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A FRAMEWORK FOR EVALUATING PLATFORMS IN PRODUCT DEVELOPING ORGANIZATIONS

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Abstract

Platforms have grown in importance as product developing companies strive to be competitive by simultaneously increasing product variants and lowering internal costs. Sometimes platforms have been beneficial but in other cases they have not been. The questions are why is this so and how can we evaluate platforms in general. Furthermore, it is of interest for companies to be able to take general strategic action plans to improve the performance of their platforms.

Numerous platform definitions exist, ranging in context and scope. Due to their diverse nature, platforms are difficult to interpret, discuss, and evaluate. We define a platform as a set of core assets that are reused to achieve a competitive advantage. The term is arguably broad, but we find that it has the advantage of capturing a company's variety of reused heterogenic assets that are in effect the core enablers of competitive advantage for the company

In the paper we propose a framework for a discussion-based evaluation method for platforms. Such a method would serve as a support tool for stakeholder to quickly comprehend the nature of the diverse platforms used in a company, and so make better decisions on explicit strategic action plans for each individual platform.

Keywords: platform evaluation, decision support, platform terminology, platform strategy, asset management

1 Introduction

With the advent of globalization and a higher level of competition, companies are striving to remain competitive by both decreasing internal costs, as well as increasing customer satisfaction [1] – meeting the customer's expectations in terms of technical performance, innovation and time of delivery. This has caused great managerial challenges, where a partial remedy has been found in the use of platforms.

Platforms have in many cases been successful in creating a match between fulfilling market demand and creating internal benefits [2-6]. Other research however has indicated that they have at times not been beneficial [7]. This raises the question of what exactly it is that makes a platform successful and how can they be evaluated in general. This again raises the fundamental question of just what a platform is.

A literature review on platforms in the context of product developing companies has shown that vast amount of definitions exist, in different contexts and scopes [8, 9]. Based on the review, we boil down the core essence of the term and define a platform as *a set of core assets that are reused to achieve a competitive advantage.* Here, a competitive advantage can both

be created inside the company (e.g. within design and production) as well as externally (e.g. due to more attractive products leading to higher sales). The advantage with this arguably broad definition is that it enables stakeholders to capture a variety of reused heterogenic assets that are de facto the core enablers of competitive advantage for the company.

Many methods exist aimed at assessing platforms [4, 10-12], each of them doubtlessly beneficial for their particular context and scope, but arguably not appropriate for our broader definition of the term. Furthermore, we argue that the methods often are quite complex to use (see e.g. de Weck et al. [12]) and require a great deal of information that is hard/tedious to acquire. This in effect makes them unattainable for many potential users.

We find that there is great need for an alternative method – based on already available explicit and tacit information and data – which enables a company to evaluate all platforms in a standard way. In today's praxis, managers and other stakeholder make decisions regarding platforms based on intuition, multi-tasking ability, and cognitive juggling of numerous parameters.

2 Theoretical background

To be able to create a framework to evaluate platforms in product developing companies, the platform definition itself has to be clear. There exist numerous definitions of platforms, existing in different contexts and scopes. According to Moore et al. [13][1] a *platform* is a foundation for a range of individual product variation, i.e., something that is developed once and used in multiple applications. Ericsson & Erixon [14][2] similarly find that a *platform* refers to a *common base* from which a number of predefined models can be built. Gonzales-Zugasti et al. [15][3] include *interfaces* into the concept and define a *platform* as *the set of elements and interfaces that are common to a family of products*. If we look specifically at the use of the term *product platform*, it can refer to the sharing of *functions*, the reuse of a *physical frame* that is constant over time, a collection of *modules which can change* over time, or even in some cases it might be a *strategic tool*. Meyer & Lehnerd [4][4] define a *product platform* as a *set of common components, modules, or parts (especially the underlying core technology) from which a stream of derivative products can be efficiently created and launched*. A different perspective is seen from those who find that the reuse of *technology* is the main factor of a product platform [5, 16, 17]. Robertson & Ulrich [18][5] include all of the above into their definition of a product platform – finding that it is *the collection of assets that are shared by a set of products*. These assets can be divided into four categories, consisting of components, processes, knowledge, and people and relationships. McGrath [5] argues that a product platform is *a collection of common elements, particularly the underlying technology elements, implemented across a range of products.* At the same time he emphasizes that a product platform is *primarily a definition for planning, decision making, and strategic thinking*; it is the set of *architectural rules* and *technology elements* that enable multiple product offerings and defines the *basic value proposition*, *competitive differentiation*, *capabilities, cost structure, and life cycle of these offerings*. Here it is clear that the platform encloses the core competency of the organization; that *certain something* that gives the organization a competitive advantage. Significantly different is the definition from Farrell &

[1] Work within the field of business and marketing
[2] Work within the field of engineering
[3] ibid
[4] Meyer works within management
[5] Work within the field of information- & product development

Simpson [19][6] of a product platform, as it is not a steady, unchangeable foundation or basis, but rather a *design architectural* concept that can change[7]. They argue that the product platform provides the basis for the product family, which is derived through the addition, *substitution, or exclusion* of one or more modules from the platform or by scaling the platform in one or more dimensions. Sudjianto & Otto [21][8] move from viewing a product platform as mainly being *a collection of physical assets* to being *a set of shared functionality across multiple products.* In the case of the use of multiple brands, *a product platform is a set of functions shared across multiple products each within a different brand.* It is clear in this case that the definition has a different character, as there is no certainty of reuse of components although we reuse functions[9].

From what we have read, we see a gradual increase in *scope* in the *product platform* definition – from including only physical components and modules, to including technology, human resources, design, and functionality. This leads to an ambiguous use of the term product platform. Such ambiguity is not unique for the term product platform; the authors have also found certain ambiguity in the use of the terms *technology* platforms [23]*, brand* platforms [21, 24]*, global* platforms [25]*, modular* platforms [26]*, process* platforms [25]*, customer* platforms [25]*, integral* platforms [26]*, scalable* platforms [27]*,* and *high-tech* platforms [3].

The concept of *platform thinking* is defined by Sawhney [25] as the process of *identifying and exploiting the shared logic and structure in a firm's activities and offerings* to achieve leveraged growth and variety. It can be applied to the firm's products, brands, target markets, geographical markets, and business processes. He finds that each of these dimensions is a vector for growth and variety creation, and together these dimensions enable firms to achieve leveraged high variety. He describes five types of platforms to facilitate the analysis of the firm's activities and offerings, i.e. a *product platform*, a *global platform*[10]*,* a *customer platform*[11]*,* a *process platform*[12]*,* and finally a *brand platform*[13].

From what we have seen, within the context of a product developing company, there exist 1) a number of different types of platforms, 2) each different type of platform has a number of ambiguous definitions, and 3) we argue that the term *platform* is understood in different ways.

How can we define a platform in the context of a product developing company in a way that captures the core meaning of all different types of platforms? We argue that this is only possible if we set the scope of the term in a way that it is compatible with an *accepted* body of definitions as the lowest common denominator. Based on our findings we define a *platform* as:

a set of core assets that are reused to achieve a competitive advantage

Here *assets* is adapted from Robertson & Ulrich [18] and defined as **components** (e.g. part designs of a product, the CAD tools needed to make them, the circuit designs, software, and

[6] Work within the field of engineering

[7] As an example in the automotive industry a platform can include interchangeable modules [20]. The chassis may even have different lengths as long as the same stamping dies are used.

[8] Work within the field of engineering

[9] Even if we assume a one-to-one matching between the physical components and the functional elements – i.e. what e.g. Ulrich [22] refers to as modular architecture – we cannot assume the reuse of components.

[10] Consisting of a core offering that is common across global markets and customized elements that enable speedy and cost-effective localization of the firm's offerings to country-specific conditions and customer preferences

[11] The *beachhead* that the firm chooses as its point of entry into a new market can be conceptualized as the firm's *customer platform*

[12] E.g. manufacturing processes, design work-steps, assembly procedures, and logistics handling procedures

[13] Platform thinking applied to brand management allows a firm to exploit synergies among brands, to minimize overlap among brand identities, and to achieve coherence and clarity of positioning across the product family

product function), **processes** (e.g. the equipment used to make components or to assemble components into products, and the design of the associated production process and supply chain, and material), **knowledge** (e.g. design know-how, material know-how, technology applications and limitations, production techniques, mathematical models, and testing methods), and finally **people and relationships** (e.g. teams, relationships among team members, relationships between the team and the larger organization, relationship with a network of suppliers, and alliances). The term *core* indicates that the company views the asset as an enabler of competitive advantage; the expertise of use of specific material, the concept of differentiating the final product after first phase quality control, the secret multi-step process of manufacturing a SiC semiconductor wafer, or for that matter the secret mixture of the Coca Cola syrup, are all examples of an organizations reuse of core assets. According to Porter [28], a company can achieve a competitive advantage by following one of three generic strategies: Differentiation, Cost Leadership, or Focus (Figure 1). However, a company should only focus on one of the competitive advantages: *being "all things to all people" is a recipe for strategic mediocrity and below-average performance, because it often means that a firm has no competitive advantage at all* [28]. If a company wants to have a competitive advantage for a number of segments (broad target), it can either aim to achieve *cost leadership* (at the same time achieving proximity or parity in the bases of differentiation relative to its competitors) or *differentiation* (at the same time achieving cost proximity or parity relative to its competitors by reducing cost in all areas that do not affect differentiation). By focusing on cost, a firm seeks a cost advantage in its target segment, while by focusing on differentiation a company seeks differentiation in its target segment. After a company has chosen one of the three generic strategies to create a competitive advantage, it has to align its platform strategy in accordance. In Figure 1 we can see a matrix illustrating Porter's three generic strategies to achieve a competitive advantage.

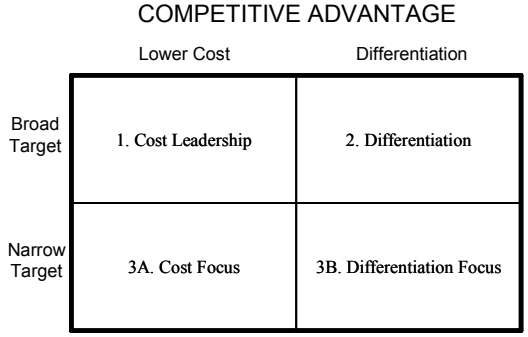

Figure 1. Porters Three Generic Strategies [28].

Methods exist aimed at assessing the *goodness* of a platform; e.g. Meyer & Lehnerd [4] have defined the *effectiveness* and *efficiency* of platforms by looking at platform engineering cost, derivative product engineering cost, net sales of a derivative product, and development costs of a derivative product. Jiao & Tseng [11] use two commonality indices – one for component part commonality, and one for process commonality – to *understand* product families for mass customization. Similarly, Siddique [10] developed a commonality metric for platform and product family evaluations. These methods are without doubt good for particular contexts and scopes, but arguably not appropriate for our broader definition of the term platform.

3 Research aim and methodology

The primary aim of this paper is to propose a framework for a discussion-based evaluation *method* for platforms. Such a method would serve as a support tool for stakeholder to quickly comprehend the nature of the diverse platforms used in a company, and so make better decisions upon explicit strategic action plans for each individual platform. The method should use qualitative information already available within the company – both explicit as well as tacit – to create awareness of the "as is" status of platforms, as well as the company's need and potential to change them.

In effect, in this paper we are proposing the general fundamental structure for a *future* method, which shall enable companies to map all platforms in the same reference frame, discuss their pros and cons, and make sound decisions on basic strategic action plans for each individual platform.

Not much literature exists regarding platform assessment. We therefore based our research methodology on deductive reasoning, where our starting point was our given definition of a platform, i.e. *a set of core assets that are reused to achieve a competitive advantage*. Based on findings from a body of literature as well as from own insight we then identified a number of characteristics that where common among seemingly heterogenic platforms. These characteristics were then *formed* into basic *steps* that we then used as the main building blocks of the framework.

4 The framework

Using our basic definition of a platform – i.e. a set of core assets that are reused to achieve a competitive advantage – we propose the following framework (Figure 2) to evaluate platforms in product developing companies.

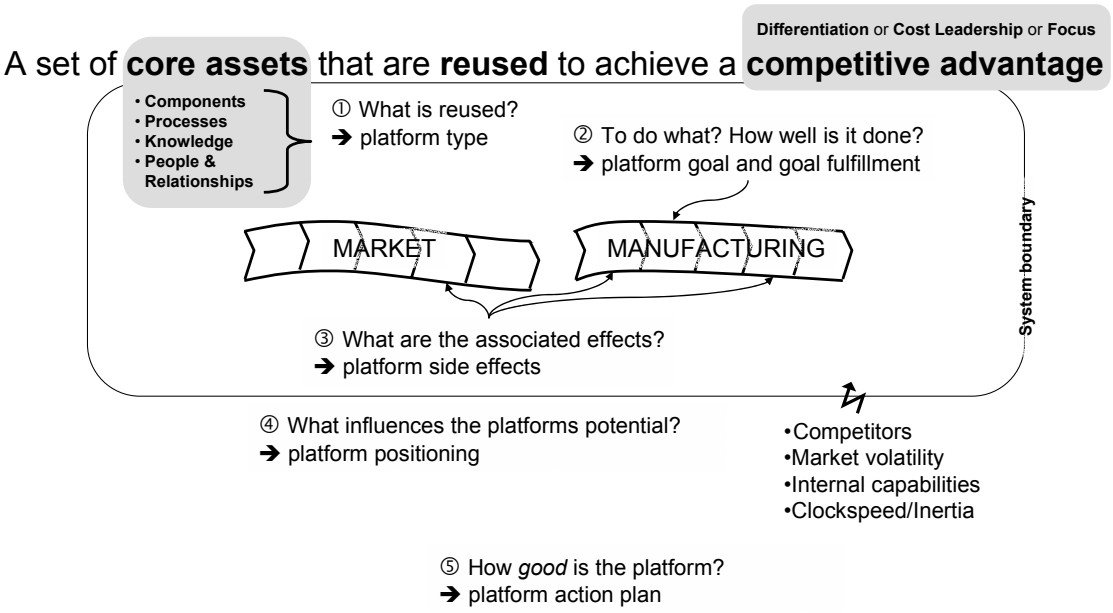

Figure 2. A framework to evaluate platforms with the goal to decide on individual action plans

The framework consists of five steps: 1) platforms of a company are *captured*, 2) their individual goals are identified and goal-fulfilment evaluated, 3) the side effects of the

platforms are identified and assessed, 4) factors that influence the potential of the platform are assessed, and finally 5) a total platform evaluation is created and concrete strategic action plans decided.

In Figure 2, we show these steps, and demonstrate how platform goals affect parts of the value chain while side effects can affect other parts. The chain is divided into Market and Manufacturing. *Market* describes any factors / elements of the value chain needed for a new product to reach the market, i.e. any element needed to sell and support the product – e.g. market research, distribution channels, and customer service. *Manufacturing* describes any factors / elements of the value chain needed to design, develop, and create the product – e.g. research, development, procurement, production, and inbound logistics. Furthermore, we distinguish between inside and outside the system boundary. Inside the system boundary we illustrate the "*as is"* situation of the platform; *what it is,* h*ow well it fulfils its goals and what its side effects are*. Outside the system boundary are elements that influence the *potential* of the platform to maintain/improve its current value; *how skilled is the company in regards to the platform, how does competition affect its value, and how well does it match market volatility.*

In this section we will explain each step of the framework, how it was derived, and why it is important.

4.1 Step 1: Platform type

In the first step of the framework, we *capture* the platforms of a company. In general, platforms are difficult to grasp, conceptualize, and put into words. The term *capture* in this case then indicates the identification and naming of a set of core assets that stakeholders within the company consider logical and practical to group together.

As an aid for this task, we use the fact that platforms consist of a set of assets: components, processes, knowledge, or/and people & relationships. We argue that platforms can be divided into four different platform types depending on their dominant source of assets, i.e. into *component* platforms, *process* platforms, *knowledge* platforms, and *people & relationships* platforms. The main rule is that a company should define its platforms based upon what it considers to be *a logical and practical grouping*.

In praxis, we suggest working though a company's list of individual products, and for each product identify the platforms it uses – from component- to people & relationships platforms. In the following table we display four different platforms, each one of a different type (Table 1).

Table 1. The list shows a sample of platforms used for a specific product.

Platform	Platform type
J500 Controller (operating system, circuit board design)	Component platform
Prototyping workshop	Process platform
Computer vision technology (image processing)	Knowledge platform
The subsidiary FabriCat produces the cutting machine	People & Relationships platform

4.2 Step 2: Platform goal and goal fulfilment

Every platform has a goal, be it to create savings in the manufacturing, to shorten development time, or to increase the number of variants. In the following table a sample of possible platform goals are presented (Table 2).

Table 2. A sample of platform goals.

• Increase variation • Shorten time to market • Reduce risk • Reduce systemic complexity • Simplify testing	• Improve service levels • Reduce non-value adding work • Create economies of scale • Create economies of scope • Increase ability to mass customize	• Reduce development cost and time • Reduce manufacturing cost • Reduce investments

After having identified the platform goals, their actual fulfilment needs to be assessed. This can be done in different ways, e.g. by using the following table (Figure 3).

		REASON							IMPACT					EFFECT		
		IMPORTANT			NEUTRAL			UNIMPORTANT	SUPERIOR		AS PLANNED		INFERIOR	POSITIVE	NEUTRAL	NEGATIVE
Competitive advantage	**Platform goal**	7	6	5	4	3	2	1	1	2	3	4	5	1	0	-1
Differentiation	Shorten Time-To-Market (TTM)															
	Increase variation															
	Technology improvement															
	Service level improvement															
Cost leadership	Cost reduction															
	Risk reduction															
	Learning curve utilization															
	Economies of scale															
	Testing simplification															
	Complexity reduction															
Focus	Improve differentiation for niche market															
	Improve cost leadership for niche market															

main goal ← → side-effects

Figure 3. An example of how platform goals, along with their fulfilment can be captured.

For a given platform, a rating of the main reason for usage (platform goal) is compiled together with a relative evaluation of the deviation between the impact and expected impact. Finally, the effect is registered as being positive, neutral, or negative[14]. Note as platform goals are rated as less and less important, they change from being *goals* to being expected *side effects*[15]. Furthermore, in the figure we see that a column has been added (first column from left) titled "Competitive advantage." According to Porter [28], a company can choose one of three general strategies to create a *competitive advantage;* by Differentiation, Cost Leadership, or by Focus[16]. We find that it is possible to view each of the platform goals in Table 2 as contributing to one of Porter's three generic strategies to achieve a competitive advantage. Viewing the platform goals in this way can be advantageous, as it enables stakeholder to understand the core strategic value of the platforms. In general a company should follow only one of the three generic strategies. This does not mean that every platform should be aligned to the chosen strategy; it does however mean that their overall combined effect should contribute to the strategy.

[14] A Likert Scale Summated Rating (data: interval) is used to rate the reason of using the platform. To assess the impact of the platform in terms of the specific goal, we use a Comparative Scale (data: ordinal). Finally to rate the general direction of the effect we use a Simple Category Scale (dichotomous; data: nominal). For further information on the rating scales used, please refer to e.g. Cooper & Schindler [29].

[15] It is not within the scope of this paper to go into the specifics of how to use the framework as a concrete method. Here however it makes sense to illustrate how it could be used in praxis.

[16] Please refer to the Technical Background section for more details.

4.3 Step 3: Platform side effects

A platform might fulfill its intended goal adequately but still have a number of negative side effects diminishing its overall benefit. These side effects can appear in any part of the value chain, be expected or unexpected, and range from being positive to being negative.

As an example, if the goal of a platform is to increase the potential of creating variants, a side effect may be that the production process is less efficient; if however the goal of the platform is to create economies of scale in production process, the side effects might be that the platform isn't flexible enough to create the desired variants.

In general we can look at these side effects as being either internal or external.

Internal side effects

The platform can have vast side effects on the internal organization. Throughout the value chain, it dictates work processes, sets restrictions, and generally limits degrees of freedom. On the other hand, it frees up resources and facilitates focus on value adding activities. An example of an internal side effect is the negative effect that using a platform might have on the functionality of a specific product, i.e. where the functionality does not meet the target functionality directly due to the use of a specific platform.

External side effects

External platform side effects are perhaps the most difficult to assess. How does the reuse of core assets affect the customer's perception of the product?

As an example, in a given scenario, a customer is interested in a high price segment product due certain functions. In this case, these functions are directly related to the use of a specific platform. The customer then finds out, that the exact same functions (same platform used) are available in a product in a low price segment. This revelation might cause the buyer to choose the less expensive product (cannibalization) or/and might have a negative effect on the customer's image of the higher priced product (especially in the case of brand differentiation).

It is clear that a basic understanding of the affect a platform has on the customer's perception is important to explore.

4.4 Step 4: Platform positioning

In this step we evaluate factors that affect the platform potential to improve; in contrary to the assessments made in steps 1-3, in step 4 we look into the future and evaluate the platforms *potential/position* to maintain or improve its current value.

Seen from an internal perspective, the general competency a company has in regards to a platform is the most important factor affecting a platform's potential to improve. The level of know how, the number of researchers/developers assigned to the platform, and the quality of the facilities are all factors that affect the general competency.

The most important external factors that influence a platform's position are a) the level of competition within the platform area, and b) how well the platform's clockspeed[17] and inertia match the market volatility. Clockspeed and inertia are useful concepts to describe respectively the speed of evolution of the platforms, and the general resistance to change.

[17] Fine [30] defines the concept *clockspeed* to describe various rates of evolution in industries.

The platform *competition* level is an indicator of how focused a company must be to excel. High platform competition indicates that a company must focus heavily on the platform to create a competitive advantage.

Market volatility is an indicator of how fluctuating the product demand is. In general, if the volatility of the market demand is high, a company should strive to remain flexible in terms of what it can manufacture. As an example, it is ill advisable for a company to develop a platform with a high inertia and slow clockspeed, if a) it highly influences the products it is part of, and b) the demand for the products is unstable.

For each platform, the *clockspeed* and *inertia* can be assessed. Different platforms have different clockspeeds depending on their rate of evolution. As an example, the clockspeed of a CPU component platform can last for a period of 6 months, an automotive component platform for 10 years, and an automotive process platform for up to 15 years. Finally, the platform inertia is an indicator of how much *freedom* an organization has in choosing whether or not to use a specific platform. The inertia can be seen as being due to one or more of the following: *financial* inertia, *development time* inertia, *standard* inertia, and finally *knowledge* inertia[18]. A financial inertia derives from a situation where a company is forced to use a platform due to lack of financial muscle. A development time inertia derives from a situation where the demand to have a short development time forces a company to use a platform. A standard inertia derives from a situation where a company is forced to use a platform as it is a standard. Finally, knowledge inertia derives from a situation where a company is forced to use a platform due to lack of knowledge to do otherwise.

4.5 Step 5: Platform action plan

The framework is meant to be the foundation for a discussion-based evaluation method for platforms; to quickly get up to speed on the status and position of a platform and so support decision making regarding strategic action plans for each individual platform.

In this last step of the process, the findings from steps 1-4 are accumulated to evaluate 1) the need to change the platform, and 2) a company's potential to change the platform. Finally, after evaluating the need and potential to change a platform, strategic action plans are decided upon.

In Figure 4 we see how the action plans derive from an assessment of the need to make changes and an assessment of the potential to make changes. In the former, the need is estimated from an assessment of the platform's goal fulfilment, side effects, and the platform's position in regards to competition and match with market volatility. The assessment of the potential to change derives from a study of the internal competency of the company in regards to each individual platform.

[18] This classification has been found by studying general change resistance forces of platforms.

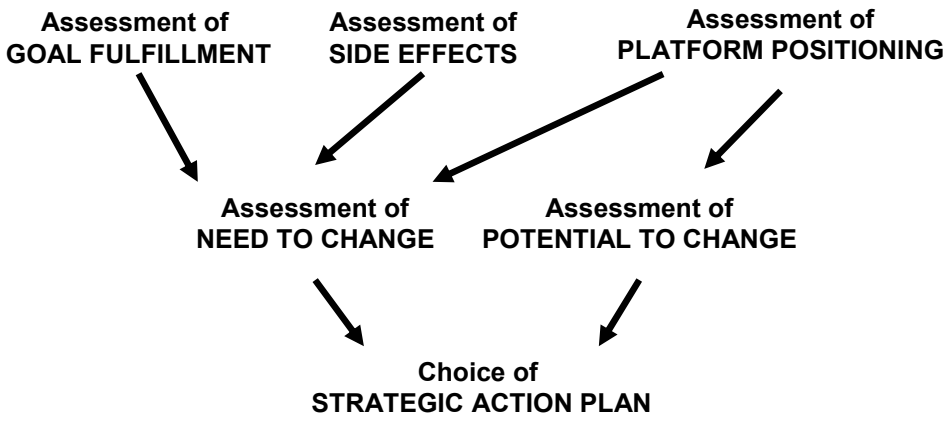

Figure 4. An overview of how the need and potential to change platforms are evaluated and specific action steps derived.

After having completed the process steps, stakeholders should be able to understand the "as is" and positioning of each platform. Based on the results, a limited number of a strategic[19] action plan alternatives can be considered and finally one chosen.

5 Conclusions and further research directions

The framework introduced in this paper was designed to view all *sets of assets* that create a competitive advantage – i.e. platforms – in the same frame of reference. It should create a picture of the "as is" situation of each platform, as well as the need and potential to improve it. Furthermore, all required information and data should be gathered from a group of multi-disciplinary stakeholders in a discussion-based forum/workshop. As the steps of the framework are followed, a more and more accurate *picture* of the platform is created; by identifying them, discussing their goal fulfilment, their side effects, as well as their need and potential for improvement, stakeholders should be able to make better decisions upon concrete strategic action plans for each platform.

The direction of further research is on creating an actual full-fledged method. Each step must be extending in detail and information gathering must be designed to capture best possible estimates of the fulfilment of platform goals, side effects, as well as positioning of the platform. Simultaneously, a row of industry case studies must be conducted to validate the method.

Although we are still in the very beginning of developing a method, we are optimistic that it will be of great value to companies striving to manage a broad range of platforms. We point out that merely "conceptualizing" platforms in the proposed way could be very advantageous – enabling stakeholders to discuss, reflect, and agree upon action plans for each platform.

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[19] With *strategic* we indicate that the plan is not meant to be detailed – it should in general give the direction to follow in regards to the platform. As an example it might be sensible to use five different action plan possibilities:

1. Status Quo (i.e. do nothing)
2. Minor changes / Improvements
3. Major changes
4. Create new platform / Split platform
5. Eliminate platform / Merge platform

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