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## SMEs Innovation Modes in Context of Globalization and Technological Development

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## **SMEs Innovation Modes in Context of Globalization and Technological Development**

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### *Abstract*

*Conventionally, SMEs are seen as poor on financial and human resources but rich in flexibility, fast decision making and competitive within niche markets. The aim of this paper is to discuss if this profile of SMEs is changing in the face of globalization of the economy, multiple technological opportunities, and a global sustainability agenda. Focus is on the innovation by SMEs and in particular on developing a typology for SMEs innovation modes in perspective of these mega changes. The paper forms the first step in what eventually lead to an empirical study of changing modes of innovation by SMEs in Denmark.*

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### **1. Introduction.**

Using the EU definition, SMEs constitute more than 99% of all companies and they employ about 2/3 of the work force. Furthermore, they generate around 60% of the total national value and accounts for 40% of total exports. Furthermore, SMEs keep the market economy dynamic in the sense of many new ventures being established each year at the same time as the competitive process selects non-viable SMEs to leave the market and a few viable ones grow into multinational enterprises (MNEs). These figures and this profile make it important to study what will happen (opportunities and challenges) to SMEs in the perspective of globalization, availability of multiple new technologies, and a global sustainability agenda.

Reviewing the literature, no clear tendencies have emerged related to new roles and positions of SMEs. SMEs are still seen as being poor on financial and human resources at the same time as they are flexible and fast at decision-making. The niche label is also still tagged to the SMEs. One stream of literature stands out, however, as several researchers, in the later years, have

linked SME innovation to the framework of open innovation and found that SMEs increasingly practice open innovation (Wynarczyk, Piperopoulos; and McAdam 2013; Theyel 2012; Hossain 2015; Vanhaverbeke 2017). By digging a little deeper into the changes that have occurred over the last 20-25 years, we believe we can find facts and arguments for other changes in the role and position of SMEs.

The paper starts with a section on the overall context and how this new context can be conceptualized. This section is followed by looking at dominant innovation concepts from the innovation literature and how SMEs relate to this conceptual world. In section 4, a set of observations from the literature are pinpointed and the observations are summarized into a typology of SME innovation modes. As most of these modes entail that SMEs will have to engage in various types of networks, a final section is devoted to how to formulate a network strategy for SMEs.

## **2. Conceptualizing Meta Changes**

The two concepts of “increasing globalization” and “multiple technologies” dominate the opening chapter of many books and articles on business development (e.g. Dicken 2015) and a third concept “sustainability” is increasingly joining the two former concepts in setting the agenda on much development and strategy research within business. Some leave it at this abstract level while others try to pin down the meaning and concrete manifestations of these terms. As we are to (re)position the SMEs in the context of globalization, multiple technologies

and sustainability, we need the terms to be defined and we need to pinpoint their concrete manifestations.

Globalization means an expansion of countries that take part in cross-country trade and investment; secondly, it entails a deepening of economic relations and activities between partners from different countries, and thirdly it leads to an integration and coordination of activities across countries by multinational companies (Dicken 2015). The globalization of the economy is very well captured by the concept of “global value chain” (Dicken 2015; Gereffi, Humphrey, and Sturgeon 2005; Hjørringgaard and Sorensen 2016), which are the global highways along which economic activity takes place. These global highways runs through a set of locations, where value is added to products and services, before they are delivered to the final buyer/user. These highways are constructed by the MNCs, who coordinate/control the economic activity along and on the highway. At the same time, SMEs in various locations, link to the highways by offering their value adding activities or they ply smaller roads running in parallel to the highways with their differentiated/niche products competing on the outskirts with the more standardized and mass produced products of the MNEs. Thus, the discussion of a change in the role and position of SMEs shall take place around these emerging global value chains for products and services that have emerged due to the adoption of a liberal trading and investment regime by more and more countries. Viewing the global economy as consisting of a set of global value chains with globally distributed activities and actors provides a reasonably manifest and operational tool for understanding and discussing the (changing) role of SMEs and their innovation activities.

In an SME perspective, it is also important to understand changes in the activities, resources and ownership that are globalized. Distinguishing between trade (ex- and import), production, and

R&D activity, trade has increased but more so did internationalization of production through foreign direct investment (FDI). Both trade and production were driven by demand possibilities, but especially from the 1980'ies and especially 1990'ies, internationalization was driven by outsourcing, of production. Thus, a reallocation of production took place and this reallocation increased trade as outsourcing was more prominent than off shoring of production. Furthermore and partly associated to the reallocation of production (off shoring) and partly driven by its own logic, R&D activities were also increasingly globalized. Again, it implies a growth as well as a relocation process.

SMEs joined these global processes, especially related to the globalization of trade, exports but also imports, the latter again being a result of the outsourcing wave to benefit from lower production costs. Aligned to the trade increase, SMEs also increased FDIs in terms of establishing sales and service subsidiaries, while the internationalization of production and R&D activities in general were beyond the capabilities of SMEs. The less investment demanding joint ventures and strategic alliances were alternatives, but both are highly demanding in terms of organization and management capabilities.

For SMEs, globalization made it possible to pursue a specialization and niche product strategy due to market expansion. This way they could remain independent of their larger competitors (MNEs), who pursued internationalization through economies of scale. In addition, the SMEs also internationalized by following their main customers abroad, for example, to China. Thus, globalization created opportunities for SMEs, which they could pursue within the resource capacity.

New ventures and born global companies, a special group within SMEs, need special mentioning. They are, as the term indicates, a child of the globalization processes as their mindset and behavior is global from the very establishment of the firm. Often, either they take advantage of new technologies related to the very value proposition they offer or they use new technologies to reach the global customers. Furthermore, often the global expansion is dependent on networking with other, mostly globalized MNEs, to reach their customers. A very special subgroup under born globals is the micro new ventures based on a new business model and value proposition, which is “assembled” single, handedly by the new venture through a digitalized network to resource providers and customers. With 3D printing, we expect to see many more of such one-man new ventures with innovative business models and digitalized value chains.

Finally, globalization of ownership has several dimensions. First, ownership is globalized through FDIs. Secondly, global ownership is also expanded through the normal competitive processes of a market economy, where firms take over companies by mergers and acquisitions (M&A), which changes the competitive landscape.

The relocation of production through outsourcing has an implication not noticed so much by researchers. Outsourcing requires that the countries to which production is outsourced have the production capacity and the labor skills that are required. If this is not the case, outsourcing must be accompanied by establishing new ventures, i.e. outsourcing is accompanied by a huge growth in new ventures and entrepreneurship.

The globalization of the economy poses a challenge to the SMEs in terms of resources and capabilities needed to monitor and take advantage of the multiple global opportunities downstream (exports) as well as up-stream (sourcing/out-sourcing). In order not to be de-coupled from

the global process, SMEs have to establish linkages and networks through which they can access information and other resources needed for being competitive in a globalizing economy.

Fortunately, they are not alone on this resources search mission. MNCs are constantly on a global search mission for opportunities to improve their competitiveness. Thus, at times, a good web site may be enough for an SME with appealing ideas to be discovered.

Turning to the emerging multiple technologies, these can be conceptualized in different ways. We can identify the number of new technologies such as ICT; materials technology; medico-technology, and biotechnology, and the multiple ways they can be combined to new products. We can also look at the technologies in terms of their scope, i.e. how broadly they can be used with ICT being a technology that can be used in all spheres of life and new materials being used in a smaller range of industries. A third way of looking at the multiple technologies is in terms of the degree of novelty, i.e. incremental or radical with the radical innovation most likely disrupting existing businesses. A fourth way to look at multiple technologies is the extent to which they are science based or based on experiences from the market and in use. A fifth and final distinction is one between hard technology and soft innovation, where the latter includes, among others, business model innovation; branding; experience economy, systems design, etc. In the latter cases, we move outside what is conventionally understood by (new) technology and into novelties that are socio-economic in nature – an issue we shall return to.

These basic dichotomies related to technology and innovation are very useful to discuss the role and position of SMEs (see section 3). However, we shall also introduce a more recent tripartite classification of new knowledge with a distinction between analytical knowledge (innovation from science based knowledge); synthetic knowledge (innovation from combinations of existing



knowledge and experiences), and symbolic knowledge (innovation through providing meaning to a market offer) (Asheim, Coenen, Vang and Moodysson 2005; Sørensen 2017). This knowledge classification model is highly useful in the present context with so many technologies and experiences to combine and in a time, where customers expect firms to provide not just functional qualities and value, but also meaning (stories and context) to the value proposition in order for customers to accept and in a broader sense legitimize the product and the firm.

The multiple new technologies is a challenge for SMEs as they do not have the capabilities to monitor the development of the many new technologies and thus may not be able to spot when a new technology could be useful for the products produced by the SME. Even if they could monitor the technology market, they may not have the absorptive capacity (Cohen and Leventhal 1990) to take the technology on board. To be able to create new and competitive market offers whether products or services, the SME has no choice but to leverage the new technologies through networks and membership of clusters, which requires the SMEs to enhance their network and thus be able to leverage external capabilities and resources - perhaps even at the expense of own in-house innovation capacity and activity. One form of network used internationally, is the international strategic alliance (ISA), which is an internationalization mode between the pure market transactions and FDIs. In an ISA, firms pool resources, collaborate and manage the alliance through joint efforts and the expectations are that the benefits will be mutual in nature.

The concept of sustainability is relatively new in the business vocabulary, but reference is made increasingly to the eight UN Millennium Goals from 2000 and now, from 2015, the 17 UN Sustainability Goals. Increasingly, sustainability – alongside the concepts of legitimacy and

corporate social responsibility (CSR) – is becoming part of corporate strategic thinking. At first, business resisted the extra costs associated with being sustainable, but soon firms realized that sustainable products and processes could generate an income stream beyond the extra costs of innovating sustainable products and processes Nidumolu, Prahalad and Rangaswami (2009). By asking the question: “How can meeting the sustainability goals be turned into a competitive advantage”, firms started taking sustainability seriously and included sustainability into their strategic thinking. An interesting example at an early stage was Novo Nordisk – the Danish world leader in insulin development and production, who established a small office with the aim of looking at human rights and answering the question, how human rights can be fulfilled and provide a competitive advantage simultaneously.

Sustainability is pursued at both global, macro and micro level. At global level, nation states meet in global fora such as the COP-meetings on emission and global warming to come to an agreement on how to “save the planet” broadly speaking. At the same time, individual nation states formulate policies and plans for their country to be in the lead of sustainability in one or more areas. Finally, as indicated above, individual firms have realized that by greening the firm and its products and processes and pursuing the relevant sustainability goals, they can generate additional revenues.

Turning green and fulfilling sustainability goals require partly a change of managerial mindset and partly a change of strategic orientation of the firm. The areas for this reorientation are many but a starting point is often related to products and production processes. Sustainability has been conceptualized into the 3Ps (planet; people, and profit), which implies that a revenue stream (profit) can be generated by saving the planet and building welfare for people. Given this new

and still emerging context, we shall discuss how SME reposition themselves. Sustainability however goes beyond the individual firm and to fulfill sustainability goals, the global value chain seems to be a valuable constructs together with circular economics and life cycle assessment (Tukker, 2015; Anderson & Zeithamal, 1984), it is possible to measure the environmental and resource impact of activities of firms along the value chains and across countries.

Sustainability is both an opportunity and a challenge for SMEs. Given that SMEs are flexible, a change in mindset and a strategic reorientation towards sustainability are more easily accomplished in SMEs than in large MNCs and this in turn can form the basis for innovation in and around the present processes and products. However, sustainability also entails the generation of new knowledge, as our experiential knowledge is still meager in this new area. Here, SMEs will have to create links to universities and research institutions to develop sustainable products and processes. In addition, the sustainability agenda will also give rise to the establishing of new ventures on a science based knowledge platform. Thus, incumbent SMEs can pursue incremental sustainability innovation by “greening” their present products and processes (and thereby those of their customers) and new ventures can pursue more radical innovation for sustainability. Thus, the sustainability agenda is a great opportunity for SMEs, which are able to change mindset and strategic orientation and focus on incremental innovation related to their processes and products (Moini, Sorensen, and Kristiansen 2014).

In sum, the three mega trends outlined in this section constitute a new context to which SMEs must adjust and take part in shaping. The trends indicate that SMEs meet both new challenges and new opportunities that may change their overall role and position in the business system and global value chains, but even so, SMEs will still be important for a dynamic competitive market

economy. This dynamics is to be assured by the interplay between three categories of firms – new ventures, SMEs and MNCs. Taking Denmark as an example, some 20.000 new ventures are created each years and a similar number is selected by the market dynamics to leave the economy of which most are to be found between the new ventures; a sizable part is from the ranks of established SMEs and a few (as they are a tiny group) from MNCs. In addition, among the multiple SMEs, only a few belong to a sub-group of “growth SMEs”, i.e. SMEs with a high annual growth rate above 10% (IRIS Group 2015).

### **3. SMEs and innovation Theory.**

This section aims to link SMEs to the concepts of innovation from innovation theory (Tidd and Bessant 2013). Often innovation researchers tend to see social reality in dichotomies, for example incremental versus radical innovation. Such dichotomies are often useful to pinpoint an important dimension and issue and thus fit the purpose of this paper where we want to look at SMEs innovation in a new context.

Figure 1 provides an overview of a set of innovation dichotomies and how the SMEs relate to the concepts. The figure provides the 3sense of the innovation concepts and how SMEs relate to the concepts. In the following, we discuss specific issues related to the innovation constructs.

Looking across the ten innovation constructs, it appears experiential knowledge play an important role in SME innovation. The term experiential knowledge is in the innovation literature mostly used as a summary term for all experiences in the firm and rarely unfolded so that we can see and work on its constituents parts. One exception is Theyel (2012), who in a

study of US SMEs, looks more broadly at innovations along the value chain (technology and product development, manufacturing, and commercialization) and in this way we realize that SMEs do not just have multiple technologies to choose among, but also multiple experiences. Taking this concept one-step further, these multiple experiences can be coordinated and especially integrated in various ways. In other words, experiential knowledge as embedded in employees is a holistic construct in need of being unfolded and compared to science-based knowledge, which often is very specialized along disciplines. A weakness related to experiences is, however, that often they are tacit and non-reflected to become valuable knowledge and thus cumbersome to study.

The dominance of experiential knowledge within SMEs may lead to both incremental and radical knowledge. The SMEs may be in what we may call an “experience trajectory”, where the increase in experience give rise to new ideas and incremental innovation. However, we may also see experiences combined in a more radical way and give rise to radical innovations. This is what the various “creativity platforms” aim at (Hansen and Byrge 2018). Here they use a variety of techniques to support the process of combining both the experiences within one person but also the experiences across persons with different background and experiences. Radical innovation may of course also take place based on new science derived knowledge, especially through new ventures.

The generation of new ideas is often linked to weak ties (Granovetter 1983) between partners, defined as ties where not much is at stake except to exchange experiences and intuitively explore new ideas. SMEs value, however, strong ties more especially ties with customers as this implies trust, loyalty and other values that underpin the revenue stream. With globalization, multiple

technologies and a complex sustainability agenda, SMEs may have to develop their network to include more weak ties, for example, by being member of a cluster (see later section).

Globalization, multiple technologies and a complex sustainability agenda will also imply that SMEs move from internal innovation to innovation that is more open (Vanhaverbeke 2017).

SMEs do not practice internal or closed innovation through R&D centers, but may establish a product committee that filters the experiences and divide new ideas into, for example, three levels. At level 1, a team is formed to explore the idea further and come up with design and prototype. At level two, they take action to adjust, and at level three, the idea and the newness is handled as part of normal adjustments within operations.

As SMEs do not have R&D laboratories, they are weak on exploration through R&D. However, this does not mean that no exploration takes place in SMEs. In SMEs it is done differently, namely through the integration of exploration and exploitation. This is the case in order based SMEs where they produce customized products. In this case, the SME offers a “capability” to the market and not a product. At first the capability is used to prepare a design (design capability), that fits the customer requirements and secondly the capability is used in manufacturing (manufacturing capability).

On product-process innovation, the product seems to be “the baby to be nursed” for SMEs, which makes sense for niche producers. However, for producers of customized products, they may need both generic processing equipment as well as highly specialized and flexible technology. Abarnathy and Utterback (1978) found that process innovation tailored product innovation. When a dominant design had been found in an industry, the competitive forces made companies turn to process innovation to lower production costs. The formula was one of

exploiting economies of scale. SMEs however often exploit economies of scope and this requires a more flexible production system.

Also related to the product-process innovation debate, a discussion on the separation of production and R&D has been going on (Slepnirov, Waehrens and Johansen 2014) related especially to the wave of the outsourcing of production and 'the internationalization of R&D from the beginning of the 1990's. The argument against a separation have been the importance of close collaboration between production processes and product development, i.e. a separation between production and the D in R&D. The R and especially basic research have always been separated from production, notably through basic research taking place in universities and research academies or institutes, but also in basic research labs in companies, for example, in the medical industry. For example, Novo Nordisk has laboratories, which are located near talent rather than near production. Thus, low distance is the more crucial the more we move from R and in the direction of D or said in another way, the more we base innovation on experiential knowledge.

SMEs also face this dilemma, not in the sense of separation of their own labs from production, as they do not have such labs or R&D facilities, but in the sense that they have to leverage new technologies from outside through the market or through collaboration with non-market based organization such as universities. This in turn, requires that SMEs need to have solid absorptive capacity and as the absorptive capacity of SMEs is primarily experiential knowledge based, it is difficult for SMEs to absorb science-based knowledge. Looking into the future, however, the product-process discussion may take on new dimensions as in case of 3D printing, where the design, production and product discussions are taking place in (almost) a simultaneous process.

Finally, related to the so-called Smile Curve (Mudambi 2008) where the value chain is divided into upstream and downstream value addition activities, the value creation and appropriation by SMEs seem to run from the design over production and to the commercialization stage, i.e., it includes the low value addition from the production stage. For SMEs basing their business model on order-customization innovations (see pt. 3), value is created at the design stage combined with “branding” of the firm as a quality producer with on time delivery and good service. This business model requires flexible production systems. Thus, SMEs do not specialize in certain stages of the Smile Curve, but generate and acquire value across the design-production-sales/service part of the Smile Curve, bound together by their experiential knowledge and creative/innovative capabilities. However, based on cases from Denmark, the customization process makes it difficult for SMEs to cover the costs of the design stage as it is not separately billed and customers would like to take the design and ask for offers from different producers.

On a final note, the distinction between innovation in big and small firms could also have been included as a dichotomy used in the innovation literature (and in much other literatures) as the expected changes in the role and position of SMEs under the new context is much related to how MNCs are (re)positioned. This paper is not directly discussing the issue of big versus small related to innovation. Earlier, there was a heated debate (Van Dijk et al 1997; Vanhaverbeke 2017; Deakens and Freel 2012) on whether the biggest is also the best or smallest is the most beautiful and the conclusion was that there is a dynamic complementarity, i.e. an interaction between big and small, the nature of which depends on the industry and the stage of development within the industry. Given the stipulated mega trends, this MNC-SME interaction has become



even more important than earlier.

**Figure 1. The Conceptual World of Innovation and SMEs**

No	Innovation Concepts	SME	Source
1	Incremental- Radical	Innovation in SMEs is mostly incremental, i.e. improving the market offers through adjustments based on market feedback and internally accumulated experiences. However, new high-tech ventures may also offer radical innovation to the market based on new science inventions or combinations of existing high-tech inventions	Dewer & Dutton (1984)
2	STI - DUI	Innovation in SMEs is mostly DUI based, i.e. innovation based on learning by doing, using and interaction and not STI-based, i.e. Science and Technological Innovation. While STI follows strict/rigid scientific rules, DUI is a broader concept with experiences from several sources.	Jensen et al (2007); Parilli and Heras (2016)

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3	Science Push – Demand Pull	Innovation in SMEs is mostly demand driven (see pt. 2)	Dosi (1988); Rothewell, (1994)
4	Explicit – Tacit Knowledge	Innovation in SMEs is often based on tacit knowledge built into routines. Especially when combining experience-based knowledge for customized products, SMEs know what works but not why it works.	Nonaka & von Krogh (2009)
5	Closed-Open	Innovation in SMEs have traditionally been in- house (closed) but globalization and multiple technologies are increasingly making SMEs practice open innovation in networks	Vanhaverbeke (2017)
6	Strong-Weak Ties	Innovation in SMEs are mainly based on strong ties to specific customers but also some weak ties in various local networks from which they derive new ideas. Especially, the tendency to become member of clusters blend the two types of ties.	Granovetter (1983)
7	Explore-Exploit	Innovation in SMEs is based mainly on exploitation and through the exploitation, SMEs explore, how they can incrementally improve	March (1991)

		their market offer. Thus, exploration goes into the SME innovation agenda to various degrees.	
8	Local embeddedness – global integration	Innovation in SMEs is mostly locally embedded with adaptation of the market offer to other localities while little global integration takes place.	Granovetter (1985); Uzzi (1997)
9	Product-Process Innovation	Innovation in SMEs has much focus on product innovation, but with the focus on automatization, process innovation has become very important for SMEs.	Utterback & Abernathy (1978)
10	Upstream-Down Stream innovation	Innovation in SMEs are not positioned clearly on the Smile Curve (Mudambi 2008). If R&D is eliminated from the upstream, SMEs are generating and appropriating value both from mid- and downstream	Roy & Sivakumar (2010); Kuada and Sorensen (1999)

Overall, this confrontation of SMEs with the conceptual world of innovation theory indicates an SME innovation agenda with special characteristics, and it also reveals that there is plenty of innovation opportunities for SMEs arising from the multiple application possibilities from even a few scientifically based invention such as those related to digitalization technology (science push

innovations) and opportunities arising from the multiplicity of human needs globally (demand pull opportunities).

It should be mentioned that Figure 1 does not capture a small group of High-Tech new ventures, which are more science driven and/or business model driven (see section 4). However, they can be added as a second column in Figure 1.

#### **4. Trends, Competitiveness and SME Modes of Innovation**

The aim of this section is to identify and describe the dominant innovation modes practiced by SMEs. We define an innovation mode as the approach to and the organization and manage of a firm's innovation activities. In principle, all the innovation concepts listed in Figure 1 could be used to characterize the innovation mode. However, for SMEs we find that the following four innovation dimension form the core of how SMEs approach and organize innovation, i.e. the key dimensions to describe the innovation modes of SMEs.

1. Closed or open innovation, i.e. whether the innovation activity is conducted in concealed labs internal to the company or openly in collaboration with external partners (the actor base of of innovation)
2. Science or experience based innovation, i.e. whether the knowledge base for innovation activity is the company's own experiences or a scientifically derived knowledge (the knowledge base of innovation)
3. Specialized or system based innovation, i.e. whether the innovation is highly specialized or broad in scope (the market position of innovation)

For example, a sub-supplier to the auto industry may be responsible for the innovation of a module for the car (system-based innovation) and use open innovation to access science based innovation from a research university to be integrated with the firm's own experience based knowledge.

Alternatively, a supplier of specialized components may practice open innovation with its customers and use experiential knowledge to come up with a solution to the specifications by the customer.

In Figure 2, the main modes of innovation of SMEs derived from the literature are listed. The innovation modes ranges from macro to micro and from the conventional, well-documented ones to the emerging innovation modes caused by the Meta trends discussed in section 2. We shall present and discuss each of these SME innovation modes.

**Innovation through the Market Selection Mechanism:** The most dominant mode of SME innovation is the innovation that happens through the natural market selection of losing and winning firms (Dosi and Nelson 2010). For example, in Denmark, around 20.000 firms disappear every year at the same time as around 20.000 new ones are established. The new ones are established on some novel competitive ideas and competitive business models. The innovations are either new to the firm (an incremental innovation based on imitation) or new to the market (a more radical innovation).

The creation of new firms is on the agenda in most countries, establishing incubators at universities and knowledge institutions in general; establishing clusters, and promoting and using business angles and venture funds to underpin the entrepreneurial ideas. Presently, a number of

SMEs are established based on a business model derived from digital platforms and from the UN sustainability agenda.

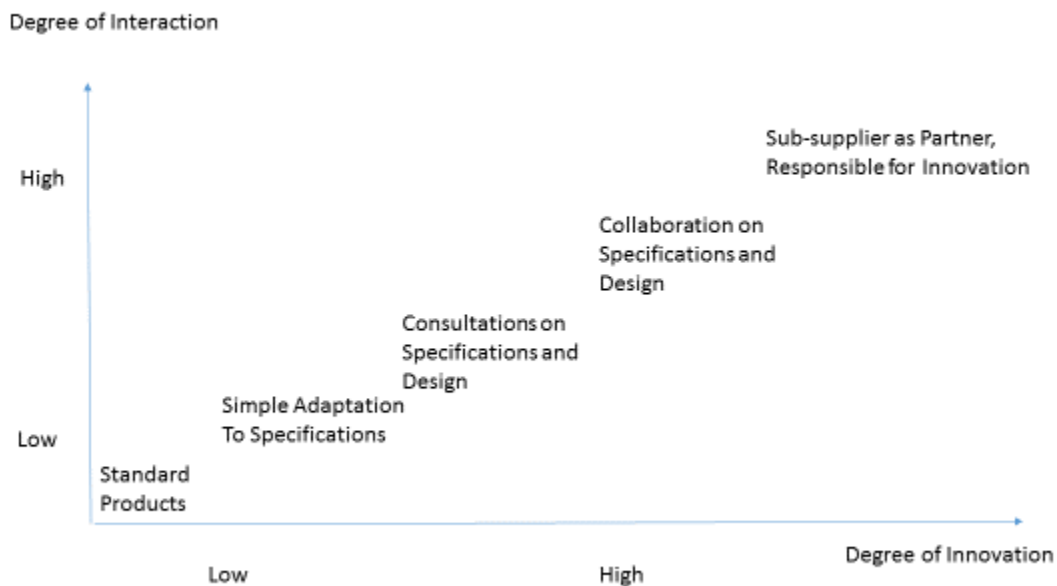
**Innovation for Niche Markets:** The conventional innovation mode for SMEs is the development of market offers (value propositions) for niche markets. These differentiated products or services are attractive to a segment of the market, which are too small for MNCs to satisfy. SMEs catering for niche market belong to the same industry as the MNCs, who take advantage of economies of scale and producing standard products for the mass market. As mentioned, this niche position and associated innovation mode is under pressure due to the increasing use of flexible specialization systems (Piore and Sabel 1985) making it possible for MNCs to produce small batches of differentiated products and even customize products and enter into co-production with customers. With 3D printing, the production mode by SMEs and MNCs will be even more alike. However, this does not mean that SMEs are eliminated from the market – only that they have similar production mode as MNCs and thus compete on non-niche dimensions such as nearness, speed, quality, dialogues, etc. It is also possible that the SME incrementally add new features to their products. One basic formula for adding features relates to digitalization, where the SMEs back in time (20-25 years) may have added a chip to their products making the product smaller, faster, more efficient etc. The next step was to add smartness to the product by including, for example, various sensors so that product owners better can use and manage the product from distant locations. Now we are at the third stage, where the SME links both product and production to the internet (internet of things) to be able to monitor/manage at a distance; communicate across devices, and add service providers to the product.

**Innovation as a Sub-supplier:** The fragmentation of the global value chain combined with the multiple technological opportunities have changed the division of labor in the value chain. This in turn has created room for SMEs to tap into the global value chain as innovators, preferred suppliers, or part of the MNC-formed tier system of sub-suppliers.

Blenker and Christensen (1994) developed a typology for sub-suppliers based on the relationship between contractor and sub-supplier in terms of task complexity and degree of coordination. Building on this model, but replacing task complexity for innovation, we arrive at a typology with five degrees of innovation (Figure 3). At the lowest level, the sub-supplier delivers standard items with no innovation tasks; At level two, the sub-supplier adapts to simple specifications by the contractor by adjusting the product and production process. Again, innovation is negligible. At the third level, some consultations between contractor and sub-supplier is required to define the specifications. Moving to the upper two levels, the sub-suppliers become even more important related to defining the specifications and developing the product that the contractor needs. At the fifth stage, the partnership stage, the sub-supplier functions largely as the innovation lab for the contractor. Thus, over the five levels, the absorptive and innovation capacity of the sub-supplier has to increase. This typology fits well into the general fragmentation and reorganization of the global value chain, where we see MNCs reorganize their supplier system into a tier system and thus outsource production and innovation to sub-supplier. MNCs may have contacts to only tier one, two or 3 sub-suppliers, while the sub-suppliers are responsible for lower ranking levels. For example, innovation partners are at tier 1 level, developing and producing modules; second tier SMEs are producing components to the modules while the third tier sub-suppliers produce semi-manufactured products.

**Innovation through Customization of Transactions:** The conventional perception is that innovation is an activity before launching a complete product/service on the market. However, SMEs increasingly offer their “innovation capability” to the market rather than a concrete product or service. By doing so, the value chain is turned on its head as it starts by soliciting orders by promoting their capability to customize the products. Having signed the contract, a design is prepared and based on this, materials is ordered, processed and delivered to the customer. In this way, SMEs innovate as an integral part of the production process and revenue stream – and innovation is not purely a cost as in case of R&D departments.

Figure 3: Typology of Innovation Level of Sub-suppliers



(Based on Blenker and Christensen 1995)



Innovation through transactions implies a shift to a Schultzian perspective focusing on the subjective view on innovation. Customers may not be able to articulate their needs and their needs and demands change in the course of using the products/services. This implies that producers must become explorers and exploiters simultaneously. In the words of Yu (2003): Producers “...are engaged in an expedition with the aim of transferring tacit knowledge into articulated knowledge. In doing so, they immerse themselves in the community of their potential customers. They often use field works to help them to conceive the ways in which they can create value for potential customers by synthesizing the firm’s technologies and capabilities into a variety of performance possibilities or other product features.” (p 407). Thus, technological insights and experiences are mixed with human agency capabilities and subjective understanding of business reality.

**Business Model Driven innovation.** Presently, we also observe SMEs and more so new ventures and born globals moving from being niche producers to being first mover and lead producers. In this case and based on their experiential knowledge, the SMEs have ideas about what the market needs, i.e., they are a kind of Kirznerian entrepreneurs (Deakens and Freel 2012) spotting a new market opportunity and they are able to formulate a value proposition on which to base a business model. However, they may be weak on technological capabilities and/or manufacturing capabilities, perhaps also on abilities to reaching the market. This business model driven innovation has two sub-categories: One is based on the combining of existing technological knowledge with new technological knowledge, i.e., research based knowledge. The other is based on experiential knowledge and especially on a combination of experiential

knowledge existing within the SME across sections and departments. Vanhavebeke (2017) presents several cases of business model driven innovations and emphasizes that it is not the technology but the business model that grows SMEs in low- and medium tech industries. However, it is also emphasized that engagement and passion on part of the SME owner/manager as well as network building is crucial for this business formula to work, as many outside partners have to be mobilized to get access to the needed resources and capabilities related to technology, manufacturing, and commercialization.

Related to the business model driven innovation, the distinction between analytical, synthetic and symbolic knowledge becomes interesting. The driver in the science based business model is clearly the analytical knowledge, while in the experiential driven model it is the synthetic knowledge, i.e. the combination of exiting knowledge related both to technology (e.g. making the product smart by adding sensors) and to the insights into customer needs (even if these needs are hidden to the customers) and business model formulation. The symbolic knowledge may also be crucial especially related to new products and services. You need to know what potential meanings the customers would like (or at least accept) to be associated with your product or service and what combination of more functional features with more emotional ones would go well with the customers.

### **Sustainability Driven Innovation**

In a global perspective, sustainability is about saving the planet and creating welfare for its inhabitants of all kinds. Given that we have been on a trajectory that endanger the planet, sustainability require a change in mindset and in direction.

Focusing on SMEs and how they can contribute to the global agenda, it is clear that they would also have to change mindset, for example, from linear thinking to cycle thinking, and direction for their innovation (Moini, Sorensen, and Kristiansen 2014). The innovation agenda changes from being focused on product and process to seeing the whole of the SME as a platform in need of innovation for sustainability, based on, for example, the 3Ps formula (profit, planet, people). When sustainability was seen as a cost incurring activity, SMEs resisted the concept. However, gradually SMEs and MNCs alike realized that there are two types of sustainability activities, the cost incurring and the revenue generating activities. The latter entails activities that make the SME more competitive in the market alongside an increase in the demand for sustainable value propositions.

Innovation for sustainability requires new tools – tools that provide a sustainability perspective and tools that can actually measure the degree of sustainability improvement. First, the SME must look beyond its own organisational borders as the source of non-sustainability may lie outside the firm. Here the global value chain (Gereffi 1994; Hjoerringsgaars and Sorensen 2017) is a useful construct as it can map the chain (or rather the cycle) and identify the “leaks” related to non-sustainability.

**Figure 2. Modes of SME Innovation**

No	Mode of SME innovation	Description	Trend

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1	Innovation through Market Selection of SMEs	The market mechanism selects firms into the competitive and non-competitive ones, where the non-competitive firms fail the market test. At the same time, new firms are established on innovation to the firm or the market.	Ongoing. No sign that fewer new ventures will be established
2	Innovation for Niche Markets	SMEs develop products or services for a small segment of a market that is too small for MNCs to reach due to their focus on economies of scale.	Under pressure as MNCs adopt flexible specialization systems and thus can compete with SMEs.
3	Innovation as a sub-supplier	SMEs innovate for other SMEs or MNCs in the value chain. SMEs contribute to/tap into the value chain as innovation partner, component producer, or manufacturer of semi-processed items – each of them with an innovation com production role.	Increasing opportunities for SMEs due to fragmentation of the global value chain and the multiple technologies
4	Innovation as an Integral Part of Transactions	SMEs offer their innovation capability to the market and thus perform innovation as an integral part of selling customized product and services.	Increasing opportunity as customers are in need of customized products

5	Business Model  Driven  Innovation	SMEs use their experiential knowledge and networks to generate ideas and formulate them into value proposition and subsequently into business models. They are either Kirznerian SMEs that spot market opportunities or Schumpeterian SMEs that synthesize existing technologies into new value propositions. The value proposition is primarily based on synthetic and symbolic knowledge.	Relatively new approach to innovation and the development of the SME
6	Sustainability  Driven  Innovation	SMEs change their mindset and innovation direction to identify areas of contribution to sustainability in SME wide activities, i.e. how sustainability can increase the competitiveness of the SME	Relatively new approach to innovation

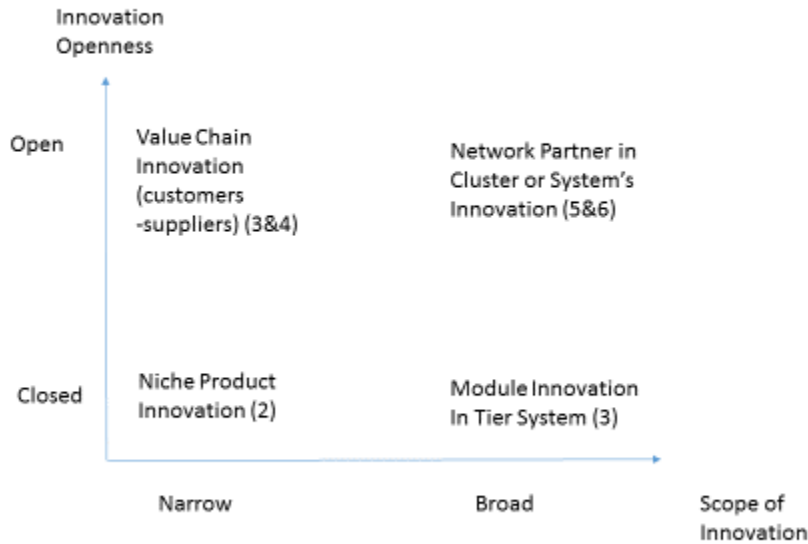
Secondly, life cycle assessment ( ) can be used to measure the present non-sustainable footprints of the SMEs and thus form a benchmark for the SMEs. Thirdly, having drawn the GVC map and conducted a life cycle assessment, the perspectives and tools of circular economy may be used to redesign the industry/value chain in the direction of sustainability. Sustainability has, as mentioned, been conceptualized into the 3Ps (planet; people, and profit) ( ) and based on this formula, firms have started preparing annual sustainability reports based on a set of

agreed standards. The theories on and associated tools of corporate social responsibility (CSR) are part of the toolbox. However, this may not be enough. It may be necessary to see sustainability as part of the actual strategy of the firm and an associated stakeholder legitimization plan.

The sustainability agenda has created multiple new opportunities for SMEs and an area for innovation where the MNCs do not have a lot of experience. Basic research is highly needed, but combinations of existing knowledge that can be put together by SMEs is also a way to support the sustainability agenda.

The identified six modes of SME innovation can be conceptualized into a matrix (Figure 4) where the two scales distinguish between openness (closed-open innovation) and scope (narrow-broad innovation scope).

**Figure 4: Framework for SME-Innovation Modes**



## 5. Innovation and Networking

Open innovation has not been presented as a special mode of innovation for the reason that all the modes identified require that the SMEs use open innovation. This is not new to the SMEs, as they have always worked closely with their customers and suppliers. However, now they need to use open innovation even more and to an extent that they need to develop a strategy for how to create and manage a network that will assure them access to resources and capabilities controlled by others.

To leverage resources and capabilities from outside, the SMEs need to establish links to the resource/capability holders and make them interested in collaboration. This requires social capital; absorptive capacity (Cohen and Leventhal 1990) and capability to establish and manage relations and networks (Vanhovebeke 2017; Ford 1998). In a review of the literature on SMEs and open innovation, Hossain (2015) found networking (p. 6), collaboration (p. 5), and of innovation management (p. 3) to be important for successful innovation, but he found also many challenges for SMEs in practicing open innovation due to “...scarcity of resources, complexity of the scientific field; coordination of the operative functions of the firm, and access to up-to-date scientific excellence. “ (Abouzeedan et al 2013). This list of barriers is interesting, because SMEs seems to be able to innovate despite these barriers, i.e. they seem to be able to circumvent the barriers – using their own innovation formula.

**Figure 5. Strategy for Innovation Networking**

No	Network	Description	Trend
1	Relations in the Value Chain (customers and suppliers)	Vertical business relations to sourcing especially experiential knowledge on needs and new (technical) possibilities.	Most important source for SME innovation with preferred suppliers and advanced customers.
2	Business Association	Horizontal knowledge/experience sharing relations and agency for advocacy vis-à-vis government and other stakeholders.	A traditional and important way of organizing in a market economy. Includes also



			networking at exhibitions, fairs, etc.
3.	Relations to Knowledge Institutions	To access research based knowledge and knowledge workers (students)	Increasingly used to integrate the SMEs' experiential knowledge with research based knowledge
4	Cluster	Multiple relations to stakeholders with an interest in the focus of the cluster, including knowledge institutions, service providers, NGO, government agencies, etc.	Increasingly used by governments or by the grass roots to increase the absorptive capacity of SMEs and to have/develop both weak (new ideas) and strong links (collaborative links)
5.	Community Links	Membership of or taking part in local groupings and activities to secure legitimacy	Increasingly used as PR, CSR, and to build legitimation

There is no indication that SMEs should be poor in social capital and thus in the ability to establish linkages and build network – even with big companies (Deakens and Freel 2012). However, to establish and manage multiple relations and an extensive network is resource demanding and thus the SME has to be selective and it is necessary to develop a “network strategy”. This strategy would include potential links to customers/suppliers; business

associations/business development organizations/business service providers; clusters, and perhaps competitors. Much have been written on the need for networks, but not much has been written on a networking strategy as a way to get access to the right resources and capabilities in an economically optimal way. Burt (1992) long ago made us aware of the risk of redundant information through overlaps in the network, but very little has been done in the area of formulating actual networking strategies.

The formulation of such a strategy may take the starting point in categories of actors with different resources and capabilities. Figure 5 lists key actors and how SMEs can benefit from linkages to these actors. This categorization can be used as a starting point for identifying the actors needed in a given SME and based on this identification prepare a strategy for building the network. Cluster building have become popular as a way to support innovation by SMEs. Some clusters emerge gradually from normal market interaction while governments, universities, or companies initiate others more directly. To understand why cluster are important for SMEs and in some cases actually become the innovation center of the SMEs, the reasons can be found in the diversity of the qualities of clusters. Figure 6 lists these qualities and shows that a well-managed and functioning cluster can provide access to many different resources and capabilities related to innovation. Furthermore, presently we observe a trend to internationalize the clusters, so that SMEs can use the cluster to link to resource holders abroad (Kergel, H. et al. 2015).

**Figure 6: The Nature of Clusters**

	Characteristic	Source
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1	Multiple types of actors with different resources and capabilities	Hagedoorn, 2002
2	Two types of knowledge and learning (formal and experimental)	Jensen et al (2007)
3	Two types of experiences (explicit and tacit)	Nonaka & Konno, 1998
4	Two types of innovations (incremental and radical; closed and open)	Chesbrough 2006; Vanhaverbeke 2017
5	Two categories of relations (long-term/strong and short-term/weak)	Granovetter, 1983; Easton, 1992; Haakansson and Johanson, 1992.
6	Two types of capabilities (absorptive and desorptive/communicative)	Cohen and Leventhal 1990
7	Two competitive situations (exploitation and exploration)	March 1991

## 6. Propositions and Empirical Study.

The discussion above indicates that SMEs in perspective of globalization, a landscape of multiple technologies and a global sustainability agenda face a new situation with new barriers and opportunities. On the one side, there are new opportunities not at least for SMEs and new ventures taking advantage of the multiple technologies that can be combined and linked to experiential knowledge. On the other side, the SMEs will be less on their own, serving markets

with niche products that competitors find unattractive, but SMEs will be increasingly linked to global value chains serving the MNCs as sub-suppliers. Furthermore, SMEs will also be embedded in networks, for example, clusters, which enable them to access resources and capabilities on a continuous basis and wide in geographical scope

This new profile of SMEs collected from the literature is in need of being verified – not as a fact, but as a trend: Is it true that SMEs increasingly are repositioning in the face of increasing globalization, multiple technologies and sustainability.

The following x proposition will be tested through a survey and some cases. Preliminary, the following propositions have been identified, but not finalized:

Prop 1: SMEs increasingly become innovation sub-suppliers to larger firms rather than competitors as niche market producers.

Prop 2: SMEs increasingly innovate through “order-based-innovation” (revenue-based innovation) rather than independent innovation (cost-based innovation).

Prop 3: SMEs innovate through combining existing knowledge (synthetic knowledge) rather than developing or acquiring new knowledge (analytic knowledge).

Prop 4: SMEs increasingly develop (grow) by using symbolic knowledge, i.e. provide meaning to their value proposition.

Prop 5: SMEs increasingly innovate by using multiple aspects of their experiential knowledge.

Prop 6: SMEs have increasingly formulated a strategy on networking (which network; how to manage networks, etc.).

Prop 7: SMEs have increasingly adopted a sustainability mindset, strategic orientation and business model that turns sustainability goals into value propositions.

## **7. Summary**

The aim of this paper is to create a frame for studying changes in the innovation agenda and modes of SMEs. Such changes are expected due to three meta-changes at the global level. The first Meta change is the globalization of the economy, which can be conceptualized as the establishing by MNCs of a set of global value chains, which SMEs in various global locations tap into. The second Meta change is existing and emerging multiple science based technologies, which can be combined in numerous ways to new market offers. The third Meta change is the sustainability agenda, led by the UN, which identifies needs that will require not just technical innovations but also organizational, commercial and institutional innovations.

As the topic is innovation related to SMEs, it was natural to start with the innovation literature to identify the answers provided by innovation theory to the SME innovation agenda. The innovation literature is characterized by conceptual dichotomies (e.g. incremental vs radical or exploration vs exploitation) and by relating such 10 innovation dichotomies to the SME, a first more conceptual profile of SME innovation is generated. Looking at the dichotomies as scales with two extremes, a profile of “innovation with SME characteristics” can be found – not, however, a completely clear one and certainly one under change.

Turning to the studies and literature on SME innovation and focusing on trends and changes in the modes of innovation, five modes were identified and conceptualized: innovation by market selection; Innovation for niche markets; innovation as a sub-supplier; innovation as an integral part of transactions, and business model driven innovations.

Across these conventional and emerging innovation modes, it appears that the experiential knowledge of SMEs is very important and need to be conceptualized, reflected and put to use. This include linking better the broad scoped experiential knowledge with research-based knowledge. Furthermore, it also appears that networking is important, as SMEs increasingly need access to resources and capabilities of various types from outside. It is necessary to formulate an explicit network strategy for the SMEs, including membership of a cluster, which, if optimal, contains most of the needed linkages. Finally, while SMEs will remain weak on analytical, i.e. science based innovation, they have plenty of opportunities related to synthetic knowledge, i.e. combination of existing knowledge including their own experiential knowledge. In addition, SMEs may also add so-called symbolic knowledge, i.e. knowledge that provides meaning and legitimation to their market offers.

Sustainability could, but is not singled out as an innovation mode. Sustainability innovation requires a certain change of mindset to identify the innovation areas and it requires a reorientation of the innovation, focusing on how sustainability goals can be formulated into competitive advantages.

Finally, a preliminary set of propositions are formulated as a first step towards the conducting of an empirical analysis of (emerging) role and position of innovation within SMEs in perspective of the new global context.

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