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Leadership, Management and Management Control – a System Dynamics Approach

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Leadership, Management and Management Control – a System Dynamics Approach

Abstract:

Utilizing a system-dynamic interpretation of the term leadership, we aim to identify the current challenges to companies from their environments, and to explain the consequences of these challenges for company design and control

As well, we aim to develop a dynamic approach to leadership based on theories of system dynamics and living systems. The purpose of leadership is to create a living and learning organization capable of development that is both internally guided and externally oriented. For a company to achieve sustained development, there must be a healthy proportion of growth and balance. Management needs to be counterbalanced by control: management and management control together enable viable leadership.

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1. Research Question and Objectives

Why do so many brilliant management strategies lead firms directly into decline? Why do so many other strategies not produce the anticipated sustainable success? Why do some companies grow while others shrink? Why are some firms extraordinarily successful over the years while others – even those in the same industry – slide from crisis to crisis? Why do so many classical theories of business administration fail to explain these phenomena and help to overcome these problems?

Business administration – and in particular management science – is constantly seeking the best approach to understanding reality, so that the patterns and structures underlying tangible events can be more easily understood (cf. *Ulrich* 1970, *Morgan* 1986, *Nelson and Winter* 1982). Apparently, traditional reductionist methods – ones that analyze a system's tangible events – are unable to adequately explain the dynamic structure of the business environment, i.e. they are unable to explain "reality." Otherwise, systems would not so often behave differently than had been "predicted" (*Sterman* 1985). Thinking in terms of determination and regularity has gradually shifted to thinking in terms of systems and chaos (f.e. *Brown and Eisenhardt* 1998). Little by little, our perception of today's business organizations as "machines" is changing to regard them as evolving organisms, i.e. living systems (*Miller* 1978, *Morgan* 1986). Accordingly, a definition of the business world in terms of simple formulas, numbers and tangible events is becoming less and less pertinent. Our complex business world can be described and explained only in terms of structures and dynamic behavior (*McKelvey* 1997, *Sterman* 2000). ***Linearity*** in our thinking has to be complemented or replaced by ***non-linearity***.

In Western culture, successful corporate leadership is usually measured by ***visible results*** (*Freedman* 1992). We look only at the "visible" – the tip of the iceberg – and neglect its underlying structure and dynamic development patterns (see Illustration 1). In firms focused on the short term, management's main objective is to deliver results on a daily basis. Such short-term optimization, however, can take place only within boundaries set by the structure of the underlying system. Organizations are shaped by individual human beings. Within the same system, however,

participating individuals basically produce the same results – independent of how different such individuals may actually be (*Senge* 1990). Consequently, we need to change our focus from visible events and individuals to the connections between them and to a system's underlying ***behavior pattern and structure***.

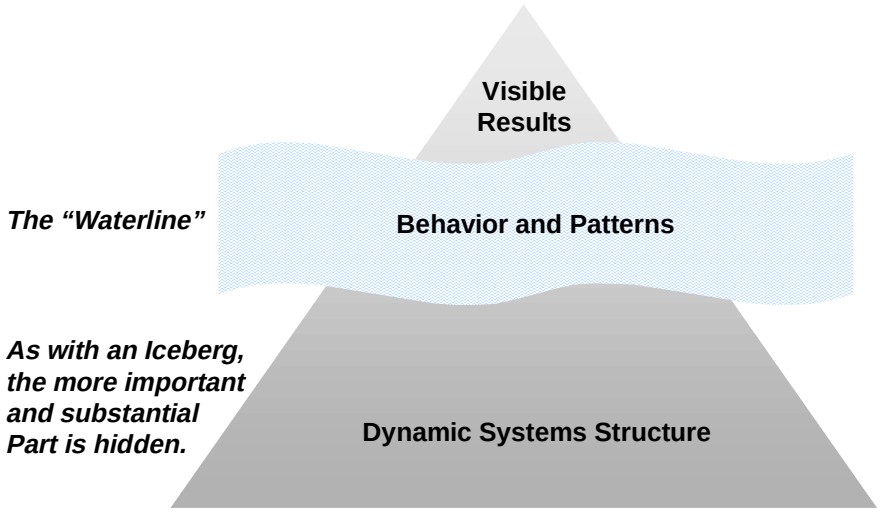

Illustration 1: System Structure and System Behavior (*Senge* 1990)

Since, however, sustainable success and successful leadership of an enterprise can be explained by factors other than visible results and the behavior of individual persons, it is necessary to understand the enterprises from a lower-level perspective that allows us to see what is below the "waterline," each system behavior and system structure, to observe and understand it better (*Mintzberg* 1979).

If this approach succeeds, the knowledge gained will help design and improve companies' structures and behavior patterns, facilitating desirable results in day-to-day management. Leadership, in this sense, doesn't primarily mean optimizing day-to-day business; more importantly, it means enabling overall success by daily creation and cultivation of structures and behavior principles that guarantee the viability of the whole firm. This approach to understanding leadership represents a fundamental shift from such traditional management concepts as

- the separation of management functions into planning, decision-making, organization, execution, control and motivation (See *Schreyögg* 1998),
- the charismatic leadership theory,
- the exclusively reactive management concept (adaptive organization).

These traditional approaches are giving way to an evolutionary definition of leadership based on system dynamics.

This paper, using theories of system dynamics, evolution, learning, complexity and living systems, aims to work out a model for system dynamics evolutionary leadership, and to detail the two most important dimensions of leadership: management and management control.

2. Theoretical underpinnings

2.1. System Dynamics Theory

Jay Forrester, in his 1961 classical "Industrial Dynamics," originated the ideas and methodology of system dynamics (*Forrester* 1961). He pointed out that traditional reductionist and static approaches of management sciences could not satisfactorily explain the causes for corporate growth and sustainable economical success:

"The solutions to small problems yield small rewards. Very often the most important problems are but little more difficult to handle than the unimportant. Many [people] predetermine mediocre results by setting initial goals too low. The attitude must be one of enterprise design. The expectation should be for major improvement (...). The attitude that the goal is to explain behavior, which is fairly common in academic circles, is not sufficient. The goal should be to find management policies and organizational structures that lead to greater success." (*Forrester* 1961, p. 449)

Growth and sustainable success have to be understood dynamically. Accordingly, they can be analyzed, understood and explained only by dynamic models. A system's behavior is a product of its structure. Complex systems consist of an interconnected structure of ***feedback loops***. Therefore, the elementary behavior of structured systems should be identified in terms of their underlying feedback loops. Such behavior patterns include ***growth*** (caused by positive feedback); ***balancing*** (caused by negative feedback); and ***oscillations*** (caused by negative feedback combined with a time delay). Other behavior patterns of complex systems — for examples, S-shaped growth or overshoot and collapse — are caused by a non-linear interconnection of these underlying feedback loops. (*Sterman* 2000).

2.2. Complexity Theory

Stafford Beer is regarded as the founder of a system-oriented management approach (cf. *Beer* 1975). His basic assumption is that the "substance" of management science is not money or capital, not machines or materials or employees, but mainly complexity (see also *Malik* 1993). Such other "variables" as profit, sales, cash flow, investments, products, prices and customer

needs represent merely "***manifestations of complexity***" and therefore are only forms in which complexity appears. These visible results of system behavior combine to form the tip of the iceberg. The complexity itself originates in the dynamic structure of the underlying system and can be represented by the measure of ***variety***.

According to *Ashby's law of requisite variety*, a high degree of external variety can be ”destroyed” only by a high degree of internal variety (*Ashby* 1958). Organizations without sufficient internal complexity endanger their very existence because they lack a vital capability: the ability to neutralize external structural challenges by making internal structural changes. In systems theory, this capability is known as ***structural plasticity*** (see the following chapter). ***Every viable system must remain structurally fit to survive in a constantly changing environment***.

Recent years have seen the emergence of another stream of research in complexity theory, rooted in the work of the Santa Fe Institute (*Kauffman* 1993, *Gell-Mann* 1994). These researchers created the notion of CAS (complex adaptive systems) to describe and explain the (co-)evolution of complex systems and their environments (*Kauffman* 1992, *Waldrop* 1992, *Holland* 1995). A few attempts have been made to utilize these ideas for business management (f.e. *Stacey* 1995, *Brown and Eisenhardt* 1998, *Sachs* 1997). Leadership assessments that consider companies as CAS regard leadership as the process of mastering complexity — reducing external complexity while increasing internal (organized) complexity, i.e. the capacity to absorb complexity.

2.3. Theory of system viability

In newer systems theory, one influential idea comes from the Chilean neurobiologists *Maturana* and *Varela*. They used a series of neuro-physiological experiments to develop a theory about the basic principles of the human nervous system and then derived an epistemology theory, which was extended into a theory of living systems and their self-generation.

Their approach is used to distinguish between living, or viable, and non-living systems. According to *Maturana and Varela* (1987), living systems are complex systems that have the ability to self-generate. Losing this ability is tantamount to the death of the system. In terms of the business world, a company that loses its ability to renew (re-create) itself dies. Therefore a viable organization is an organization that has the capacity to create its own future. But when, in practice, does this capacity exist?

To answer, Maturana and Varela introduce the term of ***structure*** into their concept (1987). By ***system structure***, they mean the elements of the system and their relationships, which constitute the specific system and represent the organization. The elements of a system allow system boundaries to exist and thus enable the emergence of an ***identity***. Accordingly, within an ever-changing environment, the extent to which the structure of the system makes modifications possible is decisive for the viability of that system. The number and scale of potential modification options for a systems structure are defined as the ***structural plasticity*** of the system and can be measured indirectly using the coefficient of measure of variety (*Maturana and Varela* 1987).

To sum up, a viable organization has to fulfill two requirements: (a) to preserve its ***identity*** by repeatedly drawing system boundaries (defining what is "internal" and "external") and (b) to maintain the system's ability to adapt to a changing environment — ***structural plasticity***.

A system's structural plasticity is closely associated with the system's intelligence (*Wilensky* 1967) and, as part of intelligence, its learning capability, e.g. the ability of the system to master new challenges with structural modifications (*Gueldenberg* 1997). In this regard, a firm's learning capability can be understood as its capacity to recognize, vary and advance the underlying mechanisms of the learning process itself along with its ability to anticipate, influence and quickly react to, both present and future environmental changes (*Reinhardt* 1993). Therefore, organizational learning is continuous shared self-renewal, a process involving, in particular, the determinants of strategy, culture and structure together with personnel development (*Gueldenberg and Hoffmann* 1998).

To summarize the basic aspects of the theories underlying our concept: Leadership depends on dynamic feedback processes set up to master complexity with the goal of maintaining the firm's capacity to self-generate (i.e. preserve its identity while continuously renewing its structure in co-evolution with its environment.)

2.4 The mutual principle of growth and balance in the development of living systems

The structural ability to grow is necessary for the viability of evolving systems. Is growth in itself, however, sufficient for survival? Nothing grows forever. The decisive question is: where and what are the limits of growth? In nature, self-reinforcing processes are slowed by balancing processes

(*Maruyama* 1963), which assure that the evolving system remains within a viable developmental corridor. Balancing processes keep the overall system alive. Their strengths are considerably greater than the ones of self-reinforcing processes.

The population of an animal species, for example, can increase in a specific area only as long as it is within the boundaries of the ***carrying capacity*** of its environment. Powerful balancing processes – the natural enemies of the animal, plus limited food resources or epidemics – normally assert themselves before this boundary is reached. In these ways, they balance the population of the animal species. We can observe the same processes in the spreading of plants, during variations in the world climate or when viruses are spread.

Are there similar natural boundaries to the development of technical, social or cultural systems? Growth in these systems typically does not stop as original objectives are achieved — on the contrary, the reinforcement of such forces leads to exponential growth. The growth of social or cultural systems, however, does have boundaries. For example, a firm's growth can be limited by its production capacity, the market size and/or the number of competitors. The faster the company grows, the more rapidly these boundaries are reached. (*Sterman* 1989)

From time to time, such limits of growth change or can be changed, for reasons external or internal. Examples of external reasons are changes in the environmental conditions that increase or decrease the carrying capacity. An internal reason, for instance, could be more efficient use of limited resources. In organizational evolution, this means that the evolving system (the organization) passes from one state of internal and external fit to the next, creating a developmental path that can be described as a punctuated equilibrium model (*Tushmann and Romanelli* 1985, see Illustration 2). Periods of balanced growth are interrupted by periods of exponential growth:

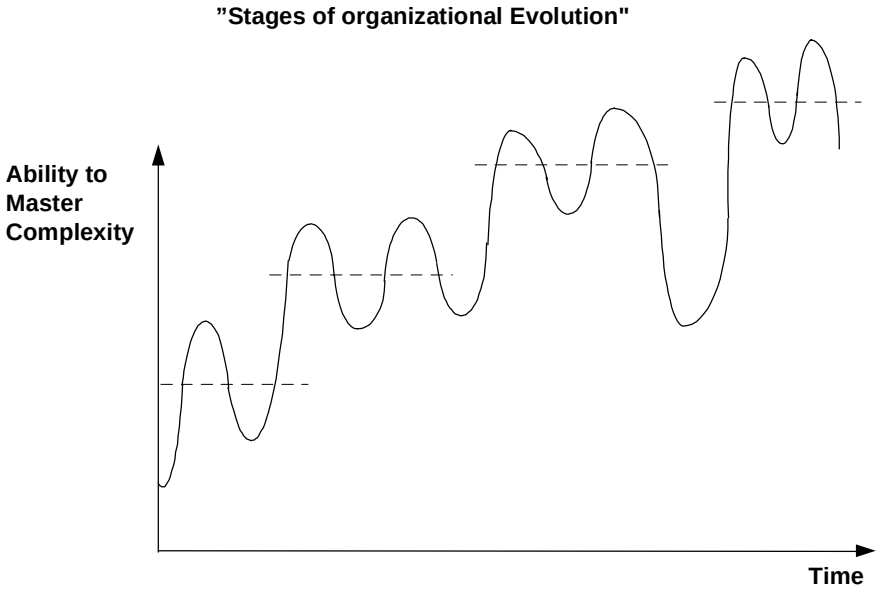

Illustration 2: The stages of organizational evolution

We humans regularly underestimate the tremendous strength generated by exponential growth (*Sterman* 1989) because we tend to assume that an amount grows about the same absolute factor per unit of time, while ***exponential growth***, which means reinforcing growth, doubles the same amount in that unit of time. If the time frame is short, linear growth reasonably approximates exponential growth. If, however, the observation period lengthens, the gap becomes enormous. Our evolution has oriented our perception to the short run rather than the long term. Since exponential growth doubles in a given unit of time, the boundaries of growth are reached faster than we anticipate, often completely unexpectedly. This distorts our perceptions, leading to unpleasant surprises and even to existence crises for the whole enterprise.

Sustaining the development of such social organizations as companies requires a balanced evolution — offsetting positive growth impulses with timely negative feedback processes. This is the only way to ensure that companies remain in a corridor of "sound growth" as they develop and don't exceed the ***carrying capacity*** of their environment and/or their resource endowment. This is especially critical in periods of exponential growth, when the organization is at a much higher risk to lose its viability than in periods of balanced growth. On the other hand, the punctuated

equilibrium model shows us that an active change in the limits of growth needs – for a restricted period of time – an offsetting by the negative, and therefore balancing, feedback loops. Such leaps in development are often triggered by fundamental changes in the surrounding environment (e.g. deregulation, new developments in technology) or by changes in top management (*Tushman and Romanelli* 1985).

3. Leadership

In accordance with our theory and that of *Peter Senge* (1998), leadership can be defined as the inner capacity of a human community to create its own future. Accordingly, a firm must have a clear vision — what it wants to create — while continually developing its capability to move successfully toward that goal. Leadership is always closely tied to *designing* and *guiding*. In a viable and learning firm, leadership assumes both functions: that of a ***designer*** who shapes the system and a ***pilot*** who guides the system to its destination. ***A social system that is able to shape its own future successfully has a high leadership capacity***.

Leadership comprises all processes that must be performed for a firm to remain viable. According to *Maturana and Varela* (1987), a system's viability depends on maintaining its capacity to self-generate. In turn, maintaining a firm's capacity to create its own future depends on its emergence of an identity and on its degree of structural plasticity — the scale of how alterable its structure is — and therefore on its learning capability with respect to itself and its environment. The plasticity of structure determines whether system structure can be modified within the scale and time circumscribed by the environment. A company that lacks the learning capacity necessary to make the adjustments required by environmental influences loses viability over the long term. If, on the other hand, the firm makes the required structural modifications without sacrificing its identity, it not only guarantees its survival but increases its future learning ability. ***Learning capability is the basis for viability, and viability in turn increases the learning ability of the firm.*** This forms the basis of the reinforced dynamic leadership cycle (see Illustration 3).

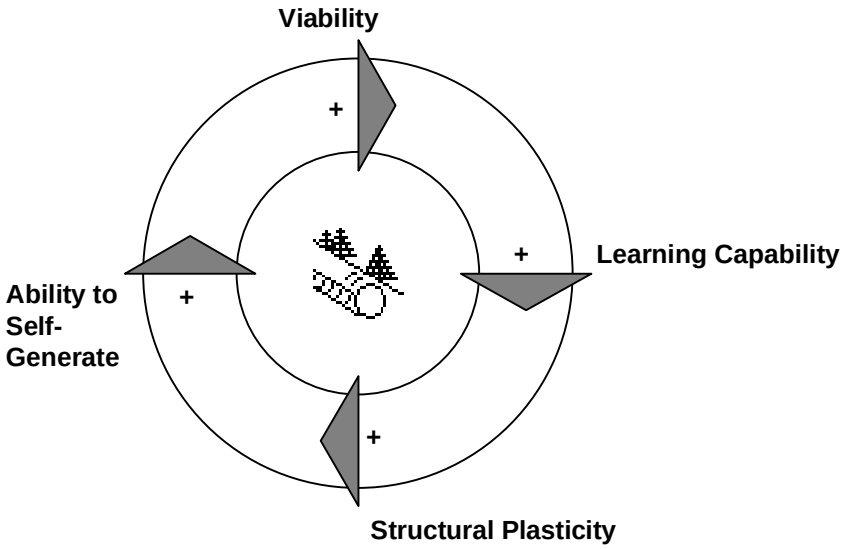

Illustration 3: The Dynamic Leadership Cycle

This dynamic leadership cycle occurs on every level of a viable hierarchical system, so a company can be considered a multistage net of interconnected positive and negative feedback loops.

Subsequently, we argue that a balanced leadership cycle requires the interaction of at least two subsystems — management and management control.

4. Management

The primary objective of every living system is to grow and enhance its viability. *Growth,* to be sustainable, requires two conditions (*Senge* 1999, p. 7f):

First, a system must include the ***potential for growth***. Sustainable growth cannot be brought in from outside. A system cannot be compelled to grow by external forces, but has to grow through internal self-reinforcing processes. In the sense of positive self-reinforcing growth, system development means creating boundaries in disregard of its environment, thereby creating its own identity (*Gomez and Probst* 1985). A firm's identity consists of its basic beliefs, core values and principles. These are the foundations of every system and therefore the root from which structural plasticity stems. This identity guides and restricts the development of a system, i.e. the evolution of a company. Therefore, preserving this core provides the basis from which a firm can grow. ***The first objective of management, therefore, is to encourage the evolution of the company by preserving its core (identity), then to stimulate the development of the system structures based on the core values and beliefs.***

Second, ***conditions allowing sustainable growth*** must be created within the system. To do this, management must eliminate such barriers to company development as fear, distrust, decision centralization and too-tight control. Management also has to ensure that sufficient resources are available to support company development. Successful management tries not to drive growth but to influence the factors that can block or support growth. Just as a shortage of light, water or land might prevent the plant from physical growth, such internal factors as distrust, fear, power concentration and a shortage of resources prevent learning in the enterprise, hindering its development and endangering its viability.

To summarize, management is the part of leadership that stimulates the growth of the company by preserving and communicating its core values and beliefs ("culturgens"; *Lumsden and Wilson* 1981) and by cultivating conditions for the company's evolution.

Many managers haven't recognized this. Managers are role models for their employees. Their behavior and expectations influence the commitment and performance of their employees, thereby shaping the development of the company. Their distribution of attention determines the development of employees' potential. Management requires communication, which injects directly

into the learning process by knowledge transfer. Management is mainly responsible for whether a company grows or shrinks.

Regardless of how managers behave, their behavior influences the growth of the system. ***Management has to initiate and stimulate sustaining growth, thereby reinforcing the firm's evolution.***

From the basic role and objectives of management, the following functions can be derived: (a) setting direction, (b) building resources and (c) creating infrastructure. ***Setting direction*** refers to creating a shared vision and formulating and implementing strategy. The tension between vision and reality provides the initial force to create corporate growth. For this paper's purposes, strategy isn't a detailed map of action. It is designating a corridor for company development through cumulative learning processes. ***Resources*** are necessary for entrepreneurial activity (e.g. *Penrose's* 1959 view of the firm as a bundle of resources). Basically, resources can be acquired externally (e.g. machinery or capital) or developed internally. The resource-based view of a firm (*Barney* 1991, *Hamel and Prahalad* 1994, *Wernerfelt* 1984) clearly states that only internally built specific resources can provide the basis for competitive advantages and above-average returns. ***Creating infrastructure*** refers to designing an organizational context that allows for growth. This includes removing barriers to learning (such as monopolizing information) and developing processes to promote learning (e.g. organizing flexible teams and interdepartmental processes) as well as providing appropriate incentives.

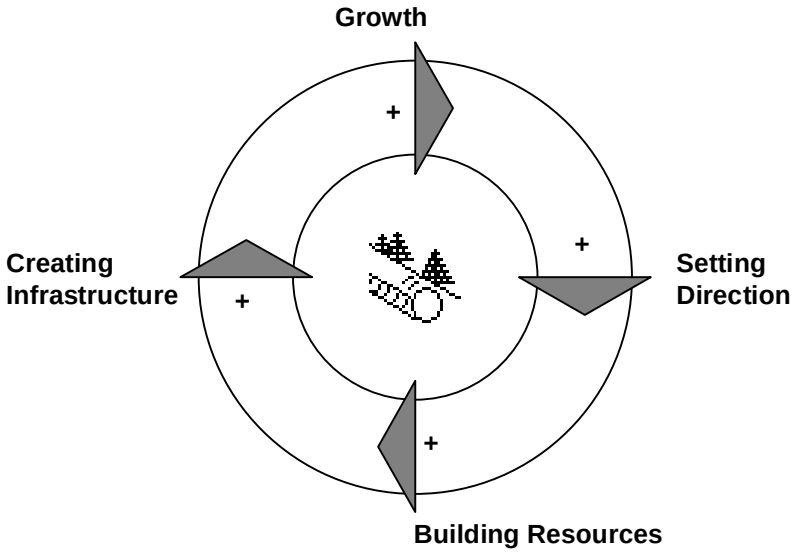

Illustration 4: The Management Loop

Setting direction, building resources and creating infrastructure are bound in a self-reinforcing process (positive feedback loop), which we call the "management loop" and which reinforces the growth of the company (see Illustration 4).

5. Management Control

Considering the picture of system dynamics, one can derive that maintaining the viability of a system (firm) requires balancing the reinforcing management loop with a complementing force, a negative feedback loop that allows for a punctuated ***balancing*** of the expanding system (i.e. the firm): ***management control***. Together management and management control form a balanced leadership cycle for guiding and controlling development of a company. While management reinforces the company's evolution, management control regulates and balances the development, i.e. makes sure that the evolution remains within a viable developmental corridor. ***It is the objective of management control, as a complementary system, to balance, in a timely fashion, the growth process driven by the management loop, thereby maintaining the overall system's viability.*** This, in our view, is the central task of management control as a part of the leadership cycle.

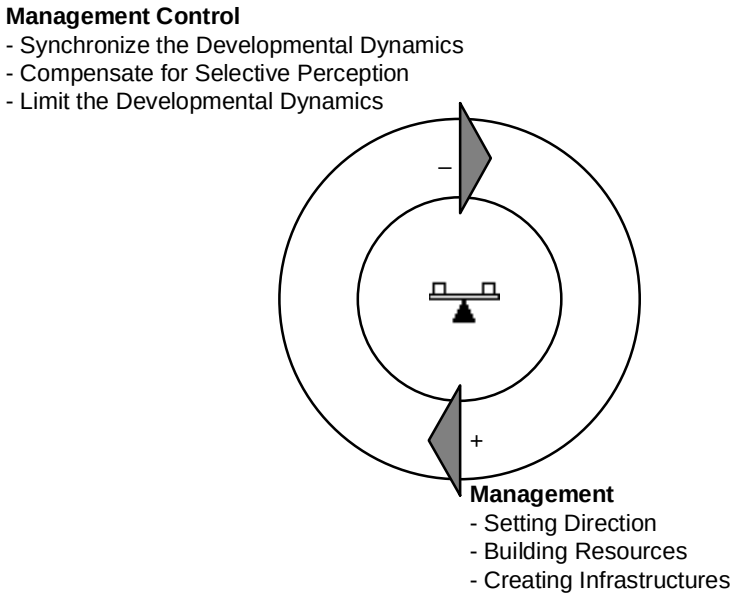

Illustration 5: The Management Control Loop

In the leadership cycle, management control has three central tasks: (a) to assure internal consistency of infrastructure, resources and direction, (b) to compensate for selective perception and (c) to appropriately limit development dynamics. ***Internal consistency of infrastructure,***

resources and direction is necessary to maintain the coherence of the company. In large companies, particularly, the responsibility for different functions of management is split among different organizational units or departments. Management control has to ensure that, despite this specialization of management functions, there remains a coherence of strategy, resources, structure and systems. Therefore management control has to co-ordinate the development of the subsystems of management (dynamic co-ordination, or synchronization). A company management, to enable development processes, must develop a simplified "view of the world" (shared mental model), which acts as a basis of activity (*Schreyögg* 1998). This model inevitably is a subjective simplification of complex reality, therefore selective and distorted. Management control is responsible for continually examining this model and enriching it with relevant new aspects ***to compensate for the selective perception of management***. In particular, managerial information and early warning systems specifically delineate a firm's field of perception (*Simons* 1994). An appropriate limit on developmental dynamics has two dimensions: content and time. **To limit the contents of company development**, management control must point out whether the firm's expansion exceeds the limits that have been set (e.g. there is too much diversification), thus endangering the company's vitality (boundary control; see *Simons* 1994) . The time limit refers to the speed of a firm's growth. Management control must assure that the speed of growth does not overtax the current management capacity (current resources and infrastructure) or the carrying capacity of the environment (in particular the size and growth of the market). Synergistic action between management's function of reinforcing the development process and the balancing function of control should set a pace appropriate for successful company development. Working properly, the interplay of management (growth impulses) and management control (balancing impulses) assures a successful rhythm of company development, a characteristic of particularly successful firms in dynamic environments (time-pacing; *Brown and Eisenhardt* 1998).

Management control influences leadership by complementing the management processes of setting direction, building resources and creating infrastructure through balancing-impulses. These impulses (a) synchronize the developmental dynamics of the different management functions, (b) compensate for selective perception of management (managers) and (c) limit the developmental dynamic of the organization according to internal and external conditions. There is, however, a time delay before these balancing-impulses take effect. Management control has to take such a

delay into consideration to avoid triggering unintended or survival-threatening oscillations. Further, management control must point out any oscillation effects caused by a time delay. This closes the balanced leadership cycle.

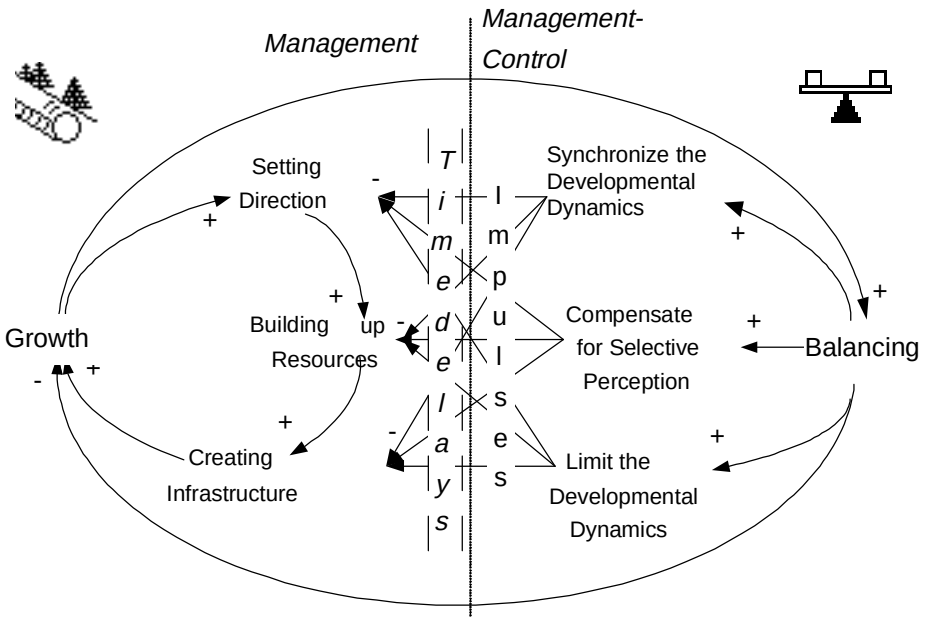

Illustration 6: The balanced Leadership Cycle

As illustration 6 shows, the process in which leadership takes place can be understood as a reinforcing and balancing cycle, allowing for a guided and controlled evolution of the firm.

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