"...rather than being a new formalized method, CVD-inspired thinking should rather be seen as an approach, attitude, mind-set which reflects the explicit acknowledgement of the present-day reality and helps to understand its implications for different design-related disciplines."

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**Version control**  
Note: up until version 3.0, the title of this working paper included the name Systemic Context Variation. Due to a variety of reasons, it was changed to Context Variation by Design.

<table>
<thead>
<tr>
<th>Version</th>
<th>Released</th>
<th>Main changes</th>
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<tr>
<td>1.0</td>
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| 2.0     | April 2014   | Main sequence of sections changed  
Explicit acknowledgement that SCV is a paradigm that is valid for all (sets of) contexts  
Making some key concepts more explicit  
Mention key thoughts earlier on  
Visuals and cases added, including a ‘red thread’ case  
New references added |
| 3.0     | November 2014 | Main points changed in this version:  
• SCV is an attitude, not a method  
• Existing methods can and do demonstrate different levels of ‘SCV-ness’; it is a continuum rather than a black & white situation.  
• Demonstrating an SCV attitude is possible by any type and size of stakeholder; the intensity that is appropriate in a situation may vary.  
• Concept “managing emergence” is key in SCV  
• More cases added to illustrate points  
• Formulations changed to clarify contents  
• Key take-aways added  
• New references added  
• Small changes in the structure  
• Minor textual changes to reflect developing insights |
| 4.0     | May 2015     | Main changes:  
• Name changed from SCV to CVD; reference to Da Vinci removed from the title  
• Additional literature references included  
• Several emerging insights made more explicit  
• Results based on empirical research incorporated  
• Possible lines of research updated |

This working paper is also basis for journal and conference papers, and parts of it are likely to be incorporated in such papers. Progress gained from developing and applying the contents of this working paper will therefore be published in other papers as well. These papers will in time therefore contain more evolved information than this Working Paper. This Paper will keep its function as a base document but may be upgraded to new versions, if the authors consider it necessary doing so.

For inquiries, feedback and requests for co-operation, contact coordinating author: Wouter Kersten ([w.c.kersten@tudelft.nl](mailto:w.c.kersten@tudelft.nl))

To get to this level of this working paper the following people have contributed their thoughts and discussion: Prabhu Kandachar, Annemarie Mink, Ana Laura Rodrigues Santos, Sarah Suib, Floris van der Marel, Deborah Sumter, Marjolein Heezen and all students who followed the Internationalisation course at the IDE faculty in the spring of 2014.
Cases for clarification

To increase the practical appeal of this working paper, we first present some ‘teasers’ of actual case studies that we have used, starting with what went ’wrong’ or where their success stopped. Throughout the paper, the case studies will be analysed through the lens of specific elements of the approach that we will unveil in this paper, called CVD.

By definition these analyses are done with the benefit of hindsight. This is not a drawback, however and has the advantage of showing how ‘what if’ reflection can help to locate many more cases that bear relevance, in absence of the possibility to search for “CVD” as key search term.

In short: many cases from real life (‘backward looking’) will be suitable to use, whole or in part, to gain insights that can then be used in new projects (‘forward looking’). To demonstrate this, the authors worked with students to explore whether cases could be identified where parts of the ideas from this paper were recognizable, or where these ideas would have had added value. From the many cases that thus were discovered, a few will be used in this working paper to illustrate various points.

**Tesla** – world famous electric mobility company - announced to the world that it would not legally chase any company that would use their patents in good faith. The world was stunned by this – by some dubbed as altruistic - move, but what if we look more closely?

**BMW** - the hugely successful car brand did not exactly strike gold with the introduction of their BMW Mini in the United States. Reasons might have been many, including one detail that seemed to trivial to pay attention to.

**McDonalds** is often heralded as a company that manages to adapt well to local tastes and customs. Could there be a way to draw even more benefits from that ability?

A rather atypical **mining disaster in Chile** left 33 miners alive, trapped and with the prospect of not being rescued for months. Who should the mining company call to make sure they can effectively keep the mental state of the miners sufficiently positive?

**WakaWaka Light** literally aimed to provide light in the dark times of families without access to electricity. Their solution worked, but how could they make it more affordable?

**Gasifiers in Vietnam** – allowing different types of fuels would be possible by pelletizing the solid materials. However, this introduces new value chains and partners to cooperate with. This was considered too complicated. Was that the only possible conclusion?

The **Toyota Motor Company (TMC)** has an excellent reputation for quality, yet had to resort to massive recalls in 2009 and 2010 in its foreign subsidiaries. What went wrong there?

**Nokia** on the one hand seemed to have done well in developing suitable mobile phones for emerging markets, but on the other side missed the boat in the smartphone take off. Enough reason to reflect on both situations.

**Apple** has struck gold with the iPod. In doing so it followed many principles that other companies seemed to have missed. It therefore serves us well to reflect on this perfect “CVD-case avant la lettre”.

**Whirlpool** made grave mistakes when introducing washing machines in India for example because they tore up saris. It is known as a case of “context insensitive” or “too universal” design. But these formulations miss a more interesting point.

**Sony and JVC** were the main companies battling for the videotape market, with their technologies Betamax and VHS respectively. VHS clearly prevailed and it is relevant to reflect on why that happened, and analyse the implications that we can use today.
Abstract
While innovation by default is the discipline that focuses on continuous – incremental and radical – change, it is now evolving faster than ever. This is especially due to its increasingly global nature in a world that is getting more connected anyway. This means that traditional paradigms about where innovation starts and who is ‘organising’ it are eroding. All actors involved in innovation need to accept this complex situation, where innovation originating ‘anywhere’ can turn out to be relevant ‘anywhere else’. The implications and current status of how this insight can best be used however seem to have room for improvement. This is true for the design-discipline, but also adjacent domains like ‘management’ and ‘innovation’.

“Design” is an integral part of the innovation process. The current prevailing practice in the design discipline prescribes a closely coupled approach through intensive interaction with the target group of end users, i.e., focus on one particular use context. This seems reasonable and valid enough: putting people that you aim to serve in the centre of your design process if you want to address their problems. However, our global society is becoming more connected, so chances are that problems and needs of different user groups are still more similar than acknowledged despite contextual differences that do matter. Current methods in the process “from idea to market” mostly ignore this connectedness. This results in having to redo most of the (design) process once scaling or expansion to other use contexts is considered. Executing the process in a different, more integrated manner implies consideration for several front ends, user groups and stakeholders (network). With current design methods this is –by and large- considered too complicated; most methods are badly equipped to deal with this or provide little guidance how to achieve it. Their aim is rather to reduce these complications, mostly by one-sided decomposition of the problem and focus on one specific use context. While the design discipline is inherently rooted in creative thinking it does not seem to have co-evolved to effectively address the globalizing and connected society.

In this working paper we present an approach or attitude of looking at design and thereby innovation, that helps to address these contemporary challenges. It is brings together two main lines of argumentation, being the evolution of the innovation landscape and the re-interpretation of traditional design paradigms, going back as far as the works of Leonardo da Vinci. We show how these inherently connected domains can be brought together in a purposeful way. In short we argue how a re-interpretation of traditional design principles through contemporary eyes will help to more consciously address the multiform nature and complexity of issues that the innovation landscape is increasingly facing.

A key aspect of looking at most contemporary innovation challenges lies in the distinction between complicated and complex. Currently many designers and in fact other people active in the innovation process consider contemporary problems that affect many people and seem to have many interconnections to be complicated situations that they try to “fix” by simplification (decomposition in sub-systems and optimisation). We propose to consider such challenges to be complex situations, which can be handled in a very different manner, starting by considering and appreciating their multiform nature. In particular: instead of considering the interrelations between different aspects of a problem as confusing, they need to be considered as key to the solutions. In other words, a true solution in a complex system cannot be “engineered” by putting together sub-solutions to sub-problems. It needs to emerge from a systemic process. If we acknowledge this reality, it also becomes clear that collective design intelligence, dispersed over different contexts and stakeholders, needs to be allowed to materialize. This implies that design and “organizational” principles need to allow and even stimulate this.

We suggest that this requires a certain attitude and approach towards (design) challenges, where complexity theory and “design as design was intended” converge. The name that we propose for this approach is Context Variation by Design (CVD). This name can be interpreted as intentional context variation and also purposeful design for multiple contexts. One of the key elements of the approach is to allow for and learn to “manage emergence” as
opposed to wanting to predict and control everything in detail and simplifying the design challenge too early in the process. Not all existing methods are totally devoid of this attitude. One could say that different methods display different levels of ‘CVD-ness’. This implies that rather than being a new formalized method, CVD-inspired thinking should rather be seen as an approach and attitude which reflects the explicit acknowledgement of the present-day reality that helps different design-related disciplines to understand its implications.

CVD is thus intended to aid designers in formulating design challenges in acknowledgement of their multiform nature. To address the challenge active interaction with more than one context will – and as we argue should - play an active role. The awareness that we want to create for designers, managers and consultants alike will not lead to detailed guidelines or instructions, but can support practitioners in design and design-related disciplines to come to terms with the attitude and approach that is required.

This paper will however provide a number of design principles, and a few general guidelines that mainly refer to the process and interaction between stakeholders. Managers and designers alike can apply these for own purposes. Such results will all be steps in a journey to explore and further develop the application in practice of CVD as a more broadly accepted approach. This includes a growing collective experience in assessing how relevant the attitude is in different circumstances.

The authors of this working paper invite researchers and practitioners from other disciplines to use their own angles to take further development of this approach forward. We propose several lines of research to set this process in motion.

One important general disclaimer regarding the relevance of this paper for the design field: the paper describes the transition from systematic to systemic approaches to design. This is less relevant for the part of the design discipline that focuses on aesthetics.

We suggest the following key take aways for practitioners:

- **Companies: no matter the size**, if you can foresee that your solution process leads you to operate in multiple contexts, don't be blinded by the differences between these contexts. Rather, acknowledge the multiform nature of what you are addressing and consider interrelatedness as opportunity. This first and foremost has to do with a mind-set, which needs to encourage looking broad rather than narrow, and see value in connections rather than in end points, i.e., predictable SMART results.
- **(Mostly) Small companies**: Even if your ambitions are more limited, it can still help your thought process if you make use of the increasing global connectedness in terms of gaining richer insights. The solution you develop will gain in quality.
- **Governments** need to facilitate partnerships that bridge contexts and should do everything in their power to remove artificial barriers to achieve this.
- **Universities** must provide students with the possibilities to develop a broad outlook, in terms of geography, disciplines and stakeholders to work with. Innovation happens mostly in ‘estuaries’, in the confluence of different flows. Where better to train this?
- **NGOs** can experiment with creating new, and dynamic roles for themselves in this increasingly interconnected world.
- **Financiers** may need to let go of some of their desire to want to remove all uncertainties upfront and accept that a self-searching and self-organizing process needs some manoeuvring space. Besides being appropriate this mind-set is likely to save costs especially if scaling to more contexts is expected.
- **Designers** need to take their own responsibility in taking a broader view, with a purpose, allowing emergence to play a role in the process and reject conditions (e.g., rigid design briefs) that do not enable them to work in this way.

**Keywords**: Context Variation by Design, design principles; emergence; multiform.
1. Introduction: the logic behind the evolution in global innovation

As many people nowadays notice with mixed emotions: the world is moving faster and is becoming more unpredictable than ever. Not the planet, but all developments that especially human beings put in motion on that planet. It is therefore important to find a way to deal with this fast moving reality, before it fully takes over our lives. We have to do this without either trying to fully control what happens or on the other extreme follow all developments around us with apathy.

When we talk about changes happening around us, and in part instigated by ourselves, it is not difficult to see that there is a link with innovation, since innovation is the discipline of continuous change, i.e., finding new solutions that work and are adopted. As will be discussed in more detail later on, this has become a truly global game, more so than some people seem to realise. The same can be said about the design discipline, which can be seen as an integral part of innovation. On the one hand several design paradigms demonstrate that (some) designers don’t consider their discipline to be inhibited by continental or other borders. On the other hand, most approaches to design are not automatically well equipped to address the inherently complex situation of having to deal with different contexts.

“Context”, throughout this entire working paper, refers to the combination of a variety of aspects, which include a combination of history, culture, language, end-user groups, social norms, trust building processes, relationship building, delivery infrastructure, regulations, price, performance requirements, brand sensitivity and so on. Note that contexts do not need to be located in different countries, there can be different contexts in one country, e.g. rural vs. urban, and high-end vs. low-end. The exact definition of the word matters less than the realisation that there are different combinations of the aforementioned aspects, and that this is affecting the thought process of (solution) designers. Until now, the reality of the world existing of multiple contexts has in terms of design strategies mostly been addressed by one of the following two options: trying to simplify the situation, e.g., focusing on one specific combination of context-aspects at a time (i.e., one use context), or the opposite, generalising design to such an extent that no one is adequately served. These two strategies both seem to be an inadequate response to this increasing complexity.

What then, do we need to do? If we just follow what is going on around us without properly reflecting on it, the dynamics of increasing complexity are driving us. However trying to control these dynamics with current methods does not seem to be working either. In order to move design and innovation in a globalized and interconnected world forward we need ‘a third way’, an integral methodological approach that incorporates meaning from a broad perspective while acknowledging contextual differences.

Having made these observations, we identified that the key to develop this third way is to look in a different way at connectedness in our (global) society. Only if we see it as powerful and a given, though not fixed, element in society, we can hope to use it to our benefit. This means that we need to acknowledge complexity as a reality, i.e., acknowledge and perhaps even appreciate the “multiform and interconnected nature of many issues” as well as inherent unpredictability how solutions will evolve. Interrelations between different manifestations are likely to give us clues on the route towards finding solutions. As we will argue, “design as it was intended by its grandmasters” already included such insights. To further understand the relevance of looking in this way, we refer to the statement of Norman (2010): “Complexity is simply a state of the world. It's when we don’t understand the underlying logic that things become confusing, and complicated”. He also describes the role of designers to address this challenge. We will return to this later.

As will be discussed more in depth later on (section 5), if we go back to understanding the roots of the design discipline and formulate these roots more consistently and in acknowledgement of complexity, we can intentionally formulate a design challenge in a
multiform way. We can thereby break the vicious circle that is formed on the one hand by the autonomous development of society becoming increasingly complex and on the other hand innovation and particularly design methods that mostly are ill equipped to deal with this reality. This circle results in the desire to “reduce or ignore complications”. Thereby reality is ignored, leading to ‘solutions’ that are optimised for one use context. Instead we want to turn that around: consciously re-interpret traditional design principles so these can help us to deal with the complex innovation reality of today and certainly tomorrow.

Presenting this convergence of understanding complexity and applying it in design related processes is the purpose of this working paper. The general flow of the working paper is shown on the left. To build the case for the convergence, we will in the next three sections first outline the evolution of global innovation paradigms (section 2), more recent developments related to the globalization of innovation, including the rise in importance of emerging markets (section 3) and an extensive analysis of areas within these recent developments that in our view need more careful study (section 4). Developments related to emerging markets are included because these have substantially contributed both to the composition and complexity of the current global innovation landscape, with an effect on all its stakeholders, even if they do not realize it (yet).

Readers who are very familiar with the domain of international business development may choose to skip sections 2 and 3. These sections are more descriptive than the rest of the paper, and do not aim to “make a point”. Still these sections do provide a relevant backdrop to better understand the convergence of thoughts that we describe in later sections.

In section 5 we will draw the design discipline more explicitly into the picture by discussing how it has evolved. We subsequently suggest in section 6 how traditional design principles can be re-interpreted to be able to address the areas of improvement that were introduced in section 4. This enables us to argue more in depth the approach and attitude that will be required for design processes to deal with contemporary challenges in a better way (section 7). Finally, we suggest some general guiding principles for this approach, highlight important aspects that might be easily misinterpreted and propose how further development and application can be taken forward (section 8).
2. A brief history of global innovation paradigms

From ancient history onwards we can point at many solutions that have been created for problems in all parts of the globe. These solutions range from mere ideas or isolated inventions to ones that have actually been deployed and accepted in practice. According to popular belief all innovations that really matter originate in ‘the West’. However, the mountain of cases that proves the contrary is overwhelming. The lists of acknowledged inventions and innovations from, for example, China, India, Egypt, medieval Islamic territory as well as Central and South American civilizations are indeed impressive.

One might claim that the spirit of the statement about the origins of meaningful innovations was meant to convey the fact that innovations mostly happen in advanced societies and that in the eras when these discoveries were made, aforementioned countries and regions were indeed advanced. Still the dominant mind-set in ‘the developed world’ is that, with rare exceptions, “The West innovates, the rest follows, or copies”, or as voiced, although not as support, in for example Petrick and Juntivasarakij (2011) “The West develops, then it is modified and transferred to the Rest”.

One reason why this logic has driven global innovation strategies is because it follows Vernon’s internationalization perspective of life cycles (1966). This popular theory emphasizes the importance of the presence of factor conditions that enable and trigger innovation because of geographic collocation of scientific knowledge, innovators (entrepreneurs of any size), technology, investment capital and consumers. According to this logic, initial production and therefore also all innovation takes place in ‘advanced economies’, and once labour costs become a differentiating factor, production and later on sales will migrate to less developed countries.

This view assumes a linear model of innovation, starting with access to science and technology resulting in new product development, introduction to a primary target market (in advanced countries) and eventually in secondary markets (usually at the end of the product life cycle). The presence of not only the assumed innovation conditions as described above but also the geographic proximity of locations in the first few phases prescribes why – according to this view – innovations are at best very unlikely to occur in less developed countries, or as the more promising ones are currently called “emerging markets”.

In later literature, both Vernon (1979) and others have updated these models especially in view of the evolution of the way in which multinationals work. Their subsidiaries were taking on roles that did not follow the traditional view anymore. In particular the timing of moving production to less developed economies was moved to earlier on in the process. Later the possibility was added that innovations occur not only in the country of the headquarters of large corporations, but can occur in any location where a specific and crucial (technological) specialisation is leading (Cantwell, 1995). Literature since then has focused on the changing relations between subsidiaries and headquarters (e.g., Ambos et al, 2006) and the symbiosis between SMEs (Small and Medium Enterprises) and large firms and MNCs (Multi National Corporations). Typically, the former are by and large better in developing truly novel ideas, whereas the latter play a dominant role in being the prime disseminators of these inventions by turning them into actual accepted products and services, i.e., innovations (Rogers, 2003).

Until the start of this millennium the majority of reflections on the role that location of the origins of innovative ideas plays, has been limited in scope where emerging markets are concerned. It is in most cases still the (Western) MNC perspective that is considered to be leading. This can for example be seen in Govindarajan (2009) who fully acknowledges that he takes the perspective of the American MNC when describing phases of global innovation. Based on his model we can see five phases: 1. Globalization – 2. Glocalization – 3. Local innovation – 4. Local for Local – and finally 5. Reverse innovation. Following the sequence of

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1 The term “innovation” refers to the process that starts with identification of a need and ends with successful
these phases, especially the origins of the innovation and the recipient changes over time. First the possibility of geographic variety for the origins of innovations increases, then the variety of recipient regions, with in phase five the initial division of roles being completely ‘reversed’. Hence the name of this fifth phase that for now is considered by some to be the frontier of global innovation. This term was coined by Immelt et al (2009).

Despite the birth of the term “reverse innovation” in 2009, the fact that innovations can originate anywhere was already recognized earlier, e.g., in 2005 (Seely Brown and Hagel III). Since then, more and more examples have demonstrated the validity of these observations, e.g. Hang et al (2011). Still it does not seem to be fully recognized that emerging market based solutions and firms have something more to offer than just low labour costs.

Essentially, the shift that innovation itself is making – i.e., from product/ feature focus, to a richer solution perspective – is not being fully recognized by all. For example, Aulack et al (2011) are analysing export strategies of large companies from several emerging markets. In their analysis they use as base principle that such companies cannot (yet) bring autonomous innovations to developed markets, and therefore have to focus on low cost products if they want to be successful. In other words, they ignore the possibility of such firms developing novel solutions. It can easily be argued that with this attitude the possibility of SMEs in emerging markets as initiators of innovative solutions as opposed to large companies is recognized even less.

We will therefore now outline some recent developments in global business and innovation in section 3. While “emerging markets” are not the only domain that affects the global innovation landscape, it is essential to include a reflection of their role. This role is – both in terms of consumer markets and as source of innovative ideas – affecting the composition and dynamics of the global innovation landscape to a larger extent than actors from Western contexts\(^2\). Ignoring this importance would have a profound effect on all businesses (and in fact governments). This justifies including them in the picture, and is an acknowledgment of the reality that in fact the entire world is now part of the innovation landscape. We need to acknowledge this global nature to be able to better address it. Acknowledging that reality and understanding its relevance is crucial for any innovator today.

3. Recent developments in global business
Following the statement at the end of the previous section, developments in and related to “emerging markets” need to be included in the analysis of “development of the innovation landscape” to be able to understand where we find ourselves today. By means of this understanding we can also more easily derive the implications of these developments.

The rising interest in emerging markets in the context of global innovation is driven by a number of causes and their interrelated dynamics. The following summary captures the most relevant causes and their implications:

- **Beyond NGOs.** Based on discussions in and about the development aid sector, it is by now an accepted phenomenon that addressing social needs is not just an NGO (Non-Governmental Organization) or ODA (Official Development Aid) prerogative anymore. In fact the desire to combine ‘ideals’ with an approach that creates own revenues is widespread, see e.g., Yunus (2010) and Bornstein (2007). Additionally, GRIs (Grass Roots Innovations) are becoming increasingly recognized as source of socially minded concerns and innovations as well. See for example the National Innovation Foundation India (http://www.nif.org.in/)

- **Adding up.** As highlighted by several authors starting in the beginning of this century like Prahalad and Hart (2002) “the poor” in emerging markets do not have much individual purchasing power, which is why they were largely neglected by large corporations. However, in cumulative sense they make up an enormous market of –

\(^2\) Throughout this working paper, the terms “actors” and “stakeholders” will be used. The former refers to “parties that might be relevant”, the latter refers to “parties whose relevance has been established”. 
taking into account different segments at this so-called Base of the Pyramid (Rangan, 2011) – approximately 9 billion USD per day. This is not an opportunity to let pass by easily for any company.

- **Growth areas.** More importantly, emerging markets, including but not limited to the various Base of the Pyramid segments, represent a major area for growth in terms of size of the market. At the same time most developed economy markets are subject to fierce competition and a difficult and expensive area to innovate for, or subject to restrictive regulations (e.g., Govindarajan and Trimble, 2012). In terms of popular business strategies, becoming more active in (selected) emerging markets represents a Blue Ocean Strategy, while sticking to competing in over-competitive Western markets would be a Red Ocean strategy (Chan Kim and Mauborgne, 2005).

- **Growth rates.** Recent growth rates have shown even better how the emerging markets, in all segments, represent a larger potential than developed economy markets (Economist 2010c), so diverting attention to these growth markets seems a sensible strategy. This still seems valid, despite recent reports on growth rates also slowing down in some large emerging markets (e.g., Kochhar and Pirelli, 2013).

- **New global standards.** The nature of the current situation in emerging markets (e.g., limited legal systems and governance, market fragmentation, underdeveloped infrastructures) augmented by the rapid recognition of social needs that can be met in a business like manner instead of just charity, stimulates autonomous innovation, often of a leapfrogging type. Innovations that originate in these circumstances do not incrementally improve solutions, they jump to new curves, i.e., leapfrog (Economist 2010b). Because of the size of the initial markets, these solutions stand a high chance to become the new standards on a global level (Ping Li, 2012). In that way, consumers and end users from emerging economies become the new early adopters, instead of mere laggards, in terms of the adopter categories of Rogers (2003) in his theory of categories of end-users and their speed of adopting new products and services.

- **Contextual ties.** With that potential in mind, it is important to realize that it is not easy to innovate based on a constraint based situation. It stimulates one to be creative but that still needs to happen. This is valid in terms of products themselves but more importantly entire solutions and strategies (e.g., Klein, 2008). It is more complicated as it may sound (Gudlavelleti et al., 2013). At the very least it requires deep context knowledge and even immersion (e.g., Singh, 2011). The call for focusing on contextual intelligence (Khana, 2014) can be one of the reasons why, especially local, smaller companies fare better to gain and keep access to this ‘local sticky knowledge’ than larger ones (Asheim et al, 2003). Still, as is discussed more in depth later, it is also important to realize how one can easily dismiss the possible relevance of other contexts if all this context-awareness only encourages the identification of differences, instead of also looking for similarities.

- **Emergence of a polycentric playing field.** The prerogative for ‘true innovation’ in any case no longer lies with Western MNCs. The top-100 of the world’s most successful and innovative companies is increasingly populated by EMFs, i.e. emerging market firms (Dutta, 2012). The centres of gravity of large multinationals are also shifting (MGI, 2013). Given their proximity, knowledge and access to an abundance of an increasingly highly qualified work force, they are quickly taking large shares of these markets (Economist, 2010b). In general we are quickly moving towards a “polycentric” innovation landscape (Van Beers et al, 2013).

- **Relevance for developed economies.** These EMFs are increasingly able to put their innovative solutions on the market in developed economies as well (e.g., Hang et al, 2011). This has especially become apparent the past few years because the characteristics of non-saturated market segments in for example Western-European markets show more similarities than before with those in emerging markets. Both for national budget reasons (Bottles, 2012) and from a user perspective (Ashoka, 2013), crisis stricken developed economies are increasingly suitable to adopt solutions originating from emerging markets as affordable and ‘good enough’.
• **Lose at home = lose everywhere.** Without changes in strategy many developed economy companies, both large and small, might miss big opportunities if they are not able – as so far largely has been the case – to assess and play into these needs of un(der)served home segments. As mentioned earlier, this is the warning that was issued by Seely Brown and Hagel III (2005) when they already observed the phenomenon of “blowback innovation” and Immelt et al (2009) who dubbed it “reverse innovation”. This seems to some but still limited extent have shaken up developed economy MNCs to reconsider how they could look at innovation for different markets, including on their home turf. A recent report by Ashoka Centre (2013) on solutions for “The European poor” provides many examples why ‘developed economy’ companies should develop this mind-set.

• **No financial resources to change.** Talking about the influence of the financial crisis as still felt, especially in Europe, the influence of the crisis on innovation/ R&D behaviour of companies (Laperche et al, 2011) is real. This results in the situation where in these dire times few dare to dedicate financial resources to opening up totally new directions for solutions.

It is crucial to realize that – contrary to the belief as voiced in section 3 of this paper – many of the innovations that somehow ‘blow over’ from emerging and developing markets are not purely based on low cost labour. They can actually provide a superior alternative to consumers. This superiority can be caused by a variety of – largely mutually enforcing – aspects. Amongst others these aspects are: inclusion of previously neglected or disconnected cultural contexts, “persistently doing more with less” (jugaad innovation, e.g. Economist, 2010a), a more active role for smaller and more agile innovators (e.g., Gail et al, 2010), and more explicit qualitative inclusion of people in the development of solutions. The latter tends to hardly happen, if at all, in large Western companies that by and large still use an innovation model based on stage-gates which are primarily driven by financial and market data, see e.g. Christensen et al (2010).

These aspects result in a wide variety of innovation variations: new business models, novel modes of distribution, producer-customer relationships, ownership models, service aspects, and many more. This is relevant because in many discussions, primarily the price – sometimes in relation to performance – is considered to be the main differentiating factor for EMF products, while it is by now quite clear that the reasons for success of many of these emerging market originating innovations are more sophisticated. The old adage “Necessity breeds Innovation” and therefore opportunity (e.g., Deloitte, 2009) has clearly manifested itself here. But, given that Western innovators seldom are subjected to these necessity-driven environments, how prepared are they to deal with these new aspects? For example, are they able to develop totally novel distribution systems, see e.g., Economist (2010d)? And how can they enhance this ability? This is what we will explore in the next sections.

### 4. Bringing global innovation thinking to a next level

In the previous sections we have discussed some main developments in innovation that are mostly -but in different ways- related to emerging markets. Their inclusion has provided the major push to innovation (and therefore design) becoming a fully and multi-layered global “game”. Now we will discuss several aspects that are related to the latest developments regarding these global innovation flows. These aspects, sub-sections 1 to 5 below, have – in our view – not received sufficient attention by companies and academics, especially in light of the observation that innovation mirrors society, i.e. it is complex, and needs to be treated as such. Whereas in the domain of organization theory, the role of complexity has been on the research agenda for about 20 years (e.g. Levy, 1994), in design and innovation literature it has only been touched upon, but not yet explored in detail. As highlighted in the introduction, we will discuss the specific evolution in design paradigms, including the way how complexity has been considered, more extensively in section 5.
While not necessarily fully exhaustive, based on analysis of the developments as described in the previous section, we believe the reflection on the areas below will provide us with meaningful insights on how global innovation strategies can be enhanced. A central point in this discussion is the vision to “lead from the emerging future” instead of based on tracks from the past (Scharmer and Kaufer, 2013).

While the remainder of this chapter may contain some known knowledge to some readers, they are still encouraged to read it because the arguments together with the cases that are included as illustration will facilitate a better understanding of the necessity of the approach that we propose in section 6.

1. **Innovation is not just about the market**: by and large, global innovation paradigms emphasize the phase of market introduction because actual adoption of a solution de facto defines a successful innovation. The actual interplay of insights from different markets and contexts, to be used in designing solutions, will however also take place well before that phase. Eventual success has more to do with the entire (solution design) process than just the marketing-phase. It therefore serves us well to consider the role of -contributions from- different locations during the entire innovation process, even if that seems to lead to more complexity.

**Elaboration:**
In much of the literature on innovation (e.g. reverse and disruptive), the emphasis lies on the very last phase of the process, i.e., market introduction. Even if a solution technically works, if it is not adopted by the market, it is not an innovation. One result of this limited scope is that insights from cross border knowledge flows in stages prior to market introduction run the risk of being ignored when analysing success and failure factors of innovation attempts.

On the other side of the spectrum, concepts like frugal, jugaad and constraint based innovation (see Economist 2010a and c), seem to deal much more with the front end of innovation with much attention for the end-user needs that are addressed by new concepts. This is demonstrated for example by the concept of jugaad: “doing more with less for more” (i.e., serve important needs with less resources to benefit more people). Furthermore, such innovations, e.g. ones labelled as frugal, may not be spectacular in the sense of “patentability” but many times are based on combining existing objects and ideas (e.g., Gewald et al, 2012). While these are very interesting mechanisms for the first phases of innovation, their path to the market seems a bit more obscure. In other words, how these front end processes are linked to the “other side of innovation”, i.e., implementation (Govindarajan and Trimble, 2010) to result in actual market introductions, has been researched to a much lesser extent.

In the innovation domain the term ‘fuzzy front end’ is by now a common concept. This will be more extensively discussed in section 5 of this paper. It refers to the fact that in the first phase of an innovation process not much is known yet and different starting points and loops and direction changes may be required to arrive at the solution that will actually reach the market. Or, exactly the opposite, too much is known and using current methods, it is difficult to decide how to continue. It has been found that the “fuzziness” can be reduced by engaging with customers in a very early stage (Alam, 2006). However, different types of customers do require different types of engagement (e.g., Economist, 2010d) otherwise the ‘fuzziness’ is still not addressed in a way that stimulates progress in the innovation process.

How can different actors be expected to deal with this? This question is relevant in terms of the traditionally perceived roles and focal areas of different types of companies in developing innovations. Since innovation is considered to be an expensive process and in itself a cost centre, it is most likely to focus on markets where most customers or the highest profit potential is expected. This – as asserted by the scientific founder of the concept of entrepreneurship (Schumpeter, 1942) – usually is the domain of large companies. At the same time by now we know that at the start of the innovation process, SMEs are less burdened by internal bureaucracies to come up with breakthrough ideas (Sharma, 1999)
Combining such strengths seems to make sense, and is elaborated upon in sub-section 3. The point to make here is that if less usual markets – as judged from a traditional perspective - need to be served, and apparently more attention is required for a diversity of front ends, we see a complex picture emerging where requirements, contexts and stakeholders seem to get tangled up already early on in the process. This can look risky. At least, that is how it appears to be through the lens of current organizational models.

In short, an integral framework seems to be needed to address all phases and contexts of innovation with equal attention and make sure that better connections are made, i.e., the right actors involved, in these different phases and from different contexts. In that sense, an attempt was made by Corsi (2012) to at least allow for more differentiated thinking regarding the dominant role of different (geographical) contexts in different phases in the innovation process. His global innovation flow model distinguishes four main phases of innovation: Ideation (Concept), Development, Primary Target Market and Secondary market. Secondly, he introduces the possibility that in each of the phases, the lead lies in either an advanced or developing/emerging economy. In this way, a total of sixteen global innovation flows are possible which allows for cases from practice to be better distinguished and clustered. While this model does not yet describe the relations between different actors within these phases, it can be considered as a first step to suggest and provide some overview for the different options for innovation flows. However, we need more than that to effectively face the challenges posed by contemporary innovation processes.

2. **Intent:** a main observation is that so far with rare exceptions, the realization of applicability of solutions for multiple contexts happens only after success in the primary market. At that point the process to market a solution for this new context largely starts over again. This implies inefficiencies in the overall process. The obvious question, then, is whether the applicability of a solution for more than one (different) context can be recognized in an earlier phase. What might be the consequences for the quality of the solution, the suitability for more contexts, and the timespan for the entire process?

**Elaboration:**

Many of the oft-cited examples of successful global ‘multiple context’ innovation spark the imagination as brilliant strategic moves. Be it the CGE-machine by General Electric (Immelt et al, 2009), the invention of mobile banking and payments, by Vodafone and Safaricom (Hughes and Lonie, 2007), re-imagined cell phones based on multiple users or finger scanners connected to mobiles to serve as ATM (Economist, 2010a), open heart surgery and other health care related innovations by Indian firms (e.g., Bottles, 2012) or successful appliances like windmills, small tractors and fridges (Hang et al, 2011), they have one thing in common: despite their strong narrative power, none of these emerging economy originating innovations was intentionally construed for other than their primary markets. This is an observation, not a degradation of the imagination and the value of these innovations, since in their own way these have changed the lives of millions for the better (Paunov, 2013).

Having seen numerous examples of such innovations that have become or are suitable to become successful in other markets than the primary ones, it does raise the question what would happen if actors, apart from their initial thoughts on primary markets, would start thinking from the outset about the relevance of creating a shared solution space, which can be used as breeding ground to implement similar solutions in multiple contexts. How would this approach affect, for example, the design of the solution itself (e.g. van der Kleij, 2008), identification of different user groups and putting their needs at the centre of the solution development process (e.g., Abras et al, 2004), the collaboration between teams in different contexts (e.g., Najafi-Tavani, 2014), new types of collaboration between different types of actors (e.g., Le Ber and Branzei, 2010) and the position of different types of end-users (e.g., Stappers et al, 2009).
We would argue that as long as developments in global innovation are – considered to be –
lead by large companies, the mind-set that governs their innovation strategy will dominate
the evolution pace and direction for global innovation. In particular, risk aversion and in
general linear – stage gate, explicit metric controlled and target driven e.g., Cooper (2001) –
innovation processes are unsuitable for non-traditional innovation (e.g., Govindarajan, 2011).
In contrast, what is needed to arrive at a process that allows consideration of multiple
contexts, requires more strategic intent and less pre-determined targets. This would result in
a process where setting direction is most important, and the results are determined by the
emerging patterns that are generated by the directed but not overly-controlled search.

On the other side of the spectrum, a method which is increasingly being used by smaller
companies and start-ups is Customer development, or ‘lean start-up’ (Ries, 2011). This
method does explicitly allow quicker cycles to develop a solution, called pivots. However,
these pivots are done very systematically (by testing out hypotheses, usually changing one
variable) but are purely forward facing. I.e., if one combination of variables does not work,
then a next combination is tried. The primary focus is to develop something that people will
pay for. This is their definition for market adoption (see previous section). It would be
interesting to contemplate how this method could be ‘upgraded’ by making the pivots richer,
i.e., more need-centred and also informed by insights that can only be gained from making
bigger jumps instead of just incremental pivots.

Successful innovations (i.e., solutions that are accepted by the market place) for large
customer groups in emerging markets, and increasingly also in developed markets, must
comply with four main criteria: accessibility, affordability, acceptability and sustainability (Qin
and Fan, 2013). It is clear that solutions based on these criteria – which often include new
types of business models as mentioned before – are not the types of solutions that align well
with the comfort zone of R&D departments. At the very least this is the case for the top
management they report to, of very large (Western) companies (Washburn and Hunsaker,
2011) and the way that top management is assessed itself. Their default strategy is often to
scale down or simplify existing solutions to enter new ‘less demanding’ markets (e.g., Qin
and Fan, 2013) and it is not likely to change en masse very soon.

As it currently stands a sizable number of examples of innovations have been developed that,
in one or more of the phases of the innovation process, have ties with an emerging market,
and that have since then become a commercial success in multiple markets. Since the
success in other than the primary markets in these examples was largely unplanned for, it is
now opportune to propose a new challenge for companies: intentionally innovating for
multiple contexts, by varying the most important context variables while at the same time
connecting the intelligence from these contexts. Doing so may result in either the common
patterns for the solutions or a solid recognition that common patterns for a solution do not
exist. If this analysis is done, it will almost certainly affect the quality of solution development
processes, their result and total use of resources in a positive way.

Starting to work in this way seems well-timed considering three trends. First, the Base of the
Pyramid market is still substantial, not only in emerging markets but increasingly also in so-
called developed economies. Sen (1999) identified already some time ago that the
depprivation of capabilities to change their situation was not only relevant for people in the
former types of countries, but also for the latter. Secondly, the complementary phenomenon
of the emergence of a multi-polar “global emerging middle (class)” (PWC, 2012). This
segment also experiences an increase of basic and other needs to be fulfilled and at the
same time has increasing purchasing power. To stay competitive and benefit from these new
growth markets, companies will have to be able to serve this consumer group.

Thirdly, solutions that were once developed for people in “developing economies” now turn
out to be increasingly relevant in an – especially crisis-stricken – group of ‘developed
economies’. For example, in a study of the Ashoka Centre (2013) the situation of the
“European poor” was structured according to issues as well as innovations in six key sectors.
While the concept of looking at solutions that have been developed for entirely different contexts is hinted at (e.g., micro credits), the next step of explicitly considering applicability of solutions in multiple seemingly varying contexts was not made. The study mentions many (attempts for) innovations in Europe and thereby provides a good pool of ideas, but it seems to be more in the dark how to take actual next steps.

**Case: WakaWaka Light, a purposeful multi-context business model**

Amongst the many small companies that attempt to bring light to off-grid areas, WakaWaka Light seems to be one of the successful ones. The product they developed is simple. It stores solar energy that is captured during the day in a battery, to be used in the evening.

To increase affordability, they recognized that it might be possible to make cheaper versions of the ‘torch’ but they forced themselves to ask if this was really necessary. By considering the multiform nature of the issue, they recognized that similar characteristics were being faced in very different use contexts, for example outdoor market in developed countries.

They realized there was another option for making the product affordable for the target group in emerging markets: design a multi-context business model. In plain language: let sales of the product in developed economies explicitly cross-subsidize sales in other markets. Once this thought was born, the question changed from “How to make the product simpler and cheaper”, to “How to emphasize the natural features (robustness, strength, durability) of the design” so the product would appeal to consumers in developed economies.

By already looking at the broader market adoption phase, WakaWaka Light was able to reprioritize, and develop a multi-context business model. This would not have happened if they would not have recognized the multiform nature of the issue they were addressing.

As a final contribution on the matter of Intent, it has been observed by several authors that globally relevant innovations can have a link with the concept of “disruptive innovation”, which was first coined by Bower and Christensen (1995) and then refined by Christensen (1997). Several authors observe that there is still quite some debate about definitions and categorization of these different types of innovation e.g., Ping Li (2012) and (Yu and Hang, 2010). From our viewpoint, while it seems to be a valid conclusion that examples of innovations from emerging markets can eventually become disruptive, these innovations so far have still followed the traditional path in terms of development for different markets, see e.g., Corsi and Di Minin (2013): the markets are being explored and entered sequentially, following success in one market This sequential practice opens up the interesting question what would happen if instead the premeditated intent to design solutions for multiple contexts would be used as core strategy.

3. **Eco-systemic thinking**: the value of ‘open innovation’ has already taken a foothold, i.e., working together on innovations with parties beyond the company boundaries, as popularized by Chesbrough (2003). To reflect the ongoing changes in a globalizing society, it however needs to be taken to a next level. Especially in terms of the types of partners to be involved in the innovation process, their (possibly dynamic) roles and the ways how and to which extent these co-operations are organized.

Elaboration:
It has been realized for quite some time that the ability to innovate in an open environment is becoming more important than the traditional in-house knowledge assets (Lawson and Samson, 2001). The trend of collaborative innovation is therefore gaining strong foothold. Although authors like Donofrio et al (2008) still consider such developments from the position of national interest and competitiveness they as well acknowledge the increasingly global nature of networks to become a dominant factor in the innovation domain.
As a general statement, collaboration has been found to have a positive influence on innovation output (Tether, 2002). When looking at the topic at hand, i.e. “design for multiple contexts”, it is clear that the question of whom to involve in design and innovation processes is a relevant one. This is true not only in terms of the type(s) of stakeholder and the way to involve them, but also regarding their explicit location. While the lens of the design process will be used more explicitly in section 5, it is already relevant to refer to Dell’era and Verganti (2010). They stress the necessity of diversity in the portfolio of designers. Based on the discussion in the previous paragraphs, it now appears to make sense to also add their location and even their segment-focus as characteristics that matters.

In general, there are still many advocates for keeping the innovation process under one’s own control. In the context of a multinational as a main actor this implies a focus on the relationship between headquarters and subsidiaries (e.g. Petrick and Juntiwasarakij, 2011). Most of the early Developed Economy proponents of Base of the Pyramid-solutions seem to rely heavily on their subsidiaries. The concept of Local Growth Teams (Govindarajan and Trimble, 2012) explicitly considers this relationship and Zeschky et al (2011) discuss success factors for local R&D departments regarding frugal innovations. Because of its relatively long history in the context of international business, much is known about these relationships and their effect on internal knowledge transfer and exchange (Najafi-Tavani et al, 2014), or even in specialized areas like marketing departments (Schlegelmilch and Chini, 2003). Notably, Ambos et al (2006) find that the effectiveness of knowledge transfer back to headquarters is strongly influenced by the capacity of that same headquarters to actually understand that knowledge. While this may sound logical at first, it does have strong implications for strategies on outsourcing, and over-reliance on internal but far-away sources. New modes of thinking about ‘in versus out’ are necessary.

Insights are rapidly increasing regarding the value of being “connected” rather than being “owner of knowledge”, starting with Hagel III and Seely Brown (2006). From the start of this century, work has been executed on various aspects of networked international innovation. For example the use of spin outs to bring new innovations to the market (Christensen and Raynor, 2003), the relevance of collaborative networks for SMEs (Alba et al, 2005), the importance of diversity in partner networks (Nieto and Santamaria, 2007), alliances (Rasmussen, 2007), motivations for globally dispersed innovation (Mudambi et al, 2007), strong collaboration between direct competitors in the forms of joint road mapping or issue exploration (Morel et al, 2009), the importance of networking abilities for international innovation (e.g., Bergema et al, 2011), using “bridgers” in companies to source ideas elsewhere and take them home (Washburn and Hunsaker, 2011), the need for international innovation linkages between different types of companies (Dutta, 2012) and the possible convergence of open and reverse innovation (Hossain, 2012).

**Tesla: giving it all away?**

In June 2014, Tesla (electric vehicles) amazed the world by announcing that they would not go after anyone who would use their patents “in good faith”.

The analysts quickly tumbled over each other: had they gone mad, had they given up, they were doing so well, why would they give away their crown jewels like that? Others praised their move to the Open Source model, or their apparent ambition to just make the world a cleaner place without caring too much about their own financial gains.

As we will see in section 7.2, none of these conclusions come close to the point that Tesla saw: the value, including their own benefits, of advanced eco-systems thinking.

With this concoction of well and less well defined concepts that appear to be relevant, It is clear that the traditional way of looking at “managing innovation processes” will need reconsideration as well, as already touched upon in the previous sub-section (4.2) on Intent.
When looking at this from the perspective of the role of different actors, we can see that many companies by now use a ‘stakeholder perspective’ (e.g., Van Tulder and Van der Zwart, 2005), or if they have not advanced there yet a more narrow shareholder perspective. In that way one is in danger of considering only part of the puzzle. At best the different interests are considered and through a process of optimization combined in a strategy that will potentially satisfy no one. Instead an approach needs to be more systemic, and focus on the natural levers (‘symbiosis points’) that matter most, also if these are not always the same points in the system throughout time. In fact, this is one of the elements for which we can learn from nature.

Therefore, instead of managing and controlling stakeholders that currently happen to be connected, it seems to be necessary to engage in an “orchestra” of collaborations that extends beyond the formal boundaries of the company (Seely Brown and Hagel III, 2005). Much attention is then required for network abilities with different types of organizations (Pagano, 2009). Van Beers et al (2013) talk about heterogeneous agents, with different competencies and capabilities. The role of an MNC is then not as evident as it was before, where it was either seen as the originator of the main parts of the innovation, or the key stakeholder to be able to scale it or at least routinize the innovation process (Van Beers et al, 2013). Its new role may rather lie more in coordinating different specializations, much like a conductor, than to manage them, let alone be the central decision maker who prescribes in detail how each partner should act.

Case: Rescuing miners: how and where to look?

In August 2010, a mine collapsed in Copiapo (Chile). After 17 days 33 miners were found to be trapped but alive in a sheltered space about 700 hundred metres beneath the surface. This was atypical because mining disasters usually leave very few victims alive, let alone after so many days. The miners had to endure high temperatures and humidity in isolated conditions. More importantly however, they were alive and it was possible to supply them with food, air and messages through narrow boreholes, and a video link was established using a probe with a camera.

The main problems were figuring out how to get them out and – realizing that it might take several months – the concern for their mental well-being. The mining company and other authorities were wholly unequipped to deal with either of these challenges. Colleagues at other companies had never come across this situation either.

To get closer to knowledge that could help them move forward, they zoomed out from the problem as a system, and zoomed in on its characteristics, or aspects. They then came to realize that a reputable institute did exist with ample knowledge about a comparable situation (people in a confined space for a long time but not in lethal danger): NASA.

By decomposing the situation differently they found a channel towards an unusual partner. Not only did NASA help them to effectively deal with the mental state of mind of the miners, their engineers were also very instrumental in co-developing and implementing the eventual solution for rescuing the miners.

Key lesson: by decomposing situations differently, you will discover the relevance of new types of connections in this society that you can use to your advantage.

In many ways the Guanxi way of working (Economist, 2010a) may yet turn out an inspiration for other than just Chinese companies. This concept refers to a flexible supplier network that can contract or expand based on demand and is actively used to act as a source for innovation regarding supply chain challenges. This role is stimulated by providing rough sketches of the direction for a solution instead of detailed blueprints. This observation coincidentally or not corresponds with the underestimation of the added value of suppliers in most innovation chains (Kopecká, 2013).
With acceptance of this type of thinking – which one might compare to an eco-system - and the reality of having to cater for very different types of markets, the diversity of the collaborators in a network increases even more than for regular inter-company partnerships. Polycentric approaches with (technology) cooperation between companies from different continents have proven to be effective to successfully bring frugal innovations to the market (Van Beers et al, 2013). The suitability of such approaches, linked to the image of an eco-system, is not coincidental. The implications of that observation will be described further in sub-section 4.5.

The types of organizations that need to work together likely include MNCs (Govindarajan, 2009), either from developed or emerging economies (Ping Li, 2012), GRLs (Grass Roots Initiatives) whose perceived lack of interest in high technology so far has alienated most MNCs (Smith et al, 2012), as well as NGOs (Teegen et al, 2004 and Dahan et al, 2010), possibly intermediary organizations linking SMEs to MNCs (Szogs et al, 2009), solution designers who are able to engage with end-users (Stappers et al, 2009), facilitators for co-creation and participative design processes (De Boer et al, 2012), stakeholders with an understanding how customer networks affect diffusion of innovation (Choi et al, 2010), and actors that can provide a link with policy processes (e.g., Schwaag-Serger, 2012). Small actors like SMEs or start-ups can definitely have a role in this way of working, although most likely not often an initiating one.

This type of thinking and working goes far beyond the more familiar and relatively simple notion of working in multi-disciplinary teams, yet it is not totally new. It was already found by Maurer and Ebers (2006) that high performing firms have mobilized different individuals over time to make ties to new types of partners while new imperatives emerged. This corresponds with findings by Kratzer et al (2003) on the need to adjust the variability of team set-up and management to the required level of creativity. The phase in relation to the process influences the ideal team variability. This requires openness to dynamic participations or even rotating leadership (Davis and Eisenhardt 2011). More arguments for engaging in more open relationships are provided by Lenders et al (2003), who find that the creative performance of teams diminishes with their longevity. This seems to call for more dynamic than fixed formalized collaboration structures. Finally, general “openness to outsiders” has proven to positively influence the creativity level in organizations (Amabile and Khaire, 2008).

In this vision of eco-systems, governments are also relevant stakeholders. Whereas Donofrio et al (2008) indeed make sensible statements about national governments needing to create the right conditions for collaborative innovation eco-systems to flourish, the inherently global nature of the required eco-systems also seems to call for a supra-national level of governance. As yet it is unclear which institutions would be able to coordinate such policy efforts. It is also not evident to which extent international institutions have a coherent vision on the relation between innovation, technology and the quality of life for poorer segments of society (Paunov, 2013). Ideally, governments move to a facilitative role (Taleb, 2012), but they do not seem comfortable with the feeling of not being in the position to control innovation efforts, on an international let alone national scale. This discomfort may therefore hamper the conditions for an optimal polycentric eco-system to flourish.

This raises the question how all actors are dealing with this prospect of a seemingly infinite list of aspects, or what one might easily call, a complex situation.

4. **Embracing complexity**: the concept of global innovation flows is inherently complex, with many interrelations which are only becoming more diverse and entangled in time and place. The natural tendency has been to address this complexity by breaking up, i.e., decomposing, a problem or the entire process in smaller sub-problems or phases, or as is being discussed in this paper, markets. The main logic behind this is that people consider devising a solution to be too complicated otherwise. We believe that it is possible to use the complexity to our benefit if we change the way how we think about organizing the complexity of design and innovation processes. Although
perhaps obvious, it is useful to realize that this line of thinking is weaving all other aspects (i.e., sub-sections in this chapter) together.

**Elaboration:**

When designing solutions for end-users, we need to make sure we not only think in terms of providing goods and services, but also take into account personal, social and environmental conversion factors that influence the actual functioning for a specific user. This is called the capability approach (Oosterlaken, 2009). If solution designers are to be successful, they need to be able to identify and select partners to build a well-balanced eco-system, that understands these factors and their influence. It will be necessary to have proper insights, although not necessarily full control, in these matters. This is especially true if companies and brands operate worldwide (Economist, 2010d and Govindarajan and Trimble, 2012).

Such considerations are often considered to add complications, and are therefore many times ignored. However, it is essential to distinguish between complexity and complicated. As elucidated eloquently by Norman (2010), “Complexity is a state of the world, complicated is a State of Mind”. In other words, complexity is a basic fact of life and it is counter productive to ignore it. However, we need to strive to have some grasp of the underlying logic of the complexity and the interrelations between the different elements of a problem or situation. In absence of this understanding, we consider the world to be unnecessarily complicated and confusing and start to simplify things. In that process we run the serious risk of making the problem simpler than is justified, thereby ignoring the reality of the actual state of the world. This can potentially cause decision makers to make fundamental mistakes about how to approach and solve problems (Probst and Bassi, 2014). It can also tempt decision makers to fend off outsiders (also see section 4.3), but in a complex system this corresponds with “asking to die” (Pascale, 1999).

Innovation processes are in principle ‘merely’ a specific form of problem solving. Therefore, if we accept the strongly interlinked and distributed nature of innovation as discussed in the previous sub-sections, we don’t speak anymore of value chains or stakeholders, but talk about value networks. These networks are characterized by novel forms of cooperation between a variety of actors resulting in an orchestrated organization (Seely Brown and Hagel III, 2005) of specializations in terms of knowledge, skills and/or own network.

This affects the sourcing process. Instead of identifying gaps in abilities of the closest stakeholders, for example in-company departments in MNCs, and then closing these gaps with training, stakeholders will increasingly have to look beyond the traditional boundaries for solutions, e.g. Kleinsmann et al (2010). If they accept that partnerships may be necessary beyond the own organizational boundaries a logical reaction will be to consider which capabilities are necessary, and work on getting these on board, without necessarily fully in sourcing them (Pagano, 2009, Hagel III and Seely Brown, 2006). This logic also points at the necessity to expand insights on how learning events inform capabilities beyond company boundaries (D’ippolito et al, 2011).

Given the global nature of the required co-operations, large firms may have some difficulty with this new way of working, being raised by the theories of Porter (1990). These theories prescribe a strong analytical focus on identifying competitive advantage that is strengthened by the role of the firm in (mostly regional) clusters. The 21st century mind-set requires a level of agility that does not use geographical proximity as the dominant networking factor anymore. This will require a transition in thinking, since regional clusters have become an important element to identify strong innovation hotspots (e.g., Asheim et al, 2003) and contextual intelligence is claimed to be the key factor to innovate for contexts one is less familiar with (Khanna, 2014). These attitudes – while understandable - have downsides as well, as we highlight more explicitly later on in this paper.

By thinking more in terms of *using* complexity instead of forcefully reducing it, moving strategically and simultaneously in several geographic contexts need not be feared but can
be cherished as an opportunity, as long as it is realized that this complexity can only be addressed if it is recognized as complexity. One way of doing this is by forming an orchestra of capabilities. That orchestra then needs to represent what is needed in terms of cultural context knowledge, local execution capacities, production, marketing and human sourcing abilities and above all the ability to combine all these aspects.

Not every possible actor will be able to participate in such novel cooperative structures. Actors that are able to dynamically manoeuvre in these distributed innovation networks which encourage non-linear innovation processes, will thrive in this evolution (e.g., Hahn and Eschenbaecher, 2004). Companies that strategically put people at the core of their innovation strategy and pay due attention to creating social connections seem to stand a better chance. There is some evidence that small innovative firms may be well equipped for this (e.g., Barnett and Storey, 2000), although in small firms that are not used to it, cultural barriers may slow down this more open attitude (Van de Vrande et al, 2009).

Another determining factor in “Dealing with complexity” is the ability to think across and between disciplines, cultures and contexts. Such cross-cultural understanding ability is a known problem area, even within the same company (Schlegelmilch and Chini, 2003). Interestingly, context similarity is not a determining factor regarding the effectiveness of knowledge transfer, with regards to flows within the same MNC (Ambos et al, 2006).

This links into a concept that has gained recognition in the area of (small) business development, namely effectuation (Sarasvathy, 2001). This concept states that companies start with their means, formulate goals, and then through stakeholder cycles increase and diversify their means. The extent to which they are able to do this with for them beneficial consequences will influence their position in a network (Sarasvathy, 2008). In all likelihood, the same goes for other types of actors, i.e., other than small companies.

One final aspect that we identify as relevant in the discussion on global (distributed, collaborative) innovation networks, we mention the phenomenon of Intellectual Property Rights (IPRs). We will not initially focus on this ourselves, but it seems an aspect that needs attention sooner or later. In a world where various forms of open and other forms of collaborative Innovation are proliferating, it is anyone’s guess what this will imply for traditional IPR regimes. Some predict a tendency towards stronger regimes in emerging economies, e.g. Corsi et al (2013). Others imagine that especially new actors that appear on the scene will also change the traditional view on the necessity of protection. For example, while starting out from a classical innovation metric (triade patents) in her analysis of global innovation power by regions, Veugelers (2013) concludes by recognizing the potential of innovation processes that are less governed by direct protection, but more by opening up to the possibilities of intra-continent co-optition, identifying spill-over opportunities and serving needs where they are needed. New players might be more inclined to be open to such new ways of participating in the global innovation arena than ones that still are heavily involved in old and for now still prevailing rules (Veugelers, 2013). IPRs thus can easily be seen as yet another element that adds to the complexity of the domain of the globalized innovation arena. Whether that is considered to be a complicated, daunting prospect or a challenging complex opportunity to grasp, will affect how actors will be able to perform in the upcoming era.

To summarize, if we accept that the global innovation landscape simply is complex and that we cannot fully manage the innovation process and predict the outcomes, we can consider this approach to be similar to martial arts: capture the energy of the dynamics and let it work for us. To put that in a more contemporary context, the way in which we deal with such situations should be “anti-fragile”, so not having to invoke crisis management for each situation that was not planned, but making the absence of strong central planning a strength, i.e., making unpredictable occurrences an upside at best, irrelevant at worst (Taleb, 2012).

So instead of repressing the anxiety of these dynamics, organizations need to use it to create “spaces of novelty” (Stacey, 1996). In the context of this paper, we put forth as central thought that we need to not be afraid to look at multiple contexts at the same time.
Independent of whether these contexts are separated along the lines of segments, geography or otherwise, we need to fight the —very human— temptation to oversimplify and decompose into sub-problems and thereby limit the decisions about solutions too early in the process. Such a decomposition would ignore essential interrelations, and observing what demands need to be satisfied. Instead we should create generative dialogues, and think more holistically. The ever increasing globalization only provides more arguments for this.

In other words, we need to approach global innovation not as a complicated phenomenon which baffles and confuses us, but as a complex situation. This very complexity can then be used to solve a problem and not oversimplify it to arrive at solutions, as we would with a complicated situation. The key is how to deal with seemingly opposing constraints, not by separating paradoxical sources but by feeding seemingly paradoxical information into each other and creating a shared responsibility to find creative and satisfactory pathways to address these challenges (Andriopoulos and Lewis, 2012). Can this strategy be applied elsewhere as well? In recent work of Nijs (2013), the main guiding question for analysing several case studies was whether such a strategy can work in other than the computer industry which has in fact used it (Brown and Eisenhardt (1997). In our opinion, this question is only the start of something bigger, or to stick to her analogy, “the flap of the wing of a butterfly”.

**Case Gasifier development: complicated vs. complex**

Within a recent design project, activities were focused on the development of gasifiers for household cooking as well as for use in industrial boilers. Gasifiers are a relevant solution for regions with ample supply of biomass and they have many advantages: a variety of renewable resources can be used as fuel, the conversion process is cleaner and more efficient than with fossil fuels, and a useful by-product is biochar, which can be used to enhance soils and for carbon sequestration.

**Choices for development**

It was identified that in different regions, different fuel types are abundant either seasonally or year round. However, keeping track of all these fuel types was considered to be too complicated because they have different performance characteristics.

Furthermore, a technique which allows different fuel types to be used is called pelletizing. Any (solid) fuel type can be compressed into pellets, and these pellets are then the fuel for the gasifier. However, pelletizing requires an extra process and skill therefore specialist companies to cooperate with, in short it requires a whole new value chain. This was considered too complicated.

Result: pragmatic priority was given to one of the most abundant fuel types in a certain region (rice husk), and then further developments were be taken from there.

**Recognizing and working with complexity**

What if the situation would not have been considered as complicated but as complex? The fact that pelletizing would allow for different fuel types was a major insight in this context. It would be a game changer. Because of the higher versatility of pellets as opposed to any single fuel type, the promotion of the gasifier would benefit from economies of scale and therefore also be cheaper to produce.

The reason this solution was not chosen, was that it would change the whole value chain. As stated, this was considered too complicated, with a fear of how the business model would be affected. But what if the changes between the elements of the value chain could in fact be part of the solution?

Concretely: by involving companies that would take care of the pelletizing process, their knowledge can be used in the effective design of the gasifiers. By working together with
them, a holistic business model can be developed that covers the interests of the entire chain. Pelletizing lifts the burden from the end-users, thus a wider variety of end-users and regions can be served. This includes the move to more industrial-sized gasifiers, which are used by companies. These would in fact most likely prefer a provider which has corporate partnerships.

In short: in many ways the complexity of focusing on pelletizing offers insights that improve the quality of the solution and the solution eco-system.

5. **Broadening the scope: encompassing concepts**: the aspects mentioned above point at the need of a broader and more integrated approach. We can therefore look at other concepts that are globally relevant, and use them to learn from in terms of effective implementation. Specifically we will look at the inherently complex and integrated concept of sustainability.

**Elaboration:**

Innovation is already an inherently multi-faceted domain. Take it across borders and other context-boundaries and this characteristic is only increasing. Knowing that globalization is a field of clear and less clear interdependencies, it is obvious that any model that oversimplifies reality will be of limited use. If we acknowledge that the different levels of analysis and angles to take regarding global innovation flows are many and diverse, we clearly need to work on an integral concept to work from.

If we accept that premise, it makes sense to look at and learn from other concepts that are by nature integral. An obvious candidate is sustainable development, for the following reasons:

- **Sustainability by definition is integral, with the purpose of explicitly combining considerations in the spheres of People, Planet and Profit/Prosperity in decision making.** This requires a multi-sided view, mind-set and vision (e.g. Elkington, 1998).
- **The implementation of sustainability principles is not possible without a proper collaboration between the three spheres public sector, private sector and civil society.**
- **While it is not entirely without opposition and developments are generally slow, the thoughts behind the concept of sustainability are accepted as necessary basis for development by an increasingly critical mass of citizens, institutes, companies and investors that can no longer be considered to be a niche.**
- **The concept has global resonance, although its focus might be different in different contexts.** E.g., in developed economies it is often the ecological angle that dominates, while in emerging markets the (socio) economic one tends to receive more urgent attention. Increasingly, ecological, social and economic considerations tend to converge because issues are becoming more interrelated.
- **While caring for one’s direct living environment is an important aspect of a sustainability inducing mind-set, it is increasingly clear that having some attention for broader interrelations is helpful to put it in context.** Put differently: if you know more about what is happening elsewhere and interact with people from those places, the interaction will enable you to reflect and act on these mutual relations which leads to “emerging knowledge transfer” (Kersten et al, 2014). This cannot be achieved with just a context-specific or mono-disciplinary approach. In general, being too focused only on the own surroundings (or discipline) would only work if one would live in a closed system. In all other situations, full in-context focus will result in incomplete and ultimately detrimental solutions.
- **All these factors contribute to the necessity and recognition of an integral systemic view on the world.** Solutions need to work on all levels, but – as increasingly recognized – can still originate in different places, with concrete possibilities for anyone, including GRIs, to be the originator (e.g., Maase and Dorst, 2006). That smaller actors may not easily take the lead does not discount the fact that they can surely help to put and keep processes in motion.
It has already been observed (e.g., Atur, 2010) that design concepts that are often used for Base of the Pyramid solutions, like human centred design (People) and Jugaad, “doing more with less for more” (Planet, profit) have strong links with the sustainability mind-set. This mind-set currently is addressing more aspects than in the early days with focus on the ecological dimension, e.g. Brezet (1998).

For all these reasons, the concept of sustainability, in all its complexity and therefore “functional ambiguity”, is likely to provide relevant inspiration if one wants to get a better feeling for an equally complex phenomenon as global innovation and design eco-systems. This observation is merely the starting point of the exploration how sustainability might inspire this development. It should not be interpreted as a call to define how this inspiration is to take place exactly.

6. This section in a nutshell
To summarize this section, we see that “global design and innovation thinking” requires attention in the following areas:

To address the challenges of the contemporary polycentric innovation landscape we need to consider the entire process (4.1). If we manage to intentionally and consciously incorporate insights from various contexts, we create a shared solution space as a basis for evolving solutions that acknowledge the multiform nature of the issue and use the interaction between these insights, which creates emerging knowledge. The solutions therefore are of a higher quality (4.2). This requires making use of diverse eco-systems that cannot (just) be managed with a focus on control but that require the concept of “allowing and managing emergence” (4.3). Both the diversity in contextual insights and required stakeholders and how they interact with each other necessitate an approach that embraces complexity instead of fearing it. Focus on contextual intelligence needs to evolve to a focus on collective intelligence. Furthermore, allowing ourselves to “manage emergence” instead of just using control-focused management methods will reduce the tension between complexity and manageability (4.4). In terms of inherent complexity and relevance for many different contexts, sustainability and how it has grown from a niche movement to move more and more towards mainstream might offer some interesting lessons (4.5).

Now we have described what we consider to be the major challenges for the current global innovation landscape, we will look at the discipline that is – as mentioned before – an integral part of the innovation process: design. Zooming in on the specific history of design methods and paradigms may – if we go back far enough in time, as it turns out - help us to create insights in how to address contemporary challenges.

5. Design paradigms throughout the ages
The design discipline has undergone some changes throughout the centuries but in comparison with other scientific disciplines has demonstrated to be quite robust with regards to its main principles. As has been asserted in earlier papers, e.g. by Leenders et al (2007), systematic design has a relatively short history. Many design fundamentals trace back to Leonardo da Vinci. More modern systematic approaches were however first pioneered in the 1920s by Erkens (1928). His step-by-step approach that was based on constant testing and evaluation and balancing of conflicting demands is easily recognizable in modern design methods, eventually leading to a complete integrated design technique, Hansen (1956) and Pahl and Beitz (1977).

Referring to the combined history of design principles, based on previous research (Leenders et al, 2007), it can be concluded that contemporary systematic design approaches are in essence still based on four robust underlying design principles which also work together and keep each other in check: 1. Systematic variation, 2. Satisficing, 3. Hierarchical decomposition and 4. Discursiveness.
Systematic variation refers to the search for and combination of solutions to design sub-problems. Satisficing refers to evaluation and selection of alternative solutions and the understanding that finding the one optimal solution is not the main goal (Simon, 1996). With hierarchical decomposition a design task is divided into sub-problems in order to keep an overview regarding the design task and being able to divide it over several designers or design teams. Finally, discursiveness refers to a step-by-step approach to the design process, but the process should provide opportunity to execute these steps in ‘non-traditional’ sequence. Reflection and assessment of results from previous steps do still play a role, but with a broader purpose than just testing assumptions that were the result of the previous step.

From mid 20th century onwards, the systematic approach based on these four principles has proven to be effective in developing new products. Because of its systematic approach, much attention was devoted into making the process that was governed by these principles more efficient.

That strategy with focus on design process efficiency held up well during the eras where the Taylorian use of technology and standardization of organizational processes were at the core of corporate strategies. Technology and processes were composed of elements that are relatively predictable which were therefore inherently suitable to decompose, and optimize. Roughly from the final decade of the 20th century onwards, this started to change. Because of the increase of connections between disciplines and people, and the explicit move to the epicentre of attention of human elements and characteristics, design methods and paradigms started to be influenced ‘from the outside’. The result could be observed in the rise of design approaches that did have other drivers and goals than efficiency, decomposition and process optimization.

For example, an important development was the rise of human (or user) centred design, also from the 1980s onwards (Norman, 1988). Its core principle is that the design process revolves around optimizing the product or service around the needs, wants and abilities to use it, instead of trying to force the users to change their behaviour to accommodate the product. This core thought has resulted in different methods with slight nuances like cooperative design, participatory design and contextual design.

Another design philosophy that has become very popular since the end of the 1980s, is called “Design thinking”. While its origins can be traced back to the 1970s, it was popularized at the Stanford design school (e.g., Faste et al, 1993). It revolves around the notion of design as a “way of thinking”, more in particular, to solve problems but emphasising the improved situation, i.e., a solution. The ‘field’ of Design Thinking is quite broad so has no generally accepted definition. Buchanan (1992) chose to focus on “the ability to combine empathy for the context of a problem, creativity in the generation of insights and solutions, and rationality to analyse and fit solutions to the context”. Others focus on the method of abduction (creating new future opportunities, what might be) as opposed to induction and deduction (determining what should be or what is) as the essential difference between how designers think and how managers and engineers think (Dunne and Martin, 2006). This is also why people from these different disciplines do not automatically understand each other when they talk about “solving problems” (Dorst, 2011).

Interestingly, compared with methods that focus on market adoption like Lean Start-up, Design Thinking is more concerned with properly analysing the situation and problem before jumping to solutions. In this sense the problem oriented and market-oriented approaches might complement each other and provide opportunities to learn for practitioners of both (Mueller and Thoring, 2012).

Finally, a major development in terms of design paradigms is the concept of the “fuzzy front end” (FFE), which was first popularized by Smith and Reinertsen (1991). A universally acceptable definition for Fuzzy Front End or a dominant framework has not been developed so far (Husig and Kohn, 2003). This vagueness can become a problem to create a shared
vision for a development team (Zhang and Doll, 2001). On the other hand, we have learned that while strict definitions provide clarity, they do not necessarily encourage a fruitful dialogue. In other words, absence of strict definitions may rather than being feared and objected to, be a reason to celebrate because it provides room for discussion and creation. Therefore we are not discouraged to ‘merely’ use a generally accepted description for now, being “the phase between first consideration of an opportunity and when it is judged ready to enter the structured development process” (Kim and Wilemon, 2007). It is in other words the first phase of the New Product Development Process, where activities are often still chaotic, unplanned, and not yet well structured, contrary to the later phases of the process. While it typically does not demand a majority of the financial resources, it does take up to 50% of the development time of new products (Smith and Reinertsen, 1998). Opinions vary whether it should be seen as set of interdependent activities (e.g., Kim and Wilemon, 2002) or that it can still be handled in a structured manner (e.g., Husig et al., 2005).

With this increasing number of design methods and philosophies, with many varieties left unmentioned here, it is not a surprise that by now the term “Hybrid Thinking” (Gall et al, 2010) has been introduced. This refers to a combination of advanced design thinking and other forms of creative thinking. Especially in the context of so-called wicked problems, such a combination of different strengths may be a main way forward.

**Complex vs. Wicked**

Complex problems refer to one of the following two situations: 1. you can explain the behaviour of the system by looking at its parts but you cannot fully control or predict it, e.g., playing pool. 2. You can control or predict the behaviour of a system, but do not understand the behaviour of its parts in the whole, e.g., flying a plane or riding a bike. Complexity is a part of everyday life and to be able to deal with it, we need a level of “non-understanding” and/or “non-controlling/ non-predicting”. We already do this, as the examples show. When you are facing wicked problems, you cannot control/predict the system, nor understand how it works. This means you have even less to go on, when you start to work towards solutions.

Just like it is important to recognize the difference between “complicated” and “complex”, which has already been addressed earlier in this paper, it is also important to recognize whether there is a need or even possibility to understand a system, predict it or neither.

6. Conscious re-interpretation of design principles

At the start of the previous section we identified four main historical design principles, the oldest of which originate from the time—and works—of Leonardo Da Vinci. Our assertion is that we need to look closely at the main principle, systematic variation, as it provides a basis for dealing with complexity.

However, looking with a clear mind at this principle has become more difficult because by the end of the 19th century, other principles like optimization and decomposition emerged. Such principles became even more prevalent once design and innovation became more institutionalized with specialization of functions and tasks and striving for maximum efficiency became major goals in the tradition of Taylor and Ford. This has dominated even until today the thinking on the undesirability of complexity for innovation.

If we look at the challenges as formulated in section 4, we see that we cannot continue thinking in that way. Integrated approaches, intent, eco-systemic thinking, embracing complexity and learning from other inherently integrated concepts requires holistic thinking. This seems to correspond with the main elements of Design thinking, but because this is such a broad term it is not sufficient to merely refer to it; more reflection is necessary on the concrete use of what it means to “think like a designer’ in the face of complexity.

Design Thinking initially focused on processes that had products and services as result. More recently some designers also started to apply it to organizational and societal
transformations, e.g. Nijs (2013). Some features of that use of design thinking include: not using products as assumed end results, challenging existing constellations, the importance of co-creation and integrative thinking. Such features are all manifestations of the increasing “hybridization” in the domain of global design and innovation, see e.g. Gall (2010)

Therefore, if we want to move ahead we need to take innovation-thinking to a next level, by first acknowledging and then explicitly using the current complexity of society and its challenges. We think that carefully looking at principles that are at the core of the innovation process, i.e., the design discipline, can help us to achieve this. For that to happen, we feel that the key lies into re-interpreting the four main principles in the light of insights from this modern age. This should enable us to take next steps and at last enter a Post-Fordist era without going back (Asheim et al, 2003). This step would help the design discipline to live up to its potential, because as was argued by Sevaldson (2009), some of the innate strengths of designers – creativity and synthesizing – are crucial to address complexity. It also is in line with the dual observation by Jones (2014) that on the one hand design practices tend to have become more systemic, but on the other there is a surprising paucity of literature in systems-oriented design theory or established cases of a systems orientation to design.

Below follows our proposal how to modernize the interpretation of the four main design principles that were introduced in section 5 of this paper. We have changed the sequence to align it better with the most logical order in which these principles will be used, while acknowledging that they strongly interrelate. It makes little sense to analyse in depth how much each principle contributes exactly to the goal that we want to achieve. They should rather be considered as a holistic design principle-toolbox. A red thread in these principles is that they are more geared towards allowing organic emergence of insights that will only later on lead to developing concrete solutions.

- **Decomposition**: if a situation or challenge seems too complex to deal with, address the complexity by focusing on characteristics of the problem instead of sub-systems, see the Miners-case in section 4.3. Decomposing into sub-systems would artificially sever aspects that may in fact hold the keys to solutions. The new approach not only respects the relations between parts but also opens up the possibility to identify the similarities between needs in different contexts instead of zooming in on the differences by focusing on a specific market (i.e., sub-system). In fact, we are touching upon the aspect of “framing a problem/issue”, which is one the one hand a key creative process, but on the other not often explicitly reflected upon by designers (Paton and Dorst, 2011).

- **Systematic variation**: this should cover not only variations in product/ service specifications, but also markets, and networks, and their combinations.

- **Satisficing**: set own criteria on what is good enough and then let evolving insights govern the adjustments and work their “way up” towards improving the overall results, instead of an endless optimization process between different sets of requirements. This is necessary, because humans are notoriously incapable of identifying let alone accurately addressing all possible relevant requirements. This is called bounded rationality (Simon, 1996). The scope of this satisficing process is strongly related to the space that is created by the systematic variation.

- **Discursiveness**: allow the process from idea development to market implementation to be followed in non-traditional ways in terms of sequence of the phases. This allows for insights from more than one location or context to influence other insights, none of which are inherently more valuable than the other. Additionally, it allows for insights from “later” phases of development to be included early on in the solution development process. This leads to connections that will not be made in the traditional and even iterative development modes. It can for example help to “jump ahead” and imagine what would constitute “success”, then determine what are the
critical factors for this and include these insights in the early phases of development. This is likely to bring forward questions that would otherwise be addressed only much later. Note that this way of working goes beyond mere iterations, which usually change small parts of the solutions in a systematic way. Discursiveness is more holistically oriented and therefore less focused on specific results and features in an early stage. It therefore connects well into the ability of “abductive” reasoning (focus on what might be instead of what should be or is) that is supposed to be a core asset of designers (see section 5) and the practice of letting problem and solutions co-evolve (Dorst and Cross, 2001).

If designers use the principles above, they will automatically be more open to the reality of the interrelatedness of different contexts, on different levels (feature, segment, network, process, eco-system). This will enable them to make better use of the available collective (design) intelligence in an integrated way, instead of not using this intelligence (i.e., one design fits all) or trying to “add up” (i.e., sequential processing) intelligence. Being able to do so will be further enhanced by following a few more “organizationally oriented” guidelines, which will be discussed in section 8.1.

It must be noted that this approach and its considerations are much less relevant for the part of the design field that is focused on aesthetics because there the transformation from systematic to systemic is not a major concern. It is also clear that the principles are more process than output oriented and this may not appeal to everyone. Still, the whole point of these principles is to create an attitude where quality of the process is favoured over premature focus on the exact output, or as it is called in management terms ‘SMART’.

Case VHS vs Betamax: broad perspective vs technology push
The case on the battle for the home videotape market demonstrates several aspects of the required attitude, especially the advantage of a systemic over a technology-oriented approach. It also demonstrates how some existing design methods have a higher level of this attitude than others, thereby supporting the claim that we are not dismissing current methods, but merely put them in perspective.

In short, although different stories circulate (with popular culture – inaccurately as turned out referring to the role of porn which was allowed by JVC and not by Sony), the real reason why VHS (JVC) triumphed over Betamax (Sony) is because the development of the latter revolved around technical superiority (and indeed a better quality of the images) while the former focused on how users in home situations would use the videotapes. For example, a Betamax tape could only record one hour, which is much too short for taping movies. The network orchestration of JVC was also smarter, as in the USA they closed licensing deals, giving up some of the direct control over the distribution in exchange for an opportunity to capture a much larger market share. Finally, VHS tapes were priced lower, in part thanks to some efficiency measures in the value chain. Price is always a consideration for consumers and possibly even the main one.

Taking these observations together, it can be concluded in hindsight that JVC did more successfully vary possible product, market and network combinations, building a mix of characteristics that created a more holistic solution than the relatively isolated focus of its competitor on technical quality. This can be taken as a careful general warning that any attempt of technology push without sufficient consideration for what customers really want and need and how to configure your network to provide that, means you are headed on a virtually certain path to failure.

With many cases having been included as examples by now, it is easier to visually demonstrate the differences between single context design, sequential multi-context design and a new proposed approach in three simple graphs (figure 1), supported by the following short explanation:
First part: In regular design the interconnectedness of society is not taken into account. User (needs) in a specific market are the focus and result in a solution S.

Second part: In regular (mostly unintentional) design for multiple contexts, the users and market for context 1, in interaction with the complexity of context 1, results in solution S1. A solution for the secondary context benefits from this process, but also needs to take into account the complexity of context 2, in the end resulting in an incrementally better solution (S2). Similar for S3, again leading to a better solution for that context.

Third part: proposal for an approach that revolves around unleashing collective design intelligence. The user needs, markets and networks of all the considered contexts are seen as one interacting complexity. The four re-interpreted design principles are applied systemically, allowing more complexity, i.e., more emerging collective knowledge to be incorporated in the solution, leading to a base solution which has a higher quality than the best solution of the sequential process (S3) because it can benefit from the synergy provided by the collective (design) intelligence that was mobilized and orchestrated. This synergy is lacking in sequential development (part 2), because it requires interaction, not simply “adding up”. Additionally, each specific part for contexts 1, 2 and 3 also has their own additional local added value (+S1, +S2, +S3). In all likelihood, for actual implementation there will be efficiency gains in the process, meaning the overall time required to develop the solutions for the different contexts compares favourably with the time required for the sequential development (part 2). This can for now only be logically deduced, it is not a given and proven fact.

Figure 1: Three design strategies compared

All in all, by allowing the components of the different contexts to interact instead of just learn from each other in time (part 2), the approach as shown in part 3 above results in: 1. Better base solution that benefits from the collective creativeness and design intelligence, 2. Possibility for add-ons or emphasis on solution-elements that meet specific context needs, 3. Most likely shorter and much more cost-effective TTM (Time to Market) especially for the scaling phase, i.e. expansion to other than the initial context. This argument is very relevant.
for all innovations that want to address large scale and contextually dispersed social issues and for companies that have a broad coverage of contexts.

**McDonalds: “When in Rome...” or look beyond local contexts?**

A good case from practice that illustrates the difference between part 2 (current reality) and part 3 (potential) in Figure 1 is McDonalds.

McDonalds is an oft cited example of a global company that has been able to take a base formula and successfully adapt it in any given location to the local customs and preferences, in terms of menu items, colours, communication styles, even names. This is already more than many companies have achieved when trying to sell their products in an unfamiliar market.

To a large extent the many local successes of McDonalds seem to be thanks to a strong core solution and purposeful local adaptations, which local franchise holders have the freedom to implement.

McDonalds has mastered the art of achieving a good mix of global recognition with catering to local tastes and preferences. In rare cases, successful menu items in a particular local market have eventually even been exported to other markets.

But could they have done even better? Would the scenario in the third part of figure 1 have had different results? The answer seems to lie in the combination of the following two notions:

1. Being open to the possibility that while national cultures may demand certain local adaptations, those adaptations might also be appreciated elsewhere.
2. Recognizing that it makes sense to identify this early on, i.e., arrange a cross-border development phase to allow “collective design intelligence” to inform the process.

The result: much quicker identification of new ‘features’ (in menu, style, communication and more) that would make sense in different locations, without having to wait for their proven success. Quicker scaling because of early interaction.

As it turns out, thinking according to the principles above provides benefits in many situations. This is why using this attitude is already beneficial even if a company does not plan to go to many different contexts in the first place: the quality of the solution itself is virtually certain to be higher. In the next section we will take these observations to the end zone by combining all relevant observations from the past sections.

### 7. An evolved approach for innovation in a globalized world

The innovation realm is not monolithic. Even large innovation giants like Apple, Google, IBM, Samsung, and many others, do not operate in the same way. Still, in order to evolve towards a richer thinking about innovation, with enhanced and appropriate roles for different types of stakeholders, we will now in this section propose an evolved approach, or attitude. It aims to provide a more holistic view than currently seems to govern the discussion on (international) innovation. While not everyone may feel we have arrived at the point to change our thinking about innovation in this way, we feel the time is ripe.

The approach can inform and guide future research and practice. The insights that will thus be developed are especially helpful for different types of companies to organize or, as suggested before, ‘orchestrate’ their network in order to intentionally and successfully innovate in direct interaction with multiple contexts. This inherent complexity should not scare away design professionals. Their main concern should be not to complicate the lives of people and use complex situations as scapegoat for mistakes, or to be precise “Bad design has no excuse”, not even in the face of complexity (Norman, 2010).
7.1 Building towards the approach

The approach and attitude that we have now started to unveil is based on the following main insights from the previous sections:

- Adequate analysis of innovation flows includes **reflection on multiple phases**
- **Fuzzy front end** design principles allow multiple inputs but do not focus on the possibility of multiple consistent outputs. If the latter is the goal, these principles therefore need to be ‘upgraded’.
- Since design (in a broad sense) is a central element in these processes, it serves to look at **design principles** for guidance and interpret these in light of contemporary insights. While (some) designers may already make use of such contemporary principles, our intention is to **make them more explicit**, so they can be more consciously tested and applied.
- The notion of **intentional innovation for multiple contexts** and the way how **similarities** between contexts are identified – i.e., by decomposing based on characteristics - will influence the process and outcome of innovation flows.
- If innovation is acknowledged to be increasingly complex, it is more likely that in organizational terms it cannot only be addressed by in-company solutions. This raises the question: which types of **partnerships and other collaborations** are conducive for this way to think about and practice innovation?
- The **contemporary multiform nature of requirements** – i.e., multiple outputs and contexts, forms of cooperation and ‘organization’ and nature of different relations – is more diverse and dynamic than ever before. How can this increasing complexity be **used** instead of resorting to simplification. Simplification is what we do with complicated situations, but it is unlikely, and increasingly so, to reflect reality,
- Acknowledging complexity means building in the possibility to incorporate more knowledge and insights and therefore be able to develop **higher quality solutions**. The most creative solutions can come from “new coherence”, which becomes apparent once new angles are used of looking at a problem, information or situation (Dorst, 2006).
- The multi-faceted and globally recognized notion of **Sustainability** is likely to provide **clues** for properly addressing the integral nature of 21st century innovation processes.

Based on these main considerations we introduce an attitude required to deal with contemporary innovation, called **Context Variation by Design**.

*Context*: it is – as mostly acknowledged – very important to realize what it means to innovate and design for a certain context in terms of culture, language, sensitivities, customers etc. This context-sensitivity remains relevant when more than one context is considered, with due attention for the differences between the contexts. However, the opposite is equally relevant but much less often realized: identifying what is actually the same about the seemingly very different types of contexts and doing so early on in the process. Identifying similarities is conducive for a mind-set that combines contextual intelligence.

*Variation*: based on assertions in previous sections, we have introduced the relevance of intentionally looking at multiple contexts simultaneously. If this relevance is accepted it means that awareness is required of the impact of the context variables on different aspects of the innovation process: people, technology, design (solution and team), customers, and especially how to bring all these aspects together, i.e., how to ‘organize’ these to form a collective (design) intelligence. Consciously accepting and varying with different combinations is a necessity, not a confusing path that should be avoided. It provides a learning opportunity based on interaction instead of traditional ‘curves’. This type of interaction synergy and its effect on the quality of solutions is lacking if a sequential path is followed.

*By Design*: the reference to design aims to convey that the **design discipline** or the mind-set of “Design Thinking”, ill-defined as it is, is an important source for the type of approach that CVD encourages. The ability to take innovation thinking to a conscious next level may not be
typical in the average manager or engineer. Secondly, the term “by design” conveys that the preceding “Context Variation” is purposeful, intentional. There is a purpose behind varying the different contexts, it is based on the acknowledgement that insights from these contexts can be equally important once you look at a problem in the right way.

**Whirlpool: tumble washing delicate fabrics would not work anywhere**

To enter many emerging markets at the same time, Whirlpool developed a cheap stripped down version of a washing machine. In fact, it did not do half-bad, except for one country: India, and especially Southern India. It did not take too long to discover what was wrong: much of the clothing worn by people in especially Southern India (lungi’s, sari’s, mundus etc) is composed in such a way that the garments are torn in the washing machine and then clog the machinery. Only with high costs and much effort put in technical and organization re-design, has Whirlpool been able to repair the situation (Chavan et al, 2009).

This example is often used to demonstrate how serious “context insensitive design”, or “universal design” can be and in that sense seems to contradict CVD-thinking. This is a misconception.

If Whirlpool would have been more aware of CVD-thinking, they could have put customer-facing stakeholders of different segments together (or at least actively pull their insights together), collected all user needs, compared them with existing features and would easily have discovered that the current design would not work well with the traditional clothing, or more in general, delicate fabrics.

They would have been able to design a suitable solution early on, which would not only have served the South-Indian segments, but also, to name one example Indian diaspora worldwide who also have the same problem but not as obvious (because they likely also have other clothing). So by using a higher-level of CVD-ness, not only can the highly context-specific needs be served, but additional value be obtained for other segments. This is the main point that is relevant to keep in mind when contemplating the use of CVD.

**7.2 Four cases from the Global Innovation Arena**

As many of the examples have shown, exercising Context Variation by Design - or using a term that is intuitively easier to understand, ‘intentional multi context innovation’ - is not easy and certainly poses challenges to ‘the best of us’. To illustrate this point, on top of the cases already provided, it serves to reflect on a number of other cases. We very briefly discuss per case why we consider it to be relevant here:

1. The case of Toyota Motor Company (TMC): why did the famous innovation champion stumble in the USA?
2. Being successful in CVD-terms in one area does not guarantee that you are in another, as the double case about Nokia (successful penetration of Indian market vs. not anticipating on the smartphone revolution) shows,
3. The second part of the Tesla case that was shared earlier in the paper shows how dealing with dynamics and uncertainty can be turned into an advantage if you apply advanced eco-systems thinking.
4. Apple's iPod introduction is a case that demonstrates a high level of CVD-thinking, even before the term was ever used. Making sure these lessons are captured and consciously applied is now key.

**1. Case TMC (Toyota): even the giants sometimes stumble**

Toyota is widely acknowledged for being a company that has achieved an excellent mix of structure and culture that is conducive for continuous innovation, both incremental and more disruptive, in part attributed to its excellent execution of set-based concurrent engineering
(Sobek II et al, 1999). The fact that they are a globally successful company might lead one to conclude that they have successfully achieved CVD. Still, we can see from recent massive recalls in the USA in 2009 and 2010 – related to amongst others gas pedals and anti-lock braking systems - that this is not yet the case. The seriousness of the reasons for the recalls, and the safety performance of Toyota cars compared with that of other producers is still subject to debate.

A convincing argument on what the reasons could be that is relevant in the line of this paper, is made by Karamuftuoglu (2013). He notes that while the headquarters in Japan had successfully achieved “a tacit system of unity between cognitive and manual skills for its whole network, known as Ba”, they had not managed to export this tacit innovation philosophy to foreign subsidiaries. While formally knowledge from stakeholders like customers and suppliers was used, in foreign subsidiaries in reality that knowledge had little influence on product developments and other decisions. I.e., the network variation in practice was too limited, and even basic stakeholder-centred design was largely absent.

One could say that TMC had not successfully managed to orchestrate their global network in the same way as their domestic one, by disregarding the value incorporated in these non-domestic extensions of its eco-system.

2. Double Case Nokia: hitting home runs and striking out

Nokia in the past decade demonstrated a reasonable level and very low level of CVD-attitude respectively. This gives rise to the suspicion that Nokia does not consciously master CVD yet. Distinguishing ‘accidental’ success from structural success is important.

2a. Hitting home runs in India

First the good news, the case of how Nokia developed their business in India (Radjou and Prabhu, 2012). Here they used CVD-thinking to an extent. They have been praised for understanding actual contextual needs instead of knocking off features of premium phones. This amongst others resulted in features like pre-paid trackers and flashlights (Chavan et al, 2009). Nothing miraculous but quite crucial in the context, while these would not easily have been thought of as features in Western contexts. They seem to have ‘orchestrated their network” to be composed of a variety of partners, enabling them to successfully respond to actual end-user needs in countries like India (Radjou and Prabhu, 2012).

An interesting question now is how even more CVD-thinking might have been used. One way how this could have occurred would be if user-centred designers for several markets would have worked together at an early stage of development. This would still have allowed the crucial features to be discovered, and as an additional benefit enable Nokia to integrate these features into their models for ‘developed markets’ or other segments. Crucial features for one context can still have added value and distinguishing power in other contexts. This is ‘ultimate CVD-ness’: acknowledging differences and at the same time thinking one step beyond these by realizing early on that insights from any context may be usable for other contexts. The resulting benefits would simply not be achievable if designers restrict themselves to just engaging with very context-specific end-users and other stakeholders.

This is the case in point: being too context-sensitive when designing solutions can in fact limit your innovation potential because you ignore the collective design potential.

2b. Striking out at home

Interestingly, the last statement has turned out to be devastatingly true for Nokia’s primary markets, in the West. They famously missed the boat for a huge trend. The former market leader in GSM mobile (‘feature’) phones, is still a non-player for the successor, the smartphone.
One ‘technical’ reason is that for feature phones hardware excellence (a Nokia competence) was essential, while for smartphones the quality of the software and its interaction with the hardware is much more relevant. Nokia did not possess the knowledge and did not realize in time that they needed it. Their platform was very phone centred, since that strategy had brought them so much success in the past (Lomas, 2012).

In CVD-terms, they did not realize the importance of this product variation and therefore did not adapt its eco-system (i.e., engage in sufficient network variation) to address that change. Only recently has it made the required changes by teaming up with Microsoft, but they now have enormous ground to cover to catch up with competitors.

3. Case revisited. Tesla: beyond increasing the pie

Tesla is not giving up their competitive advantage by loosening their patent control, it is also not Open Source, nor altruism. What Tesla realized can be called advanced eco-systems thinking, allowing emergence to occur and reaping the benefits from it.

The electric vehicle market is developing and Tesla is a main player. However, for them the developments were not going quickly enough. They figured that their organic growth could be much faster if the total eco-system of electric driving gets an impulse.

They chose to achieve this by allowing other companies to use their patents. Hereby, they changed the dynamics of the development of the entire eco-system. In effect, they stimulate the market to adopt their technology as the de facto standard. This means the entire EV-infrastructure could be geared towards their technology. Because they are the front runner in using that technology they still have a head start.

What Tesla is doing is finding an innovative way to at least increase the Pie of Electric Driving, but perhaps even create a whole Pie Factory: others can, if they are able to, freely build on their inventions to create new innovations. In the meantime, they also do not have to worry about fighting legal battles, which will save them money and energy.

It’s all about how you interpret your role in the larger whole. Tesla’s move displayed – perhaps unwittingly – a high degree of CVD-attitude.

4. Apple’s iPod: not slightly better components but an ‘eco-system in your pocket’

You can love or hate Apple. But for the purpose of this working paper even in the latter case it serves to look closely at the launch of the iPod. It was not the first music player, not even the first Mp3 player, but it was much more: it was a music eco-system in your pocket. Mildly assessed, the iPod may just represent all of the elements that we discussed regarding CVD.

For the iPod to dominate the digital music player market Apple did not decompose the player into distinct components to improve these (e.g., a slightly better battery or slightly more storage than competitors), it looked at the process of “getting, organizing and listening to music”. They realized that if they would be able to facilitate all these steps as if they were one smooth operation, they would offer totally new experiences.

For that to happen, the iPod device (‘hardware’) was just part of the deal. Equally important were the development of the music store with a vast stock of very decently priced songs of all types of artists, synchronization software, easy payment, and accessibility for non-Apple users. Apple in effect redesigned the experience of choosing and listening to music. People were glad to pay some money instead of having to resort to the free download options.

This success demonstrates many CVD-elements: setting up an eco-system with different types of stakeholders, involving them in development and implementation, decomposing problems in a different way than others by putting the human experience in getting access to music at the core of the development, not going for the best player (‘feature focus’) but for
the best overall system, making sure people without an Apple PC or laptop can also use the solution etc etc. Apple’s grasp of the CVD-attitude may have been charged against premium prices, which in fact shows how relevant it can be for a beneficial business performance.

The cases include different types of countries and only by coincidence use MNCs as example. While this goes to show that using an CVD attitude is nothing to be snubbed at even by large companies, we repeat our statement that CVD is relevant for all types of economies and organizations. The starting point of ‘CVD thinking’ is to realize that nowadays innovations potentially are being developed, tested and implemented with a fast decreasing inhibiting concern for borders. Not being aware of this development, or worse, not being able to play into it, will in the end even hurt the smallest company in the corporate landscape. This does not imply that any size stakeholder has to be able to take the lead in these processes, but at the very least they need to be aware of the relevance so they can locate suitable eco-system partners. Alternatively, by using the CVD-lens they can now consciously assess whether they have looked with an open enough mind to develop a quality solution.

Companies and others who use a high level of CVD-ness in their thinking choose to consider the growing complexity in society as an opportunity rather than a threat and thereby create advantages for themselves and their constituents. It does require some level of transcending conventional methodological thinking (Chavan et al, 2009), but if designers cannot do this, who can?

In part based on cases like the ones mentioned above, the following section will outline several lines of research that will all contribute to creating more concrete insights for the development of the CVD-concept and its contribution to the enhancement of practice and theory on design and innovation processes in a globalized society.

8. How to move forward?
The closing chapter of this working paper shares a few insights that can help those who wish to move from this point onwards. Be reminded that CVD is an approach and attitude that assists in using the dynamics of the world, rather than a formal design method. We will nevertheless provide a few general guidelines for using instead of fighting with these dynamics in section 8.1. Upon receiving feedback from a few hundred readers, some points regarding the CVD-concept that appear to cause confusion are being discussed more in depth in section 8.2 so a possible misinterpretation of these points does not blur any future steps. While everyone is free to decide how they want to use this working paper, we suggest a few lines of research that seem to be most interesting for now, in parts based on empirical data from CVD-projects (8.3). We conclude with suggestions how CVD as a lens might be interesting for other disciplines than design as well (8.4).

8.1 Guidelines
The design attitude as presented above implies a departure from the notion of having to simplify the world in small sub-problems so these become “manageable”. We see a different route, in a way the opposite one: accepting the increasing complexity where that makes sense and using it as a starting point to determine how broad and diverse the scope, and network, needs to be to be able to develop successful solutions that benefit from this “accepted diversity”.

This does not mean that all world problems need to be addressed in one single blow. Rather, for almost any solution to be developed in the complex world of today the possibility needs to be considered that the many connections in current society provide keys and play a role in the “solution arena”. Similarly, the attitude how to act in this process should be governed more by questions of “who is needed” and “which roles are needed”, than by “how can I
manage and control this process properly?” It also means that the traditionally assumed roles of NGOs, SMEs and MNCs may not be valid for every situation anymore.

The above clarifies that this attitude is not something that can easily be developed overnight. To assist the process of using the CVD attitude, we therefore add some general guidelines. These are relatively broad and not on the level of instructions. This gives practitioners freedom to decide how to translate them into practice. Researchers can work together with practitioners to investigate and test whether there are discernible patterns or ways of applying the guidelines that work better, and in which situation(s):

- **Meaningful contemporary innovation revolves around people:** this does not only refer to determining needs (user-centred design) and facilitating human actions instead of following machine logic (Norman, 2010). It also refers to letting formerly uninvolved actors become active stakeholders. Innovation is a people’s business and by working together in new constellations it is possible to create collective design intelligence. Experience has shown that relying on ‘techno fixes’ to get data together does not yield the best results, especially if a process cannot be easily divided into easily distinguishable tasks. In that situation the human process of collaboration trumps technology (Malone, 2010). Leadership in such situations needs to enable new networks and lead in sense making of emerging patterns not focusing on transferring desired behaviour (Plowman et al, 2007b).

- **Initially be guided by strategic intent, not by narrow results:** CVD-fuelled thinking accommodates the inherently fuzzy design process (Smith and Reinertsen, 1991) in complex situations. Especially in the first phase, where room should be allowed for unexpected turns, it is necessary to suffice with setting direction and not have a concrete result in mind from the outset. Even in small organizations, in the face of complexity it is wiser to use scenarios than long term planning (Levy, 1994). Once emerging patterns have been identified, results can be defined more explicitly. Not forcing oneself to take decisions on the results that need to be achieved will also reduce the risk of both false negatives (seemingly bad options that turn out to be good) and false positives (Chesbrough, 2004).

- **Don’t (just) rely on control-centred management methods, also learn to “manage emergence”:** with many uncertainties rife in this process, acknowledge that it cannot be traditionally managed let alone controlled from start to end, but explicitly allow the emergence of a self-searching self-organizing eco-system. The path will to an extent be laid by walking it, not by planning it (Dorst, 2006). One might call this *orchestrating* rather than managing, with no evident given as to who is orchestrating, how and who else needs to be involved. While this does not imply a total absence of structure (Dunne and Dougherty, 2012), the process will be non-linear and guided by multiple invisible hands (e.g., Nijs, 2013) and involves purposeful experiments, analysis of emerging patterns, using different angles to assess what the best way forward might be. By “managing emergence” like this, more clarity can be obtained which may still be necessary for more control oriented design and management methods (procedures, design briefs, instructions, contracts, budget forecasts, timeline agreements etc) to catch up. Working in this way will reduce the tension between the desirability to increase complexity (hence quality) and the innate desire in managers to fully control the processes they are responsible for. The requirements for managing emergence is likely to be similar to the ones for continually changing organizations (Plowman et al, 2007). Leaders in such environments may need to have characteristics like embracing uncertainty, recombining resources and allowing the aforementioned experiments (Lichtenstein and Plowman, 2009).

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**Case: Total Quality Management or measuring where it matters**

Since the particular aspect of “managing emergence” seems to be challenging to grasp, we include a small fictitious but conceivable example to demonstrate what it could mean in practice.
Suppose a company is selling a product in a certain market. They have to put a lot of effort into managing the quality of the product as it is. The thought of expanding to other markets is daunting. Not only does the company not have the market research capacity, it already worries about what the undoubtedly different requirements from these markets mean for the production line and the effect on the size of the quality management system. Both typical “control-oriented management” concerns.

Whereas in the highest form of CVD they would already have used insights from these new markets in an early stage, at this point in time it is still possible to demonstrate ‘CVD ness’. For example by using the informal network in the new markets to test out products with potential customers, with focus on the consumer preferences for predictability and consistency of parts of the product.

Such informal research might lead to the conclusion that the vast majority of consumers do not care much about the consistency (i.e., one product can be slightly different from the other), as long as it performs its main function and one essential component is working well without exception.

Not only does this approach show that it is not always necessary to engage in full blown professional market research, the more important conclusion is that for expansion to the new market(s) the Quality Management system does not need to grow exponentially. On the contrary, the insights point to the possibility to let go of full control and limit 100% sampling to the one essential component, complemented by testing of the product as a whole. This is something that the control oriented management methods can grasp and be geared towards. They can ‘catch up’ as it were.

This example shows what “managing emergence” might mean in practice.

• **Generative dialogue**: to allow for this emergence to take place in an eco-system the dialogue with the environment needs to be generative (i.e., create insights) instead of transitional (i.e., convincing others of the own viewpoint). In part because the process will likely result in evolving insights in ‘what and who is right’. Interestingly and along similar lines, the issue of complexity of solutions depends heavily on the point of view. Often the simplicity for end-users comes at the cost of complexity for designers or engineers, and vice versa (Norman, 2010). The main concern for designers should always be to make sure that their solution does not create unnecessary complications. The generative dialogue and other principles that put people at the centre are useful starting points to achieve this. Interestingly, this can also be considered on a ‘meta level’, i.e., the dialogue about CVD itself. For example, in hindsight it is clear that the term “systems thinking” has been communicated by its proponents as a normative truth which has to be accepted first. This image did not work well with audiences (Collopy, 2009). Similarly, “leadership” in networks that use the CVD approach should invite participation, not policies and procedures (Wheatley, 1999).

**BMW Mini: the details can matter**

Using an CVD-attitude is not easy. Even the most well respected companies can miss a beat as we have seen in other cases. One more illustration is the introduction of the BMW Mini in the United States. It was not an immediate success. One of the reasons attributed to this shows that details can matter. In this case this detail turned out to be the cup holder for ‘on the go’ coffee, which was too small for the average American coffee cups. For the Mini’s target market, this was something less than trivial.

One might say that putting a lot of resources into solving this issue just for the American market seems excessive. However we can easily analyse that purposeful variation and satisficing requirements in an early stage would have had broader advantages.
A fruitful way forward would have been to (better) immerse in the habits of the targeted end-users. This would likely have resulted in identifying the relevance of the coffee habit and therefore the 'size issue'. One might then have worked with a few coffee retailers for more details. BMW could have decided to work with stakeholders from different contexts, to identify and address more of these improvement points.

The traditional design step would have been to make “bigger cup holders” for the American market. However, if we combine the principles systematic variation and satisficing, we would challenge ourselves to ask how other market segments can benefit from this insight. For this particular example the answer would be: adjustable coffee cup holders. Crucial for the US market and nice to have (and therefore of value) for other markets: everybody wins.

In that way a serious complaint would have been prevented in the USA, while extra value would have been created for other markets. Strikingly, the problem was for a long time not acknowledged even when it was clear, because technically oriented engineers did not accept this market reality. A good example of not being able to deal with complexity, i.e., they did not take variations seriously (Okulski, 2011) and did not put human needs at the centre of their solutions.

8.2 Preventing common misconceptions
Upon receiving feedback by the first few hundred readers of previous versions of this working paper, it has become apparent that some points that are being made have the potential to be wrongly perceived. While in this version even more care has been taken to lower the chances of misperception, a few points will be explained here more explicitly to prevent this from happening even more.

- **CVD and design methods.** ‘CVD’ does not dismiss existing (design) methods, it merely places them in a perspective: by looking through the lens of CVD one can assess how suitable methods are in dealing with design challenges. These challenges increasingly are complex in nature, not all design methods allow for that. It is sometimes stated that “Design Thinking” is the ideal method to address complex and even wicked issues. However, the term is very broad and it leaves so much freedom to individual designers, that its supporters cannot exclusively claim this “mind-set” to provide all guidance that is necessary. Additionally, not all situations may require a high level of CVD-attitude, although incorporating multiple insights is always likely to yield some benefits in terms of quality. A CVD attitude enables designers and innovators to draw rich conclusions when addressing design-related challenges. For more insights in the types of situations where CVD may be more called for, see section 8.3.

- **No universal solutions.** Promotion of the CVD attitude for a design process does not in any way imply advocating “universal” solutions, let alone “ignoring specific contextual characteristics”. On the contrary, it opens up the design process for the increasingly likely possibility that contexts may have more similarities than thought, and therefore bringing together the collective intelligence from these contexts can be beneficial to all. CVD promotes a “shared solution space” offering a richness of relevant insights, as basis for the best possible solution. That solution by no means needs to be universal. It however benefits from knowledge emerging from interaction instead of just sequential, i.e., delayed and one-directional learning. This will improve the quality of solutions. A logical side effect is that local adaptations likely require less large changes and redesigns than currently often is the case.

- **Also for small actors.** CVD in general promotes the sensibility to engage in more communication, more interactions, ‘manage more relations’, take more considerations into account, look across the whole globe for clues and so on. For small actors (e.g.,
start-ups) this seems to be unattainable resource wise. However, this only shows that all actors of all sizes nowadays need to think in terms of collaborative networks, formal and informal, and find smarter ways to get access to the knowledge and capabilities that they require. This does not imply that “each designer personally needs to have a worldwide network that is actively managed on a daily basis”. Projects so far have demonstrated that even a small group of people can very recently apply a CVD-approach, which may not be globe spanning but still sufficient for purposes of smaller actors. The ability and attitude to participate in emergent searching (Dunne and Dougherty, 2010), and continuous cooperation are more relevant than the size and type of organization.

- **Also for big actors.** Interestingly, it has also been suggested by early readers of this working paper that especially the required management attitude (see section 8.1) will be hard to come by in large companies. As referred to in section 4.2-4.4 (pages 13-21), large companies may have their known ways of working and structuring their processes that do not necessarily facilitate an approach that requires more flexibility. From many cases in practice, we know that it can take a long time for a big ‘ship’ to change course.

- **Design directions vs. decisions.** Seen from a mechanistic point of view, using Discursiveness could lead to information being interpreted such that premature conclusions would be drawn. However, this would only happen if “insights from the future” would be translated in concrete design decisions, whereas they should only influence design directions or scenarios. The CVD-principles help to acknowledge real world dynamics, they do not rigidly prescribe how to deal with them. If the discursiveness principle is used to provide direction, the risk for premature conclusions on detailed design-level is very low.

- **More than a context analysis.** Using the four re-interpreted design principles is not the same as performing a proper “context analysis”. This should be a standard part of virtually all design methods. Similarly, an CVD approach also goes far beyond the currently very common practice of multi-disciplinary teams. Both cases demonstrate a certain level of CVD that however are the bare basis for the required attitude but not sufficient to qualify as “full CVD”.

- **Designer’s influence.** Designers should not hide behind the fact that they often need to work based on a design brief, which leaves little room for own initiative. In theory this might happen to very inexperienced designers only. In other cases designers can take their own responsibility and point out to partners that the process to arrive at the design brief has been incomplete. Design and innovation processes are in practice very intertwined anyway.

- **Collective intelligence, scaling or no scaling.** Some wonder how one can justify ‘large scale global sourcing’ to be able to scale up implementation of a solution if you do not know yet whether your solution will become a success. However, using an CVD attitude is not about the act of scaling per se. It is about organizing and plugging into collective intelligence that helps to create insights (“emerging knowledge”) that could otherwise not have been obtained, to develop a higher quality solution. The fact that that solution offers a better basis for success in the market in more contexts is an automatic side effect. Successful implementation however requires networks that support that phase. At least some of these implementation stakeholders should in principle already have been involved in the first phase. If you can anticipate on several contexts being important (i.e., eventual need or potential for scaling), you can count on a CVD approach allowing for an overall process that is much more cost effective. However, even if you would never plan to bring solutions to another context, trying to draw information from the other context(s) at the start will still result in insights that can lead to a higher quality solution. Obviously, the less inclined you are to go beyond a first context, the less logical it seems to source intelligence beyond the boundaries of that context. In this case a practical solution could be to be “open to intelligence from elsewhere” but not pro-actively pursue it.

- **Acknowledging complexity vs. nature of the solution.** It is a strong – albeit understandable – misunderstanding that being able to deal with complexity would by
definition result in either complex solutions or simplistic universal solutions. Neither of these results is the point and the aim of using a CVD-approach. The aim is to introduce a way how the reality of complexity can be taken on board to develop higher quality solutions, There is no pre-ordained notion of these solutions having to be simple or complex themselves. One can say that by acknowledging and actually seeking complexity in the process, the solutions become better informed, therefore understandable and potentially even simpler than otherwise would be the case. The complexity lies in the process, on purpose, not in the solution itself.

- **Local adaptation is insufficient.** Allowing solutions to be geared towards meeting context-specific demands is positive, but not the distinguishing feature of the CVD-approach. To be sure, understanding context-specific demands is important but just doing that would be similar to strategy 2 in figure 1 in section 6. A process to ensure local adaptation without using the CVD-inspired attitude does not result in feed-in of dispersed intelligence in a collective process.

- **Short vs. long term.** Readers have suggested that getting used to the CVD-attitude would not only take a long time but would also be unsuitable for large companies since the positive results would only materialize on the long term, which would displease shareholders. This view ignores a shift in attitude that emphasizes the importance of a long term view by companies including their stakeholders. Secondly, the assumption that results will only materialize on the long term is false in itself since the primary goal of CVD is generating emerging knowledge and allowing more complexity to be addressed, leading to higher quality solutions. This effect does not need to take a long time.

- **Eco-systems do not erode financial value for companies.** It has been asserted by readers that if you have more partners to cooperate with in an eco-system, the financial gains have to be shared amongst more actors so for profit-driven companies this will not be interesting. This is a narrow view on how value is created and fully ignores that novel forms of cooperation (in dynamic or other eco-systems) create new sources of value and revenues. The iPod example very clearly shows that creating a whole new eco-system has been profitable for all companies involved. In eco-systems with a wider variety of actors, different types of value are created, providing even more opportunity for all partners to capture value for themselves.

8.3 **Possible lines of research**

With this working paper as a basis, many different lines of research are possible to pursue. We provide a few examples of interesting results and quotes from our own CVD-projects so far in table 1. These show some hints of what future research might need to look at:

<table>
<thead>
<tr>
<th>Result</th>
<th>Possible research line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combining insights from different contexts is like finding the “1+1 = 3” and even “1/-1 = 3” epiphanies. But it is difficult to foresee them.</td>
<td>What types of results are typical that represent synergy between the contexts, i.e., do “typical” positive results from confronting insights exist?</td>
</tr>
<tr>
<td>Financiers do no like uncertainty about results</td>
<td>There always is uncertainty, it is about the perception and framing. What “framing” works best for which types of stakeholders?</td>
</tr>
<tr>
<td>CVD does generate more information. You can however always choose not to use it. But If you don’t have information you cannot simply expand what you have.</td>
<td>Does having “too much” information lead to better results than “too little”?</td>
</tr>
<tr>
<td>CVD provides more guidance to ‘broaden your horizon’ than most other methods which give no guidance at all.</td>
<td>What is the best mix between giving direction and not? Are there discernible differences in results?</td>
</tr>
<tr>
<td>By using CVD yourself, you really do notice that you get insights that you would not get from focusing on one context. You have to</td>
<td>How much direction is required for the phase where “insights from different contexts need to interact with each other”? [Being too</td>
</tr>
</tbody>
</table>
experience it.  

| experience it. | prescriptive can take away a large part of the creative pressure that designers cherish |
| CVD is especially helpful in the first half of the design process, up till the second design cycle (after first prototyping and testing). | Are there noticeable differences in eventual results when CVD is only used in the first stage vs. the entire process up until scaling? |
| CVD is particularly useful if you foresee the need for a ‘multi context business model’ | In which types of situations can you expect a multi-context business model? Does identifying this at the start help or block the creative process? |

Table 1: Results from projects that consciously used CVD

In part based on results like these we suggest a few research clusters below, which can later be translated into concrete research questions. While these clusters each focus on a particular aspect, where possible they should be considered within a larger open system, to acknowledge the systemic nature of the situations that we are addressing.

- **Composition of CVD-conducive orchestra’s**: What are the types and composition of collaboration “orchestra’s” that seem to be most conducive in achieving “success in multiple different contexts”? How do they work, i.e., what is the optimal mix between “control oriented organizing” and “managing emergence”? In particular, how would decisions be taken? How would leadership be shown? Which contributions are likely or typical for different types of stakeholders, if any?

- **Positioning strategies**: What are strategies for different actors to create a suitable position in these collaborations? Would large companies that might face difficulty in changing the ways they work still hold a leading position in these processes, or would they rather need to start by following others to allow for the required attitude to slowly become a guiding factor in their own regular way of working? Big ships take time to move course, but that does not mean the course should not be changed at all.

- **Design method and process implications**: In particular for the design domain: what does using the CVD approach and attitude imply for the composition, organization, tools, and methods for design teams to facilitate that the ‘best of more worlds’ is combined, instead of the worst? How should variation and satisficing be combined in to achieve best results? How to determine the minimum or ‘right’ number of contexts to be included in the exploration phase to sufficiently cover the multiform nature of the design challenge? How concrete should guidelines be to learn from others but still capture the unique process of “creating shared insights” in each specific situation?

- **Future scenarios**: Might, eventually, CVD-driven design methods and processes also govern relatively simple looking design problems, simply because the outcome is of a higher quality? Or alternatively, will design for single contexts become an extinct form of innovation, therefore giving stakeholders who have started with exploring and using the CVD-approach a head start?

- **Other conditions for successful CVD**: Which insights can we create about the situations (e.g., sectors, types of solutions, combination of markets, type of decomposition) where using CVD-principles indeed leads to better results in terms of quality of the solution and/or overall innovation effort? How would we be able to measure this in the best way? Can the outlook of a multi-context business model hamper the creative process? (i.e., too early conclusions) and how to prevent that?

- **The role of governments**: governments are particularly noteworthy of not being fond of uncontrollable and unpredictable processes. On the one hand they have to develop policies that provide some stability, on the other hand they at times need to jump into crisis situations and take decisions. Both realities are equally present. Which role might they play in facilitating a CVD attitude by other stakeholders and in which conditions can they demonstrate the CVD attitude themselves?

- **Preference for products or services**: A similar question can be asked regarding insights in the differences between solutions that are more product or service oriented. Does CVD work better for one or the other, and why, or is there no inherent difference?
• Financing complex projects: especially relevant for practitioners is the question what (type of) arguments would convince financers and investors if they have no early stage insight on the outcome of design processes, and therefore less control? The truth is that no one has control anyway, so the question revolves around the perception and (un)importance of it. Which way of communicating this message resonates best with financers, does the type of financer matter, what are implications for the process management etc?

• After implementation. An interesting point is what happens after initial implementation in multiple contexts. How should the implementation and follow-up intelligence be utilized in order to let a continuous integrated learning process take place?

• Lessons from history: To include a historical perspective, it is possible to look at different periods in time and the way how innovations have spread around the globe, to identify whether these historical occurrences contain any lessons for current innovation practitioners. Similarly, based on the case of Toyota, we might take such lessons and use ‘CVD-inspired’ versions as starting point for purposeful experiments.

Although we are seeing the first results of projects where the CVD approach has been explicitly used, for most of our research so far we had to look back at a variety of existing cases. These contain clues and patterns along the lines of investigation as sketched above, and this type of analysis will be continued. Together with results of own projects where CVD is used, more focused follow-up questions can be derived. Also, we expect that intentional design and innovation for multiple contexts will start to autonomously occur, simply because society is evolving in this way, no matter what names we put on it. Such cases can then become topic of empirical research. All in all, the CVD-attitude can be used for different angles and for different disciplines.

8.4 Relevance of CVD in landscape of methods
To jumpstart the involvement of different disciplines, table 2 below shows a first outline of an overview how different levels of CVD are used in methods for different design-related domains. It is not mathematics, but a first overview of thoughts, that can serve as starting point for researchers from other disciplines to get involved. Note that it can also be helpful to assess which types of methods from disciplines ‘belong together’ as seen from the point of view of level of CVD-ness. In time, it can be expected that situations at the left end of the scale will occur less and less and the ones on the right end of the scale more. This implies that methods with a high level of CVD-ness in different disciplines will become more relevant.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Low level of CVD</th>
<th>Medium Level</th>
<th>High Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of problems</td>
<td>Simple</td>
<td>Incremental</td>
<td>Complex (Wicked)</td>
</tr>
<tr>
<td>Main driver</td>
<td>Fixed Goal</td>
<td>Scenarios</td>
<td>Strategic Intent</td>
</tr>
<tr>
<td>Market</td>
<td>Lab-to-market: get a product directly to market</td>
<td>Lean Start-up: start with a product and pivot your way to the best fit with the market by involving end-users as customers</td>
<td>Multi-context Stakeholder co-creation: involve a multitude of stakeholders (early) in the process in order to get a diversity of insights</td>
</tr>
<tr>
<td>Product/Technology</td>
<td>Lean start-up: start with a product (technology) and pivot its features</td>
<td>Portfolio: use a range of technologies as starting point and select the one most appropriate for the challenge at hand</td>
<td>Solution platform: specific technology is not a given nor a goal upfront. Choices are fully driven by multi-stakeholder analysis</td>
</tr>
<tr>
<td>Design</td>
<td>Single context</td>
<td>User co-creation,</td>
<td>Design Thinking:</td>
</tr>
</tbody>
</table>
design cycles: distinct focus, clearly defined process

participative design: involving end-users in developing the solution

thoroughly analyse the problem in order to develop an appropriate solution

Sustainability
Think local, act Local: small focus, care for direct living environment
Think Global, Act Local: care for outside world but only apply to and act within direct environment
Source Global, Act where relevant: care for outside and acting where the situation requires you to act

Cooperation in/by business sector
Need and contract based
Multi-disciplinary teams, if necessary across own boundaries
Dynamic eco-systems; orchestra of partners; no fixed conductor

Global Innovation
Globalization: one product for all
Local for Local: different sources, different recipients. Local adaptation
Polycentric: integrated insights from different contexts used to develop solutions that can be applicable in more than one location

Table 2: Degrees of CVD thinking in design-domain related disciplines

For designers, having to assess the situation, and basically the boundary of the system that they are considering is nothing new. CVD offers some extra arguments to carefully determine whether using a narrow scope is an adequate response in a given situation.

In terms of this generative dialogue that we mentioned in section 8.1, the CVD approach has the potential to connect different existing developments. Trends in the areas of, amongst others, the circular economy, new materials and big data show characteristics that seem to benefit from the vision and practical implications as outlined in this working paper. If CVD is indeed able to establish connections between these different trends, these connections will lead to new “generative dialogues”.

We expect that based on the insights that were shared in this working paper, academics as well as practitioners will be able to take forward work that will lead to 1. articles on cases where the CVD approach has (unwittingly) to some extent been demonstrated, 2. exploratory articles on (new) forms of cooperation for which CVD is instrumental, and 3. better understanding of the conditions when a strong CVD-attitude is most likely to be the best way forward. Results of these research lines should all be aimed at contributing to the aforementioned generative dialogue.
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\(^3\) The first version in 1986 used “Psychology” instead of “Design” in the title.


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