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Co-existence of Innovation and Platforms

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Abstract
This paper present explorative results from an initial effort to explore the current state and the actual requirements to combine the challenges in meeting the need for efficient platforms and the need for effectiveness in terms of a sufficient high degree of newness to the customer. Empirical observations indicate that there are substantial and in some cases contradictory problems in meeting these two different types of challenges. The paper concludes that there are some emerging approaches that can support the development towards the ability to handle the two types of challenges.

Keywords: Innovation, Platforms, Product architectures

Introduction
There are times when a company's know-how, product range and operations setup are in harmony with the world around it. The situations are familiar; the company is well organized, trained and prepared. The managers do not need to develop and implement new concepts. During such times, the essence of management is to allocate resources to promote growth and development. This can be a very gratifying type of work. It means channelling capital and human talent to those parts of the organization which are best placed to benefit from the converging harmonious environment – and these parts of the organization return the compliment by becoming larger, better established and more powerful within the firm.
But then emerges the inevitable new situation, just as the company has neatly organized itself to cope with the previous situation, when the current business diverges. It becomes disharmonious with the way management had structured the company – particularly with the large, well-established, powerful components that benefited from the previous. If this disharmony is of a sufficient fundamental nature, then fundamental changes are required in the company as well.
According to life-cycle theories [1, 2, 3] the latter situation is where most companies will find themselves occasionally in their lifetime. Many companies will not survive the transition. This is supported by statistics. The average life expectancy of multinational company – Fortune 500 or equivalent – is between 40 and 50 years [4]. These companies are big, solid companies that have all been considered as innovative. They have also developed wide and various ranges of drivers of efficiency, including efficient platforms, to leverage their products or services.
Based on this evidence it seems relevant to question whether characteristics of these two 'regimes', the innovative regime and the efficiency regime, can coexist or if they really are mutually exclusive. We chose to explore two rather broad characteristics or symbols and ask

if these two symbols: *innovation* and *platforms* have contradictory elements in their nature. Both are currently considered as high priority management areas often associated with business success. Innovation is the symbol of effectiveness and learning. Platform is the symbol of efficiency.
There is a need of knowledge about how the many different aspects of innovation and platforms interact, and therefore, the purpose of this paper is to start exploring this problem.
Thus our aim in this paper is to discuss whether there are paradoxes in the co-existence between innovation and platforms.
We recognize the wide scope of the paper. The wide scope, however, is argued to be a necessary step in the process of generating insight that can lead to more in-depth research questions.

Innovation and Platforms

Innovation and *Platforms* are two buzzwords that individually draw attention both regarding research and industrial practise. After some years of confusion we do increasingly understand the meaning of the individual concepts. The theory behind is fairly simple and easy to communicate. Many excellent companies succeed to implement one of the two concepts successfully. However, when faced with the problem of implementing the two concepts synchronously most companies experience problems.
Christensen [5] describes how the industry leaders of the hard-disk-drive industry stumbled at each point of disruptive technological change. The diameter of disk drives shrank form the original 14 inches to 8 inches, then to 5.25 inches and finally to 3.5 inches. Each time the format changed a number of new industry leaders emerged.
As mentioned our aim in this paper is to discuss whether there are paradoxes in the co-existence between innovation and platforms. Such paradoxes might be handled with grace by a few truly excellent companies with ambidextrous characteristics [6], but to the vast majority of companies, paradoxes must be carefully considered while struggling to become ambidextrous and build excellence. If not considered such paradoxes might have a Sisyphus effect that will prevent a company from developing and in the end from surviving.

Excerpts of the Innovation Theory

In its broadest sense the term “innovation” comes from the Latin *innovare*, meaning “to make something new”. We consider *innovation* as the process of creating, developing and implementing a new idea. Porter [7] stresses this broad meaning of innovation by stating, “Companies achieve competitive advantage through acts of innovation. They approach innovation in its broadest sense, including both new technologies and new ways of doing things”.
The novelty of the idea may be relative. It may be a recombination of old ideas, a scheme that challenges the present order, a formula or a unique approach that is perceived as new by the individuals involved [8]. Innovations may be radical [9] as well as incremental [10]. In product innovation Wheelwright [11] distinguished between levels ‘breakthrough or radical’, ‘platform or next generation’ and ‘derivative’. Also most innovations involve new technical and administrative components [12]. Understanding the close connection between technical and administrative dimensions of innovation seems to be a key part of understanding the challenges of management of innovation.

Approaches to Innovation

Organizations have to manage a number of different aspects in the process of turning ideas into successful reality. There are several comprehensive frameworks attempting to capture this problem.

Tidd et. al. emphasize two different frameworks to support the operational work with innovation [10]. One framework aims to broaden the scope of innovation to be more than product innovation. This framework, named 4P-model, points to four different ways innovation can be targeted:

P1 innovation to introduce or improve *products;*
P2 innovation to introduce or improve *processes;*
P3 innovation to define or re-define the *positioning* of the firm or products;
P4 innovation to define or re-define the dominant *paradigm* of the firm.

The other framework is intended to be applied in managing innovation [10]. It proposes five aspects of the innovation management challenge: *linkages, strategy, organization, learning,* and *process*. According to Tidd et. al. the innovative organizations need to:

- establish *linkages* with their environment (internal and external). The linkages provide triggers for innovation or provide support during the innovation process;
- *strategically* select from this set of potential triggers for innovation those things which the organization will commit resources to doing. The critical issue being conscious about what and how to prioritize;
- having chosen an option, *organizations* need to resource it - providing the resources to exploit it. This includes both the specific organizational setup and the various elements of organizational culture;
- and – optional – to reflect upon the process and review experience of success and failure in order to *learn* about how to manage the process better, and to capture relevant knowledge from the experience. If done properly the following projects will take off at a higher level;
- and finally, all activities are realized through *processes*.

The first framework aims at the product or service level. According to this framework a product or a service can be placed in a continuum, that can incorporate incremental or radical innovation in the four dimensions: product (technology), process, position (market segmentation), and paradigm (perceptions of current practice). The four dimensions appear simultaneously.
The second framework aims at the organizational level. According to this framework the innovation ability of a given organization can be seen as the sum of the efforts to: establish linkages (to potential partners), define strategy (that supports how to prioritize), establish organizational setups, learn from the past, and set up processes (that incorporate the former four aspects).

Excerpts of the Platform Theory

Platform is an ambiguous multidisciplinary concept. The philosophy behind is easy to communicate and makes intuitively sense. However, the ease in communication does overshadow the high complexity faced when the concept is implemented.
The most widely used definition of product platform is the one provided by Meyer and Lehnerd [10]: “product platform is a set of subsystems and interfaces that form a common structure from which a stream of derivatives products can be efficiently developed and produced.” As in the case of innovation, the definition of platforms has also been extended recently, in this case to provide a focus on shared assets (cf. [14] and [15]). Robertson and Ulrich [15], for instance, define product platform as a collection of shared assets (such as components, processes, knowledge, and people and relationships) that are shared by a set of products.

Muffatto and Roveda [16] identified four concepts that affect product platform strategy: (1) production and logistics processes, (2) development processes; (3) project organizational structure, and (4) knowledge. Various scholars have also linked product platform to the tradeoffs between distinctiveness and commonality, cf. [15,16,17]. Distinctiveness is related to the degree to which a firm is capable of producing products that are differentiable from competitors' products. This is related to the amount of uniqueness that is idiosyncratic to a particular platform. Commonality, on the other hand, deals with the extent to which components or subsystems are shared or reused across platforms in order to create economies of scale and product variety. Here, standardization of interfaces (be processes or components) become a central issue of concern. The tradeoffs between distinctiveness and commonality are one of the challenges that management face during the platform planning process. As Robertson and Ulrich [15] articulate, "Good platform decisions requires making complex trade-offs in different business areas. Top management should play a strong role in the platform process for three reasons: (1) platform decisions are among the most important a company makes, (2) platform decisions may cut across several product lines or divisional boundaries, and (3) platform decisions frequently require the resolution of cross-functional conflict."

Among the benefits of platforms mentioned in the literature are:

- Re-use of components lead to reduced development costs and time-to-market.
- Higher volume component and parts manufacturing lead to scale benefits.
- Reduced purchasing costs.
- Shorter customer order delivery times.
- More consistent quality.

Approaches to Platforms

The practical industrial platform implementation challenge can be described as being a configuration problem with a high number of variables. These variables are different in nature; they have contradictory influence on the total performance, and, their importance change over time.

The configuration problem includes a highly visible part in terms of the re-use of components across several brands and an invisible part in terms of the re-use of less tangible factors: internal know-how, production setups, logistics, and suppliers.

In the more popular part of the literature the emphasis is mostly on the visible part, for example VW A4 platform, but obviously, the invisible part is often as important.

The effects are gained in a non-simple interaction between numbers of multidisciplinary sub-systems. To select and configure these subsystems and their interaction is, in short, the management challenge of working with platforms.

It makes sense to describe these sub-systems by the notion of *architecture*. One particular challenge is to decide on the degree of modularity of the product (or service).

Referring to modularity in product design, Baldwin and Clark [18] assert that the decomposition of a system into modules requires three elements:

- An architecture that specifies which modules will be part of the system and what their functions will be.
- Interfaces that describe in detail how the modules will interact, including how they fit together and communicate.
- Standards that test a module's conformity to design rules and measure the module's performance relative to other modules.

In this sense the architecture is the key to understand the modularity of both the product and the supply chain. The architecture can be viewed as the meta-structure of the product and the

supply chain. By taking this approach the architectures become the focus when working with platforms – and attempting to combine with the innovation challenge.
However, the decision on a particular architecture seems far from unambiguous. Hölttä-Otto reports a recent case study where different methods have been applied to define a modular architecture of two specific products. The case showed that when applying different methods the resulting architecture differed as well [19].

Illustrative case example

The empirical evidence is drawn from four years of action research [20] at the LEGO Company. A main purpose has been to study the activities associated with the platform effort.
Initially, the partly modular architectures across the company were identified. The numbers of architectures were large since the idea of modular thinking has been promoted for many years. Due to the modular nature of the LEGO bricks there has been an urge to use this modularity in analogous ways.
However, while the number of different architectures has grown there has been an increasing awareness of the need to redefine the perception behind and thereby increase the focus on competitiveness in terms of both platforms and innovation.
The initial study made it clear that the organization in general made no distinction between platforms and architectures. Consequently, this was used as an opportunity to refine the notion of architectures and to relate this to a new understanding of platforms. This was done under the following heading:

We must be able to spell
A-R-C-H-I-T-E-C-T-U-R-E
before we can pronounce
PLATFORM

To communicate the way of thinking to the LEGO organisation decorated LEGO bricks were used to illustrate different architectures. In figure 1 a platform is illustrated as three architectures that are aligned with each other.

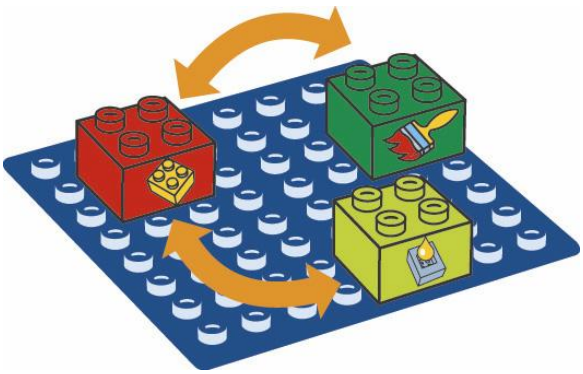

Figure 1Illustration of a platform at LEGO Company

The 2 by 2 LEGO bricks symbolize different architectures. The following is the internal popular description of the figure:

"A new platform is created when, starting with a building system, we gather all the relevant architectures and align these in relation to each other.
Element architectures, moulding architectures and decoration architectures are examples of architectures that are included in every platform. In the illustration above, the arrows pointing in both directions illustrate that the architectures are aligned.
When aligning architectures the operational task is to become conscious of our possibilities and limitations inherent in our production equipment. The strategic task is to initiate change in and the development of our production equipment to meet the predicted demands of future product launches."

The LEGO Mini Figure

The LEGO Mini Figure has celebrated its 25th anniversary in 2003. Since its launch in 1978, 3.7 billion Mini Figures have been produced. The Mini Figure architecture is consisted of 9 elements: 2 arms, 2 hands, 2 legs, a head, a torso, and a hip joint (see Figure 2). It can bend the hip, turn the arms, and grasp tools.

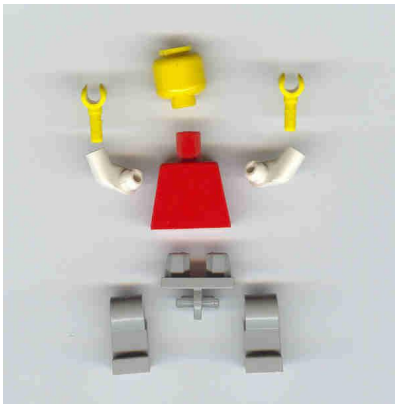

Figure 2The elements included in the architecture of a LEGO Mini Figure

Two month after the launch of the first Mini Figure Man in 1978, its first variant appeared as a Mini Figure Woman. Originally the figures were only decorated with a happy smiley-like face and the elements were one colour. It was, however, obvious that the figure could be customized; hence the early customizations appeared by means of stickers. The stickers were followed by lasting decoration techniques. Due to the addition of different headgears, possibilities for customization became, in principle, endless. During the 1980s the figures got facial expression and in the late 1990s the figures appeared in licensed products like Star Wars and Harry Potter. In 2003, the two LEGO Mini Figures, Biff Starling and Sandy Moondust, became the first "man" and "woman" on Mars.
The physical elements of the LEGO Mini Figure define the visible part of the architecture. Though the elements are standardized the customers experience a high variety, as illustrated in figure 3.

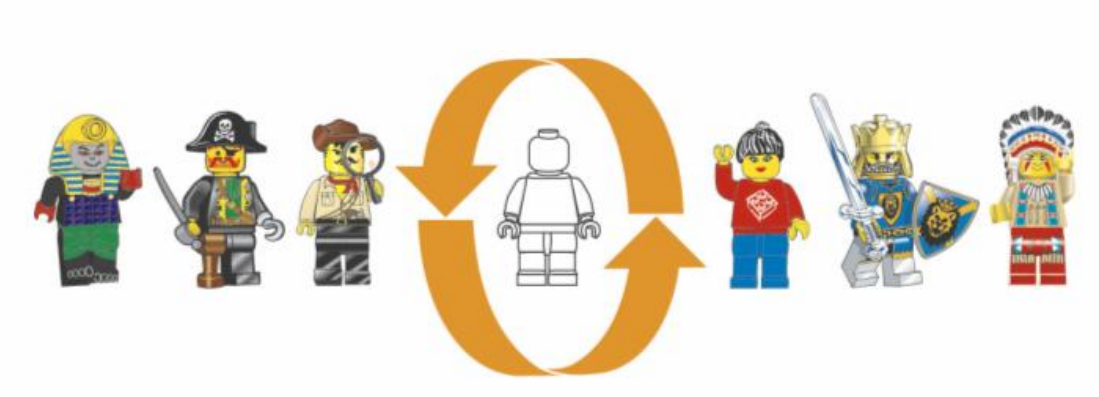

Figure 3. Variety of the LEGO Mini Figure architecture

The basic shapes (head, arms, hands, torso, hip joint, legs) are re-used in figures that appear very different to the customer. Variety is created by means of decoration and different headgear. This is made possible by the standardized interfaces between the head and the headgear.
In figure 4 three important types of architectures related to the LEGO Mini Figure are illustrated. The Mini Figure is an integrated part of a building system architecture (the brick with the brick symbol). When the elements are moulded a number of different moulding tool architectures are applied (the bricks with the moulding tool symbol) and afterwards the elements are decorated while applying several different decoration architectures (the bricks with the paintbrush symbol).
Additionally, there are a number of architectures applied to define the full platform. Among these are architectures related to: materials, moulding machines, moulding processes, assembly systems, packing, packaging systems, colours, and design.

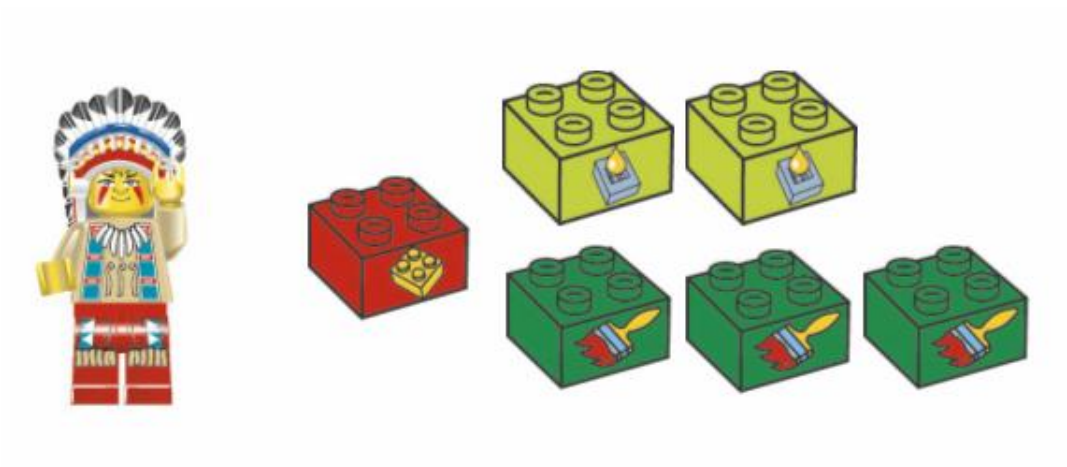

Figure 4Three important architectures related to the LEGO Mini Figure

All architectures have a physical structural dimension and an underlaying knowledge structure. The main parts of the architectures are invisible to the customers and maybe more important also to the competitors.
When the architectures are aligned (as illustrated by figure 1) this is defined as the platform. However the inherent problem is that aligning architectures is not by any means a trivial exercise.

Reflections on the empirical case

The case illustrates the development of an approach that facilitates the co-existence of platforms and innovation in terms of derivatives of products.

The simplified case from LEGO illustrates the challenges of balancing between the need for efficient platforms and the need for effectiveness in terms of a high degree of newness to the customer. However, the Mini Figure is just one element and at LEGO 12 platforms comprises app. 8000 different elements. The serious financial problems at LEGO in the past years have been partly explained by this complexity factor.

Clearly, the complexity of the underlying internal and external supply chain increases as the numbers of different elements go up. Even minor technological developments in some part of the supply chain may affect the efficiency and effectiveness of the whole system. Also, the complexity highly increases the risk of sub-optimizations.

Co-existence of Innovation and Platforms

When companies become industry leaders for a shorter or longer period of time they are mostly able to introduce new innovative products and at the same time be highly competitive in terms of costs and delivery. They may be for instance doing this by being able to master both the innovation challenge and the platform challenge.

A number of examples can be found in the literature:

- Black & Decker's dominance within power tools during the 1970s [13].
- SONY's dominance within the portable audio electronics segment during the 1980s [21].
- Netscape's dominance within Internet Browsers during the 1990s [22].
- Rolls-Royce's high-powered aero engine family during the 1970s [23].
- IBM's ThinkPad PC product line during the 1990s [24].

In each of these cases the industry leadership has subsequently been weakened or in some cases lost. Some of the companies have kept a very strong market position though.

It is thought-provoking that the few cases we know often dates back in time. In the case of platforms the concept is old - but the focus has been intensified since the mid 90'ies. When appointed as CEO of VW in 1993 after a serious financial loss Ferdinand Piërch had to come up with a strategy that could comfort the financial markets. This strategy had strong modularization elements, "...group wide standardization and differentiation strategy for product development, production process and procurement", and formed the basis for the VW dominance in the European auto industry in the late 90'ies and until now.

The public (and the research community as well) have been focusing on VW as a role model for their combination of working with platforms and innovation. Naturally, most companies are very reluctant to report of their experiences. For example, studies of the product development process at Toyota indicate that they master to benefit from platforms at a level that exceeds VW [25]. But unlike VW that have been forced to report on their progress to the financial markets Toyota has kept silent with their strategy and experiences.

Continuous Innovation

The balancing of the challenges of innovation and platforms can be framed by the notion of "continuous innovation" [26]. Continuous innovation seeks to find a balance between operational effectiveness (efficiency, quality, operational flexibility and speed) and strategic flexibility (responsiveness, time-to-market, customization, innovativeness).

The challenge can be expressed in a simple to-dimensional framework (see figure 5). "*Reactors*" survive with minimum adaptation. "*Singular mechanistic*" competes on efficiency and continuous improvement (e.g., a supplier). "*Singular organics*" compete through innovative processes (e.g., a designer company). "*Binarys*" can manage both

efficiency/improvement and innovative processes but separated by either time or space (e.g., described by the punctuated equilibrium theory of change). "*Duals*" manage to synergistically balance efficiency/improvement processes and innovation processes (these are the 'ideal-type' continuous innovation companies/entities) [26].
There are reasons to believe that the companies mentioned above can be classified as "Binarys" – some of them moving towards "Duals". The process of generating new innovative product concepts can be handled by "Singular organics" organization but only the "Binarys" and "Duals" can handle the combined challenges of sustaining a high level of innovation and efficiency, for instance in terms of establishing competitive platforms.
Charles Fine has described the process of transferring an innovative new product to a platform [27]. Apparently this process holds some inherent traps that the company has to overcome.
Our prior research indicates that a company has to follow the path through one or both of the singular levels to reach the binary level.
The transition from reactor to singular seems to be relatively simple and facilitated with several available methods. Though the means are relatively simple and well documented there is a significant business risk associated with the move from the reactor level.
The transition from singular to binary, however, does require a substantial effort. Our observations from the LEGO case and similar research suggests that companies moving towards the binary level need to know their product and supply chain architectures to a sufficient debt. Sufficient shall be regarded as a comprehensive contingency factor depending on the company and the particular industry. This knowledge has to be present to the extent that the companies can identify where the need for innovation relates to the architectures. The innovation needs might be technological or more feature based.

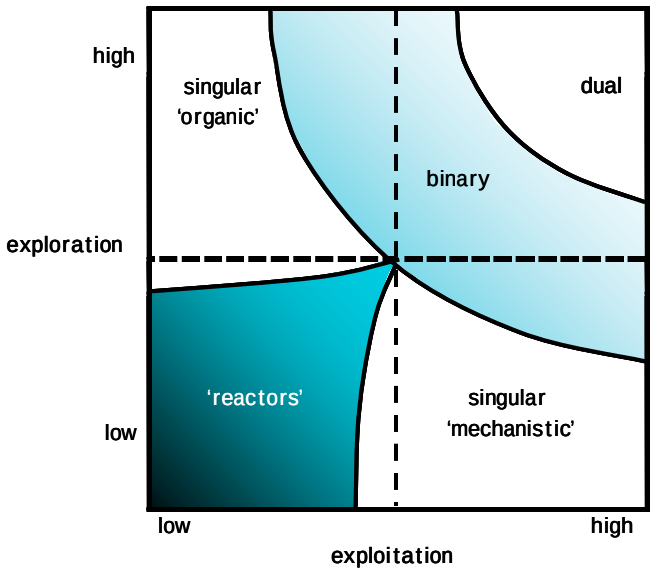

Figure 5Continuous innovation mapping framework [22]

The second strong emphasis needed when companies are moving towards the binary level is a focus on the organizational setup. This has been discussed in the former section regarding "Approaches to Innovation". As stated, the innovation ability is related to the right balance between the elements of process, strategy, organization, linkage, and learning. "Right balance" is to be seen as strongly contingent upon the particular industry.
When it comes to transition to the dual level, we must acknowledge that our knowledge and the documented research are limited. We are in the process of elaborating on this field in a recently launched research project incorporating more than 45 Danish, German, and British companies.

Conclusions

As part of a larger endeavour to explore the requirements to fulfil and balance the challenges in meeting the need for efficient platforms and the need for effectiveness in terms of a sufficient high degree of newness to the customer this paper has started exploring how the concept of platforms ties into our understanding of innovation. We have provided an overview of the emergent theory of innovation and theories of platforms. The empirical evidence from action research at the Lego Company in Denmark showed that the company has developed and implemented platform thinking in a process that runs parallel to the product innovation process. Although the innovation in case is of a rather incremental nature, the example sketches an understanding and a structure that enables the company to create a synergistic alignment of an "efficiency driven" platform process and an "innovation driven" process.

Although the paper leaves many questions open an interesting case example and the theoretical outline have hopefully spurred and inspired to further research.

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