed in Figure 7.

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Efficiency is a relative, no absolute measure. "Efficiency is always defined relative to a specific set of individuals whose interest are being taken into account in determining economic arrangements" (Milgrom & Roberts, 1992: 25). Based on Milgrom & Roberts, efficiency of an organization form can be defined as: An organization (form) X is efficient for a given economic relationship if all other organization forms Y_i applicable to that relationship yield outcomes that are viewed by all the people involved as being at least as good as those that X produces, but that sometimes X produces outcomes that at least one person definitely prefers to the outcomes under Y_i.

This definition takes into account that e.g. a firm not only produces products and services, but also has outcomes like trained workers, identity, social relations, human and social capital, opportunities to advance in life, etc. The definition of efficiency assumes that some procedure exists through which those involved with a specific organization can decide on the most efficient organization form or that a mechanism exists which disciplines e.g. managers to make such decisions.

Five such mechanisms can be identified. The first is managerial professionalism as defined by Berle & Means (1932/1991). These are executives who use their discretion not narrowly for their own interests, or even those of the shareholder, but for society as a whole and understand that efficiency of their organization is in the interest of the welfare of society. The second mechanism is the product market. Firms that are inefficient have too high prices and will be replaced by efficient firms with lower prices. The third mechanism is the system of internal control, especially the role of the non-executives who will discipline executives not choosing efficient organization forms and thus wasting investment capital. The fourth mechanism is the capital market. Investors will withdraw their funds from inefficient firms and place it with efficient firms to increase their return on investments. The fifth mechanisms is that the legislator may decide to change the organization form of especially monopolist to achieve a higher level of efficiency for society at large, as has been the case in the breaking up of ATT. Neither of these mechanisms is perfect in itself. Especially Jensen laments that private equity is the only force to discipline executives in their decisions with respect to allocation of investment funds and deciding for efficient organization forms (Jensen, 2007). But even private equity as force to decide for most efficient organization forms has it limits. Private equity investors select their targets on basis of benchmarking. Taking a seat on the board private equity investors apply conventional methods to improve the efficiency of the organization, usually a form of reengineering of processes and other cost saving techniques.

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Another issue is that judgment on the efficiency of (new) organization forms is subject to interests (hence also the efficiency-power hypothesis), bounded rationality, satisfying behavior, blind trust, rule following behavior and other behavioral aspects and institutional elements in managerial decisions makers and with stakeholders. The fast spread and wide application of the M-form after the Second World War (Fligstein, 1985), not only was motivated by the efficiency of organization forms of individual firms, or by the level of labor productivity in the USA, which in 1922 demonstrated a level that only would be achieved by Europe in 1960. In e.g. France and in the Netherlands labor productivity programs in the fifties not only were pursued for economic reasons per se, but also as a weapon against the perceived threat of communism. Also, the acceptation of scientific management in the thirties by countries, even with an anti-capitalist governments, like Italy and Russia, was motivated by the promise of higher macro-economic labor productivity and thus legitimization of these regimes (Guillén, 1994). Multiple forces at multiple levels can decide, often in an intractable way, on the efficiency of an organization form.

A next question is why the multidimensional organization would be able to produce a higher level of efficiency compared to especially the M-form. The higher level of efficiency of the M-form compared to the U-form can be attributed to the fact that this form added governance-level efficiency (2nd order economizing) mechanisms to the operational level efficiencies (3rd order economizing) of the F-form (Williamson, 2000). Governance-level efficiencies consist of allocation of available investment funds (through an internal capital market), double loop control, management development, standardization and exploiting a number of synergies, both to reduce costs and to increase the return on investments in knowledge (economies of scope). Efficiency mechanisms, for efficiency of the organization as defined before, consists of two types, efficiency mechanisms to reduce costs and efficiency mechanisms to increase the maximum-willingness-to-pay by the consumer. The maximum-willingness-to-pay minus the costs of resources represents the value created by the firm and equals the sum of the consumer surplus and the profit of the firm. This sum is a better proxy for the outcome of the firm, respectively its organization, as judged by its stakeholders compared to profit only. Part of the efficiency of the organization is how the value created is distributed to those involved, including consumer surplus, social surplus, and shareholder value, personal income for the managers and workers, and fair prices for suppliers. For this distribution no positive calculation models exists, only the existing systems for corporate governance can produce decisions on this. These systems for corporate governance have their roots in the economy of the second industrial revolution and thus are biased toward the shareholder being entitled to the full residual claim on the value of the firm. In more recent opinions on corporate governance, e.g. published by the OECD en and the World Bank,

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emphasis is laid on an equitable distribution of the value created by the firm among all those who have contributed to that value.

Assuming that the value as defined as being the difference between the maximum-willingness-to-pay and the costs of resources can be taken as a proxy for the efficiency of the firm as defined before, the question is what mechanisms a firm has available to maximize that value. Most efficiency mechanisms are concentrated on lowering the costs of resources. Examples are:

- Operational efficiency techniques, scientific management, time measurement methods, process re-engineering, tasks specialization, work methods, work flow techniques, standardization (all in different degrees being dependent on information technology)
- Learning curve effects in production
- Economies of scale and speed
- Operations research applications to reduce costs of material, transportation, inventories, energy, etc.
- Resource commitment to market segments to reduce costs of coordination (the M-form)

Methods to increase the maximum-willingness-to-pay are:

- Research & development, including market research
- Design
- Marketing
- Creating standards with positive externalities for the user
- Creating a reputation, creating brands with an emotional appeal
- Creative new ideas, especially with respect to experience, answering basic human needs etc.

With the shift in the economy from the emphasis from manufactured goods, to services to experiences creating raising the maximum-willingness-to-pay not only requires research & development (as for nano-technology and life sciences) but in addition to that creative processes, in which specific, personal non-codified knowledge is applied. The latter in their turn require different organization forms and work processes compared to those for firms that are characteristic for the economy of the second industrial revolution.

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It may be assumed, that whereas most large firms deploy shared service centers, by now efficiencies resulting from economies of scale are largely achieved although this source of efficiency is not yet exhausted completely. Based on the cases from the research it can be concluded that the efficiencies created by the multidimensional organization results from three sources: (a higher degree of) economies of scope (through the separate organization of market opportunities and resources), a larger capability of adaptability to dynamic markets against lower costs (through being prepared by having defined and organized multiple dimensions), and a measurement system for results and inputs that facilitates the exploitation of specific, personal knowledge owned by experts working in teams in which the value of each of the individual inputs is increased in a non-linear way (by operating a multidimensional transaction recording and management information system).

Economies of scope is about multiple products respectively production functions having sharable inputs, conserving in the joint production more or less the amount of input to be used in single production without the need to expand other inputs (Panzar & Willig, 1981). Knowledge, which has a public good nature, is an example of a type of input being capable of this. Sharable inputs for multiple products create the problem of measuring and allocation returns on the deployment of the shared input, respectively measuring its efficiency. The fall of costs of information has reduced the costs of measurement of inputs and outcomes.

Exploitation of knowledge cross unit boundaries in a multiunit organization is restricted due to the transaction environment in the M-form. Especially the allocation of costs and returns of deploying individual experts cross units in e.g. system integration projects and account management is costly in traditional accounting systems, based on the unit being the profit center in the internal organization. What the multidimensional organization does, through the principles of corporate ownership on transaction data, multidimensional recording of transaction data and universal accessibility, but especially by taking the customer as profit center, is creating a more efficient transaction infrastructure in which transfer pricing (with its behavioral consequences of double mark up) is eliminated by a cost effective cost allocation system. The falling costs of information reduce the cost of measurement of output and of inputs. Casson has noted that cheap information makes it easier to specify claims to ownership in greater detail. Thus as information costs fall it becomes economic to distinguish ownership by a family from ownership by a clan, and then to distinguish ownership by an individual from ownership by the family to which the individual belongs (Casson, 1998: 284). Alike the fall of costs of information individualizes recording of inputs and may improve insight in the relationship between individual inputs and (individual) claims on the output of the firm or a project. This is reflected in process

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reengineering and TQM through which improvement of efficiency has been achieved by adding to input and output measurement, measuring performance and quality at multiple stages in the throughput process on basis of which inefficiencies could be identified far more precisely and costs of specifying interfaces and thus standardization and outsourcing could be improved. The multidimensional organization either coincides or is induced by the shift in the economy from the dominance of exploiting codified knowledge to the exploitation of content-type knowledge, which is specific and personal (Boisot, 1995). Jensen (1998: 111) has argued that this shift should imply that the need for co-location of knowledge, decision rights and rights to the capital value of those decision rights only can be achieved through alienation, that is changing from labor contract and hierarchical coordination and control to (suppliers) contractual control and coordination. However in this Jensen assumes the internal organization of the firm to be a system of transactions. Grant (1996) has observed that especially in the case of experts with specific, personal knowledge the firm, respectively its organization integrates expertise from individuals, who do not transfer their knowledge, but combine it with those of others into valuable products and or services. This is the firm as teamwork, beyond the mere exchange of economic goods. To define the organization as a governance mechanism falls short of the organization as an environment for creative workers that effectively competes with the open market and the Internet. As Grant has observed, transferring knowledge is not an efficient approach to integrating knowledge as required to exploit content-type knowledge into creative products and solutions. Exploiting specific, non-codified, personal knowledge requires interaction between experts, not transactions. Foss & Mahnke (2003) argue that the knowledge and expertise of experts is complementary and therefore the price mechanism fails to coordinate the actions and the interaction of the experts. But so does imposed or hierarchical coordination (Jensen, 1998: 111). So the firm has to recourse to self-coordination between the experts (which is never without some imposed coordination, else we are talking about the market mechanism). To rely on self-coordination as form of delegation of decisions to be made requires a number of conditions to avoid a too large divergence between individual or subgroup goals en the interest and objectives of the firm. Efficient delegation of decision rights is that as many and as low as possible in the organization, individuals and subgroup can for themselves decide if and which contribution their decisions make to the overall objectives or value of the firm, included the external effects of their decisions on other departments (Arrow, 1964). This not only requires a clear objective function of the firm, more specifically it requires a calculation model or cause-effect model of the firm through which decision makers can simulate the effect of their decisions on the overall objectives and value of the firm.

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Jensen's principle of co-location requires a co-location of decision rights, information needed to make those decisions and the right to the economic value created or destroyed accruing to the decision maker. Grant (1996) suggests that the principle of co-location requires that decisions based upon tacit and idiosyncratic knowledge are decentralized, while decisions requiring statistical knowledge are centralized. This can be stated more precisely. Multiple types of information and use of information exist. For this discussion three types of information suffice: content type information and knowledge, which is specific and personal, information with respect to the objectives of the firm, its objective function and its cause-effect or economic model, and information with respect to the performance and position of the firm, financial and non-financial, including that of its individual members, groups, teams, departments and dimensions. Specific, content type information that is personal, by definition is decentralized, at the level of the individual experts or department of experts. The objective function and the information codified in the cause-effect model of the firm is to be shared as wide as possible in the organization, but needs to be decided, albeit possibly with a broad input, by the executives of the firm. This type of information is both central and decentralized to ensure decentralized decisions making whilst maintaining the unity of the firm. The third type of information is what usually is called management information. This is information on e.g. profitability per customer, per product, per project, per individual worker and on the various inputs. Marschak & Radner (1972) assume that team members bring different information to the team and try to solve the subsequent decision making problem. Gibbons (2003): "Team theory is the application of statistical decision theory to 'team' settings, where different agents have different information and control different actions but share a common objective (such as maximization of the firm's profit." The phenomenon of multidimensional organization sheds a different light to team work, which is far more insightful. Members of a team bring different competencies, expertise, knowledge, insights, intuitions etc. to the team, which preferably are complementary. The resulting products and or services are created in a process of interaction between those individual whereby the final outcomes of the team work cannot be attributed to its individual members, although their individual input is known. (With this we exclude teamwork which is mere assembly as if a temporary classical production function like in e.g. construction). In order that the self-coordination is efficient in view of the objective function of the firm members of the team (1) all need to know and understand the cause-effect model of the firm and how the project relates to that; (2) need to have the same information with respect to the performances of the firm, actions and performance of individual team members in order to be able to anticipate and to react to actions, decisions and performances of others. In the case of firms like e.g. IBM and

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Microsoft precisely this information is provided from one trusted source, and the same information provides a transaction infrastructure on basis of which returns on team member effort equitable can be distributed among its members. The lack of information asymmetry will also expose shirking and free rider behavior. "In effect, the firm is viewed as a team whose members act from self-interest but realize that their destinies depend to some extent on the survival of the team in its competition with other teams" (Fama, 1980). Viewed in this way the firm not only is a nexus of contracts, especially the firm is an integrator of knowledge that is difficult to transfer. "Hence, firms exist as institutions for producing goods and services because they can create conditions under which multiple individuals can integrate their specialist knowledge" (Grant, 1996).

Hence it is plausible that the multidimensional organization represents a higher level of efficiency compared to the M-form: because it facilitates the exploitation of specific knowledge in a non-convex or non-linear way, and because this exploitation plays an important role in the economy of the 21st century economy. Because the multidimensional organization is easier to adapt to changes in its market (due to the separation of market opportunities and resource exploitation), it will be able to appropriate more of the value created in network industries, compared to the M-form.

The plausibility of the multidimensional organization being more efficient compared to the M-form or multiunit form does not imply in itself that this form will be accepted smoothly nor quickly. Organization forms also are social institutions and exist of social elements like identity, routines, habits, power basis. To choose for this organization form suggests that executives are more prone to make decisions on basis of rational consequences and less so on rule following. Casson (1997:274) predicts that because the decline of information costs has increased the intensity of global competition, renewal of organization form will be more through a process of ecological change than through a process of changing existing organizations. This may be more so because the installed based of information systems, especially ERP-systems may turn out to be a barrier instead of a help to move form multiunit organizations to multidimensional organization where strategy and market require doing so. In a large number of firms the existing business model or multiunit organization form is hardwired in the transaction databases, making it difficult if not prohibitive for some firms to organize the management information required in the multidimensional organization. Another aspect of change is that the shift from exploiting the combination of tangible assets with codified tangible assets to a combination of tangible assets, codified intangible assets and specific personal intangible assets in operational terms appears to be a gradual, incremental change, not a transformation. In this

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thinking the concept of the unit remains dominant, also as a social anchor. As a result needed cooperation in teams may be acknowledged, but remains to be seen as marginal with respect to the status and role of units and unit managers. Cooperation in teams remains to be perceived as an assembly operation, to which the individual unit deliver goods and services on basis of transfer prices.

6. Conclusion

The rediscovery of the multidimensional organization, including an understanding of its working, first of all provides entrepreneurs, executives, managers, workers and investors with new opportunities to pursue opportunities and to create wealth. The multidimensional organization helps to understand not only the success of the M-form, but especially its limitations in view of the economy of the 21st century. Its application however not only will be driven by rational arguments, but will depend even more in the capability of executives and managers to overcome social conventions. Within the system of corporate governance this will be a combination of individual and institutional decision making.

The emergence of the multidimensional organization cannot be explained from traditional organization theories, neither from operational models as in use with managers and consultants, nor mid-range theories and even not from academic theories. Only by stepping outside the traditional field of economic theories, in the economy itself, explanations can be found for the emergence of the multidimensional organization, the fall of costs of information and its multiple consequences, being the most important. The resulting explanation not explains the limitations of the M-form, its also brings to the surface the working and limitations of the Weberian hierarchy as a basis for most internal organizations. As its working is based on monopolizing information to influence the thinking and initiatives of members of an organization, this monopoly is eroded if not evaporated, at least with respect to transaction, performance or statistical information by reducing the information asymmetry. This implies that the basis of power shifts towards those which are most insightful and creative to define issues and solve them.

With respect to the economics of a firm the emergence of the multidimensional organization redefines the economic theory of teamwork. Teams are not about its members bringing different information to the table, creating a problem of decision making in view of the individualistic decision making as assumed by Simon, teamwork is about interaction between

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creative workers, on basis of the same management information. In this way the emergence of the multidimensional organization provides a solution to the problem that so far the economy has tried to produce post-modern products and services through the application of modern organization forms. Managers, as predicted in the philosophy of pragmatism, will find their way in this. Now it is the turn to academics to revise and rewrite their theories to address the complaint of a CEO of a multinational company that academics in business studies involve themselves with issues ten years behind the agenda of executives.

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