Managing innovation for growth in high technology small firms

Abstract

This paper studies ways to support sustainable growth in high technology small firms by managing innovation. The paper examines technology based and knowledge intensive business service firms (KIBS) and their innovation management in Finland. The goal is to find at least one meaningful innovation process for a small KIBS firm that takes growth into consideration. In the paper incremental, radical, disruptive, open and systemic innovation are seen from small KIBS firm perspective a model that combines these types of innovation is presented. Two cases of small technology based small KIBS firms are also selected to closer examination.

Growth, knowledge creation and innovation in small KIBS firms

Growth can be seen in many ways in small firms. It can be seen as intention to grow or potential to grow. It may also be growth in competitiveness, effectiveness, turnover, profit, personnel, partners and networks, knowledge or innovativeness. In this paper growth through creation and commercialisation of new innovative services in KIBS is in focus. There are growth models for firms (like Greiner 1972, Churchill and Lewis 1983) but they are not studied in this paper as such.

In knowledge based economy competitiveness of firms is strongly based on innovation (Tidd et al. 2005). According to innovation management theories a systemic approach in management of innovation is needed (Rothwell 1992). Development and learning should be strategy based because it accelerates them. Many KIBS act in turbulent environments so strategy must have rather simple rules so that decisions can be done fast. Content of services is most important but selection of technologies and market demand must support the content and business models and service concepts.

In global knowledge based economy there is a transition from products to services and competition is based more on business concepts and models than on technology, products and services. While large firms focus to their core competencies and processes they outsource others than core processes including research and development and even the whole innovation chain or parts of it. Outsourcing of r&d is expanding to open innovation where new ideas are searched outside the organisations and also ways to commercialise ideas are looked outside the organisation as well. Global economy requires local and global presence simultaneously, knowledge intensity is increasing and new technologies enable novel processes. Value chains are breaking so that research is done on favourable regions and production is mostly moving and done close to large markets. Change is happening with accelerated speed in operating environment of firms and therefore also innovativeness is seen as a central source for competitiveness in firms.
Value creation in KIBS is not only based on creation of knowledge but also on combining, applying and accumulating knowledge from several sources. New business opportunities are based on change or combination of discontinuities (Prahalad and Ramaswamy 2004, Hamel 2000, Tidd et al. 2005, Bessant et al. 2005). Instead of innovating alone firms innovate in networks. Also innovation models have developed from linear models to iterative and interactive models (Rothwell 1994, Sundbo et al. 2006). Innovation process is a knowledge process (Tidd et al., 2005, Nonaka and Takeuchi 1995). Innovation is also based a combination of knowledge gathered from several sources instead of single knowledge (Henderson and Clarke 1990). Innovation should happen with right timing and cycles. For example during very fast growth the idea is to sell as much as possible because market share is then determined (Izosimov 2008).

Knowledge creation in collaboration requires physical and virtual interaction. Knowledge creation process is an interaction with tacit and explicit knowledge. One concrete form of organizing it is a hypertext organization (Nonaka and Takeuchi 1995) where the system consists of line organization, project teams and knowledge platform. With KIBS firms the hypertext organisation is built with customers. The value networks can be complex (Laine 2006). In Nonaka and Takeuchi model project managers and middle managers had a special role. In the model new product development process was considered to be the most important process in new knowledge creation. Focusing on knowledge creation can bring growth on mid term scale (Salojärvi). Also in small manufacturing firms active learning orientation (challenging the paradigm) is found to be related to growth (Sadler-Smith et al. 2001). Developing a new service or product is a problem solving process. The most usual way to solve problems is trial and error (von Hippel).

Networking should be managed according to firm’s innovation goals (Tidd et al. 2005, Laine 2006). In networks there are more trust and communication in inner parts or core of the network. Outer areas of the network are based on different rules and there is not as much trust and therefore also knowledge flows are smaller between actors (Ruuskanen, 2004). One strategy a small firm for optimising networking could be to have connections to partners who have a lot of contacts. Networked firms are better in recognition of new opportunities for collaboration and they make better strategic decisions. On special fields of technology best partners are often international partners (Lemola and Honkanen, 2004). Networks can also be used for innovating by brokering where ideas collected from one network are commercialised to other networks (Hardagon 2003). It is not networks itself but how you build and use them (Huston and Sakkab 2006).

Most of innovations are incremental meaning small improvements to existing products, services and processes. Incremental innovations seldom create fast growth but they can create slower growth with lower risk compared to radical or disruptive innovations. Incremental innovation is also more manageable than disruptive or radical innovation. Changes needed are smaller and also customer needs are clear (Tidd et al. 2005). Incremental innovation can also be used when KIBS service is started as radical or disruptive innovation and there is a need to improve process or technology after the launch of the service. If a small KIBS firm likes to start with an incremental innovation in services it will face challenges. It has to compete against more experienced firms with smaller resources. In beginning of a firm and entering markets a niche strategy seems to be easier for a small firm. In case of small KIBS a regional niche is often enough to start with. Small firms may also not have enough knowledge about customer acceptance because of their small customer interface. Therefore their possibilities to create successful incremental innovations are smaller.
Disruptive innovation is an interesting way for a KIBS firm to start because according to the theory of disruptive innovation it gives room for new entrants. It is based on identification on emerging technologies where small firms are good at. It should also be connected to market knowledge to create a low-end disruption or market disruption (Christensen 2004) Small firm can recognise opportunities well but they may lack market insight. Therefore to make a disruptive innovation successful small KIBS need to develop their market insight.

Open innovation model (Chesbrough 2003) has been followed with open business models (Chesbrough 2006). Open innovation is based on finding ideas outside the organisation and also finding new ways to commercialise new ideas through external channels. Large firms are disappointed to their r&d effectiveness (Chesbrought, 2006). They look for ideas in public research centres, universities and small firms. It is good to keep in mind that open innovation is not outsourcing where usually the same things are done cheaper in somewhere else. Goals should be clear when entering to open innovation (Huston and Sakkab 2006). One benefit in open innovation is also that selling the same technology or knowledge to others forces the seller to be competitive by adding value by other means. So from this point of view open innovation is an innovation incentive itself.

Systemic innovations can make the innovation more acceptable. Systemic innovation means using different dimensions of innovation simultaneously like if new technology is introduced to a certain process also process is developed at the same time (Teece 1986). When systemic innovation requires changes in adopting organisation it is not easy way to go for a small firm. Scalable business model enable growth. Scalable business model means that there are possibilities to increase turnover significantly without increasing the amount of work done. Therefore also pricing in KIBS firms should be based on added value and not on work done. Successful firms are found to innovate with concepts (Orihata and Watanabe) and they use competitive advantage to recognise new opportunities and not to sustaining their position on the market (Brown and Eisenhardt 1998). Future oriented planning and forecasting should create at least one meaningful future scenario for organisation (Hamel and Prahalad 1996).

Radical innovations are rare and the risk related to them is bigger than with other types of innovations. Therefore creation of a radical innovation is a challenge. Successful radical innovation combines change in technology or society, customer needs and strengths of the firm (Linturi 2007). Possibilities for small firms to create radical innovations depend also how radical is defined. Radical can be defined at least as new to firm, new to customer, new to field of industry and new to world. Three—quarters of attempts to grow outside the core fail (Zoo and Allen 2003).

One way to foster innovation and growth in innovative firms is to use public sector as an innovative customer. This means that public private partnerships are created where public sector pays for innovative firms to innovate for public sector. Demand supporting actions on public sector can be public procurement, standardisation and tax incentives. Growing R&D expenditure is not anymore enough to grow innovativeness in Europe. There is also a need to add support for marketing and demand of innovations (Aho et al.). Public buyers can have high volumes. They can help in creation of critical mass and diffusion of new technologies. They can help in lowering risks and accelerating learning. Their action can also foster scale benefits. Public customers can have an important role in young sectors and on sectors where their role is significant. In innovation favourable markets demand creates innovations. Public customers can also make new technologies more acceptable. Public actors can also
help firms to create regional niches. This helps firms to grow and create critical mass on their field of expertise. This kind of niche management (Lemola) also accelerates learning. Existing regulation does not hinder sustainable partnerships. It is the capability of actors to apply these regulations. Clear rules for long lasting partnerships are needed as well as to make the applying of them easier. Public procurement in innovative cases could be one central vehicle to lead small innovative firms to growth. They are seen to be important on new industry sectors (Halme and Kotilainen, 2008). When public demand is concentrating on innovative solutions it has an affect on innovation dynamics on sectors where public sector can have an important role like energy, environment and healthcare sectors to name some of them.

Innovation process in services and small firms

According to literature there are general steps common to almost all innovation processes: search, selection and implementation which are all combined to learning. It is not so important how the process is described and named than to have a process that works, is integrated and managed (Tidd et al.). Appropriate innovation management tools depend on dynamics of the environment and r&d cycle lengths (Aplilo et al. 2007). Competitive and dynamic environments foster shorter time scale, less than year and tools are more likely to be experiments, platforms and networking. With over three year scale strategic planning and research can be used. Project portfolio management is used between these two with one and two year scales (Aplilo et al. 2007).

Basically product innovation processes and service development processes are quite similar although services are intangible. Also same tools for managing innovation in services can be used than managing innovation in products (Hull 2005). Service development is perhaps more often starting from strategy and in service development it is common to connect customers to the development process from the very beginning. However, most innovative customers are not representing average mainstream customers. After first adaptors of the service there is a gap before mainstream users. A niche strategy with application is found to be essential in crossing this gap called “ the chasm” (Moore 1991).

Small firms differ from large ones in innovation. With lesser resources they have to create positive cash flow faster. So they must be better in making decisions and faster in reacting in the case of failure. Small firm’s future may be depending on a single project (Aplilo et al. 2007). On the other hand small firms are considered to be better in innovativeness, flexibility and agility compared to large firms. And they may be interested in technologies and knowledge that is not seen as interesting by large established firms (Laine 2006).

Factors that hinder innovation in services in Finland are found to be uncertainty of market demand, lack of knowledge and lack of funding (Statistic Central Finland). It is quite obvious that firms do not innovate as much as they could (Lemola and Honkanen 2004). In industry firms seem to have too few ideas and too few ways to exploit the ideas (Aplilo et al.).

In innovation process risk is always involved so there is a need for risk analysis. Analysis should be from several directions, considering all detected uncertainties (see for example Dunham 2002). In search for growth the risk evaluation should give bigger weight to return on investment, payback time, and value adding than other factors. However, in the cases
other than incremental innovation the economic calculations are very likely to be uncertain and indicative (Kettunen et al.).

Case studies

Two KIBS firm cases are selected to closer examination. The first called “Case A” is a firm that started eleven years ago and is producing simulation and optimisation services for industry. The second called “Case B” is a new firm started one year ago and produces software development services for industry based on open source, agile computing methods and their own development tools. Both firms have been started in the same incubator at Satakunta University of Applied Sciences in Finland and both of them value partnership with higher education and research institutions. Data presented here is based on several discussions, case studies, surveys and participating observation, value network analysis, and innovation management assessments, collaborative research and development projects. Some result of the case firm A have been published earlier (Laine 2004, 2006). The two case firms have used several means to improve their innovation performance. They are summed in Table 1 and also the benefits are described.

Idea screening and enrichment are more strongly based on strategy in case A. Both firms try to bundle public and private funding already in the beginning of their innovation process. They both say that they have a lot to learn on this field. Still most of the innovation process is funded by positive cash flow. This can be done by selling the idea generation phase and concept development phases to customers as well. Case A has been able to get funding also from foundations. For a small firm this can be remarkable help because reporting to foundations is usually lighter than reporting to many other external sources of funding.

Iterative development is used by both case firms. Case B uses an agile development method where iterative development is essential. Customers or lead customers are connected to their development processes. Interactive project management tools with customers are used intensively by case B. Both firms have created their own solution to share knowledge and documents with their customers. Those solutions include personal contacts and virtual environments. Experiments are used to test ideas and new technologies. Case A also heavily uses simulation. Case a sells risk analysis for its customers. Case B uses more intuitive style in risk analysis. Both are technology oriented. Both use demonstrations, prototypes and artefacts to convince customers and to make their ideas more tangible.

Both use platforms to create new service innovations. Platforms can be tested with universities or innovative customers. Case B makes cross sector benchmarking and adopts and further develops successful and promising models. This requires high absorption capacity and good knowledge of field of industry benchmarked. Case A uses project portfolio management. Case B uses customer portfolio management and looks for most profitable customers. However, most profitable customers are not necessarily the best ones to innovate with and therefore it also looks for innovative partners in other networks.

Case A is experienced and sophisticated in CRM with more experience on their field. They already have several tested ways to develop the relationships with their customers. Case a uses strongly visionary management. They have had the same vision since the beginning which actually it is more like a short statement (Kawasaki uses word “mantra” for this type of
that describes what they are doing. Both have multinational large firms as their customers.

<table>
<thead>
<tr>
<th>Tools and methods, processes</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iterative development</td>
<td>Lower risk in innovation</td>
</tr>
<tr>
<td>Experiments</td>
<td>Low cost idea testing, developing insight</td>
</tr>
<tr>
<td>Customer involvement in service development</td>
<td>Lower risk in innovation, accelerating insight</td>
</tr>
<tr>
<td>Internet based data storage for knowledge management and data exchange with customers</td>
<td>Accelerated learning, process improvement</td>
</tr>
<tr>
<td>Interactive project management tools with customers</td>
<td>Accelerated learning, fast feedback</td>
</tr>
<tr>
<td>Simulation software</td>
<td>Lowering risk, concept development</td>
</tr>
<tr>
<td>Risk analysis</td>
<td>Lowering risk</td>
</tr>
<tr>
<td>Demonstrations and prototypes, artefacts</td>
<td>Gaining credibility and mutual understanding, making intangible to tangible</td>
</tr>
<tr>
<td>Web 2.0 (social web) tools for interactive innovation process with partners</td>
<td>Cost effectiveness, increased interaction, mapped idea development process</td>
</tr>
<tr>
<td>Using open source software in service concept and their development</td>
<td>Cost effectiveness, transferring innovation to customers</td>
</tr>
<tr>
<td>Networking</td>
<td>Opportunity recognition</td>
</tr>
<tr>
<td>Partnering</td>
<td>Accelerated learning, opportunity recognition</td>
</tr>
<tr>
<td>Technology or software platforms</td>
<td>Fast development, credibility</td>
</tr>
<tr>
<td>Copying successful innovation</td>
<td>Benefiting from earlier success</td>
</tr>
<tr>
<td>Lead customers involved in new service development</td>
<td>Radical innovation</td>
</tr>
<tr>
<td>Project portfolio management</td>
<td>Allocating resources</td>
</tr>
<tr>
<td>Customer portfolio management</td>
<td>Customer focus</td>
</tr>
<tr>
<td>Customer relation management</td>
<td>Effective marketing of new ideas and concepts</td>
</tr>
<tr>
<td>Visionary management</td>
<td>Sustainable advantage, accelerated learning</td>
</tr>
<tr>
<td>Collaboration with large firms</td>
<td>Gaining credibility, accelerated learning, global business insight,</td>
</tr>
<tr>
<td>Collaboration with university</td>
<td>Credibility, opportunity recognition, idea enrichment, development of new services, knowledge and technology transfer, technology backup in decision making, incubator services and mentoring, additional resources</td>
</tr>
<tr>
<td>Mentoring</td>
<td>Business development, vision, sense making</td>
</tr>
<tr>
<td>Incubator</td>
<td>Successful start and survival, access to regional networks, first customer references</td>
</tr>
<tr>
<td>IPR management</td>
<td>Protection of own ideas, hindering competitors using same ideas, option to sell or license</td>
</tr>
<tr>
<td>Idea screening based on strategy and customer needs</td>
<td>Focus, critical mass</td>
</tr>
<tr>
<td>Public and private funding for development</td>
<td>Optimal mix of resources</td>
</tr>
<tr>
<td>Time horizons</td>
<td>Balancing visionary, strategic and operative decision making</td>
</tr>
<tr>
<td>Detecting changes to recognise opportunities</td>
<td>Possibility to disruptive innovation</td>
</tr>
<tr>
<td>Technology and market forecasting</td>
<td>Opportunity recognition and screening</td>
</tr>
<tr>
<td>Technology and service roadmaps</td>
<td>Timing, meaningful converging and diverging development paths, demand innovation</td>
</tr>
<tr>
<td>Scenario development</td>
<td>Finding meaningful path to future, developing strategic flexibility</td>
</tr>
<tr>
<td>Market research</td>
<td>Understanding real market demand</td>
</tr>
<tr>
<td>Innovation management audits</td>
<td>Finding strengths and weaknesses</td>
</tr>
<tr>
<td>Reference lists</td>
<td>Credibility</td>
</tr>
<tr>
<td>Scalable business models</td>
<td>More value added with same cost level</td>
</tr>
<tr>
<td>Niche management</td>
<td>Entering markets easier, crossing the chasm</td>
</tr>
</tbody>
</table>

Table 1. Innovation management tools and methods detected to be in use in case firms.
Case A uses strongly time horizons management. Both detect changes to recognise new opportunities. Case B has broader scanning in this. Case A uses technology and market forecasting, technology and service roadmaps and scenario development to make development future oriented and better timed. Market research used to detect real customer needs and potential. Both cases use open innovation with limited number of partners in idea generation and concept development. Case A is using also external channels to commercialise its innovations. Case A has a remarkable reference list.

Project based customer relations seem to create a challenge both for marketing and innovation. During a hectic project it is difficult to sell new projects or innovate more than necessary. Customer database with alarms may hep in marketing but mainly it is a resource question. Both firms want to develop the innovation processes beginning to be more systemic. Developing methods and processes in scanning the environment, idea generation, idea enrichment, screening of ideas and concept development. Case A wants to describe the processes and involve all to the innovation process. So innovation starts to be also a leadership challenge in case A.

Case A uses web 2.0 tools like blogs (weblog) and wikis (wikipedia type tools) with partners to create new service innovations. Both use open source software but Case B is almost totally based on open source tools and platforms. Case A has very strong networks. Social web tools help to map the innovation process. Discussions and comments are stored. This makes it easy to follow how discussion and idea enrichment has developed in time. All ideas remain in blog or similar tools and platforms and wait for enrichment or combination with other ideas for concept creation. The tools are very cost effective. Many of them are available for free as open source software or in other ways.

Both firms have been able to exploit networks effectively. There are signals of brokering where ideas collected from one network are commercialised to other networks (see Hardagon 2003). There are also dynamics in network development. Part of the dynamic seems to be emerging like strategy development. It is difficult to evaluate the value creation and strength of ties in their networks (Laine 2006, 2007). It looks like both are good in trust creation. They both seem to have analytical, creative and operational skill on their field so they are able to adapt to different network configurations. Without trust creation it is difficult to use interactive tools. Experiments create insight into innovation. They tell if ideas work or not. It is not high risk tolerance that is needed but low cost experiments that tell if ideas are worth exploiting (Hamel 2000). The firms have complex and dynamic strategies which are both emerging and planned.

Firms started in the same incubator and have been actively collaborating with university since then. The collaboration has covered opportunity recognition, idea enrichment, development of new concepts and services, business incubation, mentoring, forecasting, technology and knowledge back up, using students as development resources, using web 2.0 tools in innovation, innovation process development and collaborative research. Collaboration between small KIBS and university seem to create benefits to both parties. The KIBS can develop to a level where they start to be interesting partners for multinational companies as well. Feedback from entrepreneurs challenges university to rethink its role and make improvements to processes and gives insights to KIBS firm’s niche technology, knowledge and applications. Learning, idea generation and enrichment, concepts and knowledge are created for different reasons at university than in firms. Processes have been both goals.
oriented and open ended looking for creation of meaning (see Lester and Piore 2004 for analytical and interpretive interaction). It seems that the firms do well also without the university after the survival phase. However, they seem to come back now and then when they want to renew themselves (Laine 2004a). The university has also acted as an innovative public customer in collaborative development projects.

Innovation in small KIBS firms is not pure success. Failing, giving up, selling the business and going bankrupted are also choices that are present. These two case firms are using a complex set of tools and processes and systemic approach except in idea generation phase. However, firms do not necessarily recognise themselves that they are using a formal method. Both firms have done innovation management audits (see Tidd et al. 2005, pp. 564-569). Although they use sophisticated tools for knowledge management they both evaluated that they have most improvement potential in learning from innovation. Case B also evaluated itself to be relatively better in radical innovation than incremental innovation.

One of the key issues from the point of view of growth seems to be how to develop from customer based knowledge and business models to generic knowledge and from customer based business models to generic models. And still how to use scalable business models in development. Still there are open questions like does immaterial property management help in knowledge intensive services. In most cases only trademarks can be used. Open innovation is a challenge for small firms because of immaterial property rights. Case A has been able to protect some of their service products with trademarks. None of the two cases has a strong immaterial property rights management or knowledge on the field. The Case B firm works on a sector where changes are so fast that immaterial property protection loses its meaning and the position of small firms can be stronger. Case A was mentored by experienced expert with strong views on the field in the beginning. It had an influence also on their innovation performance.

Results

According to case studies and theories the study suggests that one possible innovation process for growth in a small KIBS firm may be as following:

1. Detecting disruptive technologies, markets and changes as opportunities,
2. idea generation and enrichment with partners and innovative customers,
3. screening and selection based on (emerging) strategy,
4. fast concept development with most innovative customers,
5. first launch of new service as “simple but working”,
6. improvements based on first customer experiments,
7. creation of generic niche application,
8. second launch for all potential niche customers,
9. incremental innovation with new customers and
10. return to step one.

Although this process is described as a linear one it is actually interactive and iterative. Interactions happen within the phases between actors involved. Iterations are both within the phases and between the phases. In phases 1, 2, 4, 6 and 9 social web tools are suitable. It is the step 7 that makes this process suitable for growth. In step 7 can also be new features be added to make the application more attractive like in the case of systemic innovation. The business model in this step should be scalable. From step 10 there is also an option for
returning to step 7 to create new niche applications. That could not be proved by the cases. The model uses open innovation only in idea generation. Although case A uses open innovation also in commercialisation it was no added to model because of lack of data. The studied innovation processes in the cases seemed to have common elements also found in literature (Van de Ven et al. 2008).

Trust creation is found to be essential from point of view of knowledge creation for innovation. Credibility and acceptance of new technology and processes are also important issues for marketing. Niche management is needed in entering the market and niche applications crossing from innovative customers to mainstream customers. Processes are often long so patience and also in many cases positive cash flow from other sources or external funding are needed.

Conclusions

The results indicate that small KIBS firms looking for growth can benefit several types of innovation and tools to achieve them. It is suggested to combine tools and processes from at least disruptive innovation, open innovation, systemic innovation, incremental innovation and even radical innovation as well. A systemic approach is needed not only in innovation process but also in combining the tools and methods. The model presented in this paper is only one possible solution and is based on two case firms. The subject deserves additional studies to find other models like using open innovation for commercialisation in small firms.

References


Christensen, C., Anthony, S. and Roth, E. 2004. Seeing What’s Next: Using the Theories of


Linturi, R. 2007. ”Radikaalien innovaatioiden tunnistaminen yrityksissä” seminaariesitelmä. [Presentation in Detecting Radical Innovations in Firms seminar, in Finnish], Pori 25.9.


Statistic Center Finland. http://www.stat.fi


