The Future Center as a Catalyzer for Innovation Ecology in Science & Technology Parks

Paper for IASP conference, Barcelona 2007

Dr. Ron Dvir, Tomas Garcia. Fernando Ozores, Yael Shwartzberg

Executive Summary

Nourishing an environment that enhance and catalyze innovation systematically is a complex multi-dimensional challenge. Firstly, we suggest a conceptual framework for an innovation ecology, composed of fourteen interlinked building blocks: time space, physical space, virtual space, organizational space, processes, strategic focus, diversity, future orientation, knowledge management, challenge focus, rewarding, teams and leadership. Together, these elements create the climate and opportunities for significant, focused, ground breaking on going conversations between the stakeholders, and in turn, such conversations bring about innovation.

Secondly, we show how these innovation ecology building blocks can be applied to Science & Technology Parks (STP) in order to enhance their performance. We suggest to establish "Future Centers" in STP, as a vehicle to realize the innovation ecology dimensions. The notion of "Future Centers" was developed in the last decade, and since 1996 about 20 centers were established. The paper describes the concept, and provides two case studies.

Analyzing in details all dimensions of innovation ecology is beyond the scope of this paper. However, the paper is concluded with an exploration of virtual/ technological space We show how a wide range of information technologies can be applied to STPs as part of a systematic ecology for innovation.

Background: Innovation Ecology

What is Innovation Ecology?

In this section we present a set of principles for an organisational climate that fosters knowledge creation and innovation – the principles of Innovation Ecology. The research on this subject is well developed in the domain of formal business organisations, and therefore many of the references in this section refer to that world. However, it is suggested that the same principles can be applied also to not-business domains in general, and knowledge cities in particular. This argument will be elaborated in the next section.

According to George Por (2001), a successful work ecology is a *"complete, organic, Ecosystem. It integrates many disciplines together to produce a dynamic, holistic view of the workplace and its relationship to its environment. It addresses all elements that make up today's high velocity, rapidly changing workplace, especially the way they interact in the form of work to produce the outcomes needed by the enterprise and its stakeholders"* (Ward A., 1999). It is a rich "stew" of interdependent elements, continuously interacting and adapting to produce outcomes that ensure the vitality and sustainability of the enterprise (Por, 1999).

Great leaders create conditions that bring out people's ability to produce extraordinary results. Central to that task is the creation of a climate for innovation, which is a force field that guides managers and intrapreneurs towards innovation – or against it (Pinchot & Pellman, 1999).

Innovation Ecology is the work environment , a setting that can enable, encourage, foster, and catalzse the generation of ideas and creation of value out of them. It supports individuals, teams, and the whole organisation in the journey towards sustainable growth and success that are based on on-going innovation.

The building blocks of Innovation Ecology

The Ecology of Innovation is a complex system composed of many interlinked dimensions. Here we list some of the more influential ones, categorized into three groups: space, cultural and focus building blocks.

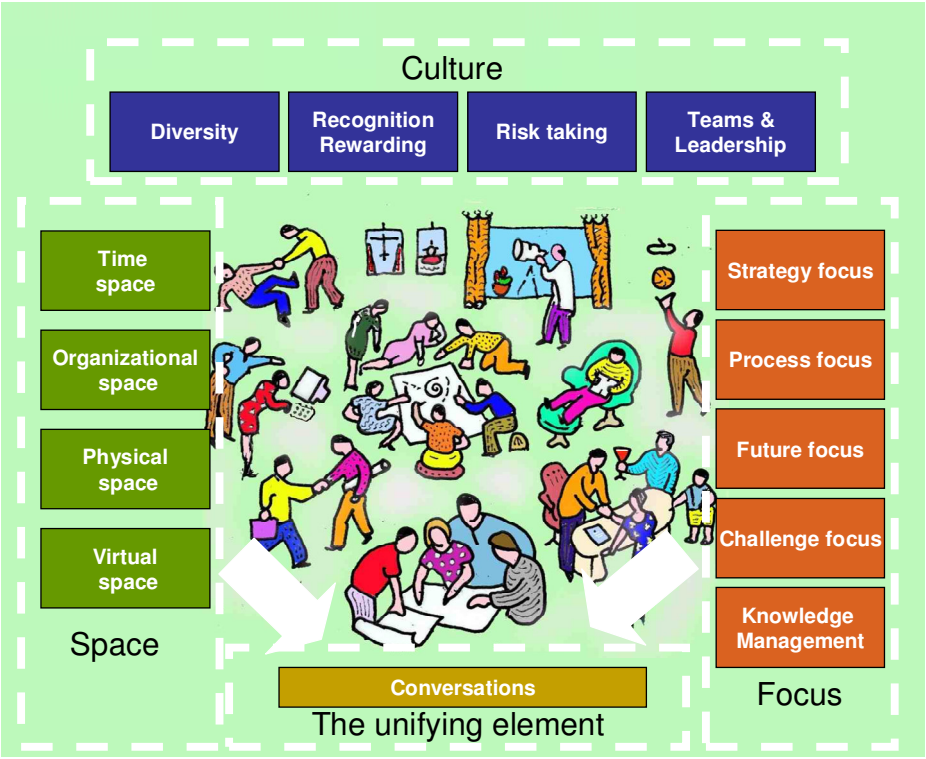

Figure 1: the 14 elements of innovation ecology

The following section provides a short description of each building block (adopted from Dvir & al, 2006). This section also mentions how future centers (which are described n detailed in a alter part of the paper) support the realization of these building blocks.

Building Block 1. TIME Space New ideas require exploration before their value can be demonstrated to others. Innovative organisations give people the freedom to use some of their time to explore ideas without having to ask permission (Pinchot and Pellman, 1999). Future Centers provide people with the opportunity to leave their daily routine and dedicate time to thinking and preparing for the future.

Building Block 2. PHYSICAL SPACE: In an economy based on innovation, what better use can there be for space than to inspire creativity? Several innovative organisations believe that creative space – both the shared space and the private office – can significantly contribute to the organisational atmosphere of wild ideas, action, positive chaos, open mindedness, and barrier-breaking behaviour (Ward, 1999; Kelley, 2000). The playful design of most Future Centers clearly demonstrates this idea. Almost all Future Centers are composed of multiple working areas, each featuring a completely different atmosphere.

Building Block 3. VIRTUAL SPACE: In the typical innovative organisation of the 21st century, technology has multiple supportive roles, such as facilitating collaboration between distant members and streamlining and catalyzing the flow of ideas, as demonstrated forcefully for example by the British Telecom Ideas Management Intranet system (Lakin 2001). Nonaka, when discussing the concept of Ba, a space for knowledge creation, suggests that it can also take a virtual form, a "Cyber Ba" (Nonaka and Konno, 1998).

***Element 4. ORGANISATIONAL STRUCTURE*:** Flat organisational structure, weak boundaries between departments, low emphasis on hierarchy, and perhaps even a loosely defined structure increase the chances that the organisation will enhance, rather than inhibit, the generation, flow and leverage of ideas. Organisational forms are of fundamental importance to innovation. Different kinds of innovation have different characteristics and require different organisational forms and managerial approaches in order to be successful (Damaskopolus, 2002). Integrated project teams, multi-disciplinary teams, virtual teams, future centres, and internal incubators are examples of forms that contribute to innovation.

***Building Block* 5. FUTURE FOCUS:** In a turbulent environment, there is continuous tension between the day-to-day challenges, tasks and problems and the need to focus on the future. In organisations that excel at innovation, the top priority issue is the future. In other companies, most management and employee attention is directed towards "fire-fighting" and short-term objectives. "The future is 14 seconds away" argued Leif Edvinsson (2003), who then created the Skandia Future Center, with the explicit objective of "turning the future into an asset".

***Building Block* 6. CHALLENGE FOCUS:** Open ended, non-structured tasks engender higher creativity than narrow jobs. Most people respond positively when they are challenged and provided with sufficient scope to generate novel solutions (Ahmed, 1998). We found that most Future Centers were established in response to a serious organisational challenge, like for example, when their mother organisation faced a risk of fierce(r) competition for external players. A key assumption implied by this finding is that a Future Center that addresses non-critical issues is not sustainable.

***Building Block 7.* STRATEGY FOCUS:** In an innovative environment, the vision and strategic intent of the organisation is clearly communicated to all employees. This joins all creative forces and energies and directs them towards the strategic benefit of the organisation (Pinchot, 1997). In our visits to nine Future Centers, we discovered that if they were not working closely with the organisation strategy, they might suffer from being seen as too detached from reality and of little practical value to the organisation (in other words, seen as an "ivory tower").

***Building Block 8.* PROCESSES FOCUS:** Academic studies have found that serendipity is key to recurring innovation (e.g. Koeing, 2000). Since serendipity by definition cannot be

ordered to demand, innovative companies must enable and protect the possibility that surprises can occur. Serendipity, intuition, experience, scanning, and relationships are sources of surprise (Cope, 1998). At the same time, without a powerful process to capture 'good' ideas and turn them into value, most ideas will vanish without having a fair chance to make their way through a serious evaluation, development and "testing funnel" phase. Maintaining a degree of tension between structure and creativity can be useful, and the inherent conflicts between them should not be completely resolved (Brown and Duguid, 2001). In all Future Centers, extensive use of robust creativity, innovation and futurising supporting methodologies, processes and tools is made – some of them developed by Future Center teams themselves.

***Building Block* 9. KNOWLEDGE MANAGEMENT**: Management of the existing knowledge of the organisation provides a solid foundation for the creation of new knowledge (Ruggles and Ross, 1997), which should be acknowledged as being embedded in values and processes as much as in the content this generates. In a typical Future Center, the library is located in a central place in order to make the knowledge resources accessible and symbolise the importance of looking at the past as well as sideways when preparing for the future. Similarly, most Future Centers are equipped with networked workstations to provide access to a virtual knowledge world.

***Building Block 10. TOLERANCE of RISK*:** Innovative organisations promote risk taking**.** Innovation requires learning new things, experimentation, and pushing the boundaries of the unknown. The leaders of such organisations invite and reward (clever) risk taking and do not punish mistakes. Failures are taken as golden learning opportunities. Future Centers encourage out-of-the-box thinking, breaking assumptions and taking risks (Kelley, 2000).

***Building Block* 11. DIVERSITY**: Similar people will generate similar ideas. Some innovative organisations deliberately increase diversity in the work force. Diverse experiences, cultural backgrounds, professions, academic backgrounds, ages, and personalities contribute to the creation of fruitful dialogues based on multiple perspectives (Naimen, 1998). In the Skandia Future Center, the team used a 3 Generation model, involving young, middle-aged, and senior employees, in addition to pensioners in workshops, in order to ensure multiple perspectives. For the same reason, about 50% of the participants at Skandia Future Center's activities were from outside the company. Similarly, in the Be'er Sheva Pisga Future Center, the team insists on what they call a "360 degree" list of participants, with not not only educators, but also business people, academics, artists, and others.

***Building Block 12. TEAMS and LEADERSHIP*:** A strong team as well as visionary leaders are essential building blocks of the Future Centers studied. These leaders are usually carefully selected and trained masters of group processes, facilitation, creativity, change management processes and complementary skills. The Future Center was always the vision of ('dreamed up by') an influential person from within the organisation, who recognised the need to renew the organisation – and take a systematic approach towards this end.

Building Block 13. RECOGNITION & INCENTIVE SYSTEMS: Creative people are self-motivated. However, all innovation researchers, leaders and practitioners agree that rewarding innovation can contribute to its success. There is an open dispute about the appropriate mechanism to reward innovation. In some organisations, there are significant direct financial

incentives related to the financial expected contribution of the innovation. For example, in Pfizer, the creative people enjoy a faster career path, salary increases and prizes for individuals and teams (Kanter, Kao and Wiersema, 1997). Others believe that the softer ways are preferred: public recognition, attention from management, and symbolic signs of recognition.

Building Block 14. –CONVERSATIONS – The UNIFYING PRINCIPLE: Alan Webber argues that "*conversations inside and outside the company are the chief mechanism for making change and renewal an ongoing part of the company's culture*" (quoted in Stewart, 2001). They are a core element of all Future Centers, and "community conversation" is the core element of the model of Regional Future Centers subsequently presented.

Why systematic management of Innovation Ecology is important for STPs?

STPs are characterized by an intensive concentration of Human Capital. By their very nature, scope of work and structure STPs host a large number of knowledgably, creative and experienced scientists and developers. STPs are also characterized by a rich Structural Capital, in the form of organizational structures, R&D procedures, scientific repositories, information technologies infrastructures and more (for detailed description of the Intellectual Capital model, see for example Edvinsson et. al 1999).

However, we suggest that explicit attention to the dimensions of the Ecology of Innovation can leverage the extensive Intellectual Capital of STPs. We hypothesize that even a rough analysis of the actual operation of STPs would show that at most of them, at least some of the innovation ecology elements are not handled and managed very well. There are many cases where the physical environment is dull, organizational structure calls for silos approach and knowledge hindering, the rewarding system does not encourage innovativeness, time pressures avoid fundamental innovation and lead to incremental innovation, the long term focus is not nourished, etc. Hence, a systematic approach to the development of all aspects of the STP innovation climate is needed.

Future Center as an a catalyst for innovation ecology

What is a Future Center?

A future center is a facilitated organizational space dedicated to support an organization in its efforts to prepare systematically for the future and address it in a proactive way. Future centers nourish radical innovation and complement other functions of the organization. Future Centers have been established in the last decade by wide range of organizations. For example:

- Commercial organizations – e.g. Skandia future Center (Sweden), Ericsson Foresgiht (Sweden).
- Governmental organizations – e.g. MindLab – the future center of the ministry of industry (Denmark), the SZW academy – the future center of the welfare ministry (the Netherlands), .
- Public organizations- e.g. Future Focus of the Royal Mail (UK)
- Cities and Regions – e.g. the Future Center of Education, Beer Sheva City (Israel), the Momentum Future center (Denmark).

- STPs – the Oasis Future Center, Finland, and Sde Boker Advanced Water Technologies Future Center.

Each future center is unique in structure, mode of operation and mission. However, all of thme are based on all or most of the following elements: a dedicated physical space (in the range of 400-1200 Square meters, usually in a stand alone building or a dedicated flour); a dedicated team of 3-8 employees who operate the place and facilitate future oriented activities; a set of facilitation, brainstorming and prototyping tools and methods; a virtual infrastructure that enable to extend the extend the reach and impact of the place.

The European Commission funded research project Open Futures explore about 20 future centers and analyze them using four lenses: the organizational, methodological, physical and technological – and develops an "operating system" which provide the guidelines for creating the above elements (Dvir et al, 2006).

As stated above, each Future Center has a unique operational mode. For the scope of this paper, we describe here a typical FC projects lifecycle – based on the way the PISGA Educational future center of Beer Sheva city operates. The process is illustrated in the following chart:

A. A multi-disciplinary group of stakeholders discuss a important challenge, using multiple perspectives. This process is conducted through a series of facilitated workshops
B. The results of the workshop series are translated into "future images" – showing alternative futures and scenarios.
C. The process owners translate the future images into a set of concrete initiatives. Typically, such initiative involves the development of a new service/ product/ policy / method.
D. The "intelligence tower" is used to scan emerging future trends, best practices, emerging challenges – thus provide the stakeholders with the information needed for informed meaningful conversations.
E. Prototypes of the selected initiatives are developed in the innovation lab -
F. The prototypes are tested by potential users – and then refined and fully deployed.

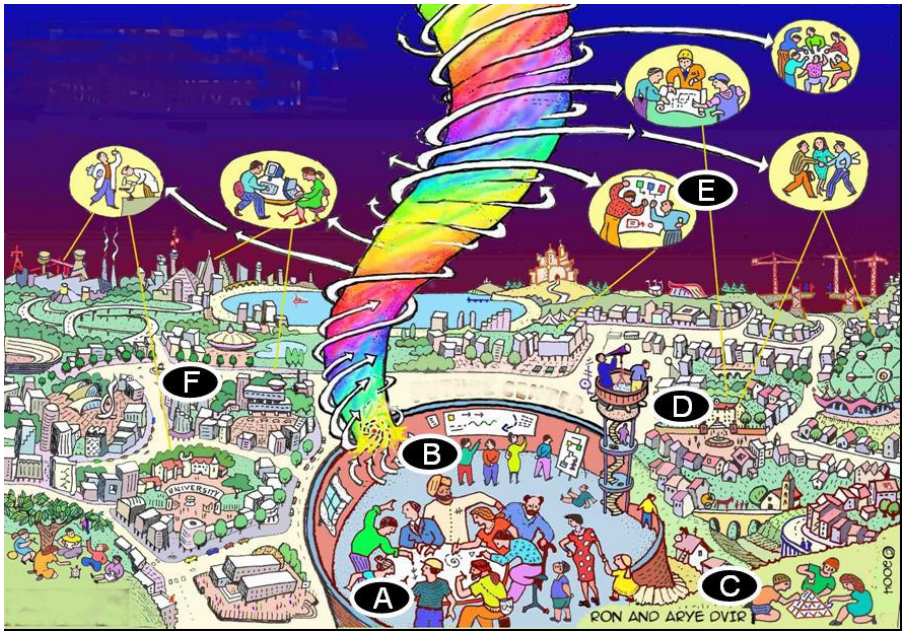

Figure 2: a conceptual view of a generic process in a Future Center

How future centers intensify Innovation Ecology of an organization?

An analysis of Future Centers shows that each of the 14 building blocks of the ecology of innovation is addressed explicitly in Future Centers. (For a detailed example see analysis of how Skandia and Sydkraft FC contributed to the ecology f innovation of their respective organizations in: Dvir and Pasher, 2002. A detailed example of how innovation ecology is realized through future center in the education domain is provided in Dvir et al 2006).

A future center is a dedicated innovation laboratory based on the principles of innovation ecology. However, the idea is not to create a stand alone "tower of ivory" which acts as the perfect innovative place for selected employees but is isolated for the main organization, and its main stream operations. Rather, the approach is to invite employees and other stakeholders to prototype and experiment with new ways of working, thinking, foresighting and collaborating – and then take the learning, ideas, working principles and methods back to their normal working environment – be it a school, laboratory, development department, directorate etc. Moreover, the continuous connection between the center and all parts of the organization is maintained through diverse mechanisms. For example, Ericsson Foresight future center established a network of 30 ambassadors – key players in its 30 business units connecting the center to the organizational reality (Dvir et al, 2002).

Future Centers for STPs?

By definition, STPs deal with the future on a daily basis. They explore, invent, create and develop new theories, technologies and sometimes even products & services – addressing future needs, challenges and opportunities. However, we suggest adding an additional element to the fabric of a STP – a dedicated organizational space which will leverage the human and structural capital of the STP. It would act as a:

- Place for facilitated conversations of the internal and external stakeholder – triggering multi-perspective analysis of current and emerging research, potential collaborations, and possibly joint strategies between different organizations working in the STP.
- A "one stop shop" for external actors – coming to explore what the STP companies can offer. It would also facilitate the conceptualization of integrated solutions composed of technologies and other scientific developments created by the different inhabitants of the STP.
- A laboratory and demonstrator of the most advanced working environments, methods and tools. As in the case of other types of FCs, the experience of working for a few days at the center will encourage STP people to embed the advanced methods in their own laboratory.
- An observation tower – providing professional business and technological intelligence services.
- A future compass – triggering continuously future focused thinking, maintaining the "big future picture".
- An effective training center for employees of the STP companies – a place to experiment with and acquire "future skills" – capabilities to handle the future systematically (e.g. foresighting, forecasting, businesses intelligence, trends catching, scenarios planning etc.).
- A landmark for the STP, providing a clear image of the collaborative character of the STP and branding it as a future oriented institution. Such image is important for attracting investors, inhabitants and employees.

The following sections demonstrate briefly two alternative approaches to the implementation of FC in a STP.

The case of advanced water technologies future center

A strategic analysis of the global water technologies market, as well as the relative advantages of Israeli academic institutions and industrial companies showed that the country can become a leading player in this rapidly growing market.

As part of a national strategic program of the state of Israel to promote the Negev zone (the southern desert) the government decided to support the establishment of large scale research center for advanced water technologies in Sde Boker. The vision includes a significant academic research center, science park, technology incubators, experiments area (which actually extend to a large part of the Negev desert) and possibly an international research institute to be established by one of the larger global corporations acting in water technologies field.

In order to maximize the knowledge and innovation productivity of this national research center and leverage the intensive intellectual capital of the tenets of the water technologies development center, it was suggested to establish in it a future center which will provide several benefits and value adding roles:

A. Integrate and synergize the research and development efforts of the different players
B. Trigger collaboration between the internal actors and with external stakeholders (e.g. governmental bodies, standardization institutes, educational institutes etc.)
C. Facilitate long term visioning processes, inviting multi-perspective foresighting and "Out-of-the-box" ideas
D. Serve as a center for business and technology intelligence (what does the market need? What are the competitors doing? What are the emerging technologies in other places?)
E. Act as a "one stop shop" for potential buyers of advanced water technologies. As such, it will act as a visitor center, demonstration site and in a way – a museum for future water technologies.
F. Provide opportunities for all stakeholders to discuss seriously various aspects of water technologies (such as their political, socials, economical, and ecological aspects).
G. And finally, enhance the image of the Israeli advanced water technologies industry in general, and Sde Boker research & development center in particular as forward thinking global leaders in their field.

The following figure shows the way the future center will be connected to the different players at the Sde Boker research center.

Figure 5: a future center at the heart of the water technologies STP – a conceptual view (Dvir & Shwartzberg, 2006)

The conceptual plan of the center, showing its main functions, is outlined in the following chart, showing its eights conceptual functions:

1. ***Conversation space*** – this is the essence of the center – a place for conversations or "meetings of minds".
2. ***Knowledge Center*** – a business and intelligence center, providing access and enabling sharing of the knowledge resources created by the center's stakeholders. The metaphoric ***Outlook Tower*** is an important part of this business and technology intelligence function.
3. ***Future Museum*** – where current challenges and future emerging technologies and approaches are presented. This is a place to present "future images" of the domain.
4. ***Visitor Center*** – a "one stop shop" to expose the technologies and products developed at the water technologies center – both stand alone offerings and integrated solutions involving building blocks created by different tenets.
5. ***Learning Center*** – were both internal and external stakeholders can learn through diverse range of training forms.
6. ***Innovation Lab*** – a think tank for conceptualizing break through solutions (but the actual development will be done in the extensive R&D institutions around the future center.
7. ***Coordination Functions*** – responsible for promoting synergic mode of operation of the complete advanced water technologies STP, seeking opportunities for joint initiatives and ventures.
8. ***Virtual Future Center*** – complementing the physical, face to face activities of the center, enabling to enhance the circle of users beyond geographical boundaries.

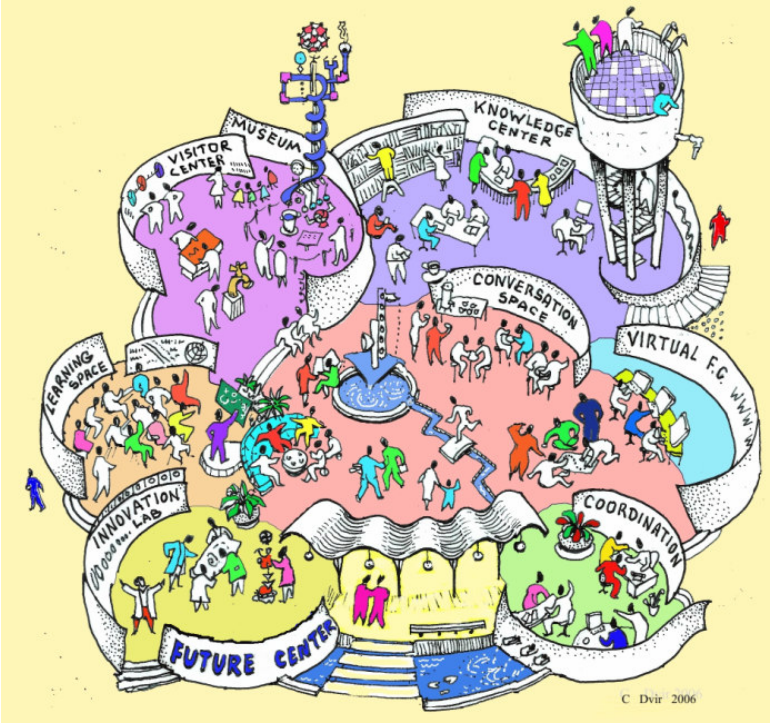

Figure 5: a future center at the heart of the water technologies STP – a conceptual view (Dvir & Shwartzberg, 2006)

The case of Network Oasis

Network Oasis Future Center was established in 2006 in the Finish JOENSUU Science Park. The early prototype, FlexLab, operated since 2004.

The vision of netWork Oasis is to act as "a collaborative working, learning and development environment. It is a space designed to inspire spontaneous and guided interactions of different individuals. It empowers individuals, groups and communities to be creative and functions as a breeding environment for new, unique and competitive combinations of expertise". ((Kakko and Inkinen 2005)

The place has two main operation modes:

- ☐ Running workshop and other future oriented facilitated activities.
- ☐ Renting work spaces to individuals from the science park – who prefer to work in this innovative working environment rather then in their normal office environment. The facilities (desks, individual offices, meetings rooms, cafeteria etc) are shared.

The center philosophy is illustrated in the following chart:

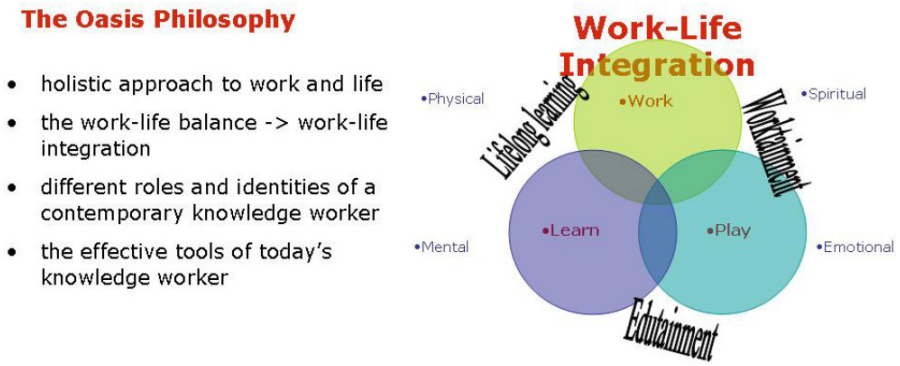

Figure 3: the Philosophy of Jonseuu Since Park future Center (Kakko and Inkinen 2005)

The center innovative working environment is illustrated in the following chart:

Figure 4: the layout of Jonseuu Since Park future Center (Kakko and Inkinen 2005)

NetworkOasis invest considerable efforts in prototyping new ways of interfacing the digital and physical working environment. It has developed a system called OasisGlow. One of its features is the automatic identification of the location of people working at the place through RFID technology – which enables a wide range of location based services at the center itself and over the web. The center prototypes new approaches to blending real and virtual realities as one option of future working environments (Chernenko, 2006).

The technological dimension

The paper presented a complex framework of 12 dimensions of innovation ecology. As a detailed analysis of all 12 dimensions is beyond the scope of the paper, we chose to focus on one of them – namely the technological dimension. In the chapter we show how well established and emerging technologies support innovation ecology in general and innovation in STP in particular.

How Information Technologies support innovation ecology?

Technology is really only the establishing base and the mechanics of the innovation process but real innovation is about great people generating and then implementing new ideas and driving them forward. With this supporting role, technology must provide a useful framework that enables the precise and optimal realization of the goals addressed at the innovation ecology dimensions. Furthermore, innovation-enabling technologies underpin the interaction between the human and structural capital and reinforce Future Centers as catalyzers for sustainable innovation.

The analysis of the many (either established or emerging) technologies that can support innovation at STP identifies some groups of different functions and goals (collaboration and participation, knowledge management, communication and creative process). The following tag cloud picture below sums up the memes and technologies that can support and enable innovation at STP according to these functions:

Figure 6: A map of innovation ecology enabling technologies (Garcia, 2007)

Participation

With the aim of harnessing collective intelligence, Social Software technologies such as weblogs, social book-marking, wikis, podcasting, RSS feeds (and other forms of many-to-many publishing), social software, Web APIs (Google maps), Web standards and online Web services represent a very powerful vehicle to share and disseminate knowledge at STP and embodies a clear example of what diversity and collaboration mean. (e.g. Oreilly 20050.

The combination of these social-networking systems with tag-based *folksonomy* (user generated taxonomy) like blogs and wikis can set up the basis for a semantic web environment that can springboard innovation in the virtual space level by the enhancement of social interaction between internal and external stakeholders of the STP community sharing knowledge and experiences.

Communication Tools

Communication and conversation are key functions to nurture ideas and opportunities, being a core element of the Innovation Ecology at STP. Most of the enabling factors support and enable communication and conversations as a unifying element. For example, the physical space, the virtual space, the time space, the challenge space (which calls for meaningful conversations), diversity – all are important enables of innovative conversations.

Technology plays a fundamental role when communication does not rely on face to face encounters (i.e. videoconferencing, chat, mail). Thus, on-line applications like VoIP and IMS (Instant Messaging Systems) e.g. Skype, Gtalk or Jabber represent a good example of video, audio and data convergence in communications (videocasting and podcasting can stimulate conversations and debate within the challenge space for example). Wireless communication (i.e. Wifi, UMTS and emerging broadband technologies like WiMax) add the mobility function.

At this level it is interesting to point out the diverse uses that wearable computing systems can bring to innovation ecology at STPs, specially those aspects related to the following innovation ecology building blocks:

- Organizational space: impacted with the different interactions between users, machines and the organization, new organizational structures, new functions, new career paths (which also impacts with the recognition and rewarding factor)…
- Physical environment (personal or common workspaces where the employee performs her tasks) and
- Time (how can STP members benefit from these emerging technologies out of their working hours)

Creative Thinking Process Tools

We have seen the importance of having a balance between structured processes and spontaneity to generate and capture the good ideas and turn them into real added value. IT provides today many solutions to tackle idea management processes based on workflow applications.

The ideation phase can be also supported by software tools that facilitate the creative process by providing systems that stimulate the flow of ideas. Brainstorming and mind mapping software are just a few examples of how IT can leverage the creative momentum by providing means to stimulate and capture the individual or group creativity.

In that direction, researchers are looking at the potential business impact of virtual worlds and massively multiplayer online games (MMOG) capable of supporting hundreds or thousands of players simultaneously. IBM is using the Second Life virtual world to host employee meetings which brings a lot of interesting opportunities - group brainstorming, challenge meetings, future visioning, scenarios planning, forecasting, foresighting, corporate presentations for leaders, team meetings, parties, break-out sessions, sporadic encounters with other people from the STP, etc (LaMonica 2006). Most provide some basic building tools and the ability to host activities and events that revolve around a wide variety of topics.

There are many different types of virtual worlds; however there are six features all of them have in common:

1. Shared Space: the world allows many users to participate at once. Thus, these virtual spaces can be used as a collaborative space for discussion and idea exchange between different stakeholders within the STP.

2. Graphical User Interface: the world depicts space visually, ranging in style from 2D "cartoon" imagery to more immersive 3D environments. Members of STP can also been represented by avatars,

3D or 2D representation of himself/herself used on internet forums and other communities (i.e. Yahoo Messenger, Second Life, etc.) or a text construct found on early systems such as MUD role games (Multi-User Dungeon, or Domain, or Dimension).

3. Immediacy: interaction takes place in real time. As said before, it allows instant meetings of any purpose.

4. Interactivity: the world allows users to alter, develop, build, or submit customized content. This playful environment becomes a perfect virtual lab for pilots and demos and a playground for people to test ideas.

5. Persistence: the world's existence continues regardless of whether individual users are logged in.

6. Socialization/Community: the world allows and encourages the formation of in-world social groups like teams, guilds, clubs, cliques, housemates, neighborhoods, etc.

Some virtual worlds have been created for educational purposes. Educational worlds come in a wide variety of forms, including 3D recreations of museum and gallery spaces, computer programming tutorials, virtual libraries, and meeting spaces for online courses. This is mostly valuable for STP as it can virtually implement many of the (virtual visitor center and showroom, STP museum, learning space, virtual lab, etc.).

Knowledge Management Technologies

In the last 20 years, KM technologies have defeated most of the time and space barriers that professionals were facing in their day-to-day jobs. Nowadays there is a wide offer of technologies and solutions with different levels of complexity, which can support Future Center activities inside STPs. Moreover, in the following decade emerging technologies (e.g. natural language recognition, semantic webs, artificial intelligence, etc.) will be a commodity that will raise efficiency and may radically change the way humans manage knowledge. (BT Technology Timeline 2006-2051)

Essentially, both existing and emerging technologies in this field are clearly supporting the **Virtual Space** and the **Knowledge Management** of Future Centers. STPs shall therefore choose the tools that could better fit with their KM objectives.

1. Obtain/Create knowledge
2. Organize knowledge
3. Share knowledge
4. Transfer/Use knowledge

Some examples are

- Yellow pages (who is who);
- E-groups (Communities of practice)
- Online surveys
- Call centers
- Intranet, extranet and virtual workspaces
- Product Data Management
- Business Intelligence tools
- E-learning platforms
- Document and Content Managements
- Ontology and Metadata technologies
- Knowledge representation (concept mapping, semantic networks, hypertext, information modeling)

- Intelligent agents
- Search engines
- Natural language recognition
- Artificial intelligence

In addition, some of these tools can contribute to raise **Diversity** and built new **Organizational Spaces** inside Future Centers. As the concept Open Innovation is gaining acceptance across executive management, Future Centers can support innovation networks to find the most convenient profile inside the STP at any time.

Yellow pages (who is who), Knowledge maps and e-groups (e.g. communities of practice), can effectively help managers build work teams with higher diversity, by identifying and clustering professionals based on their expertise and areas of interest. These tools shall defeat the existing barriers among companies in order to build effective innovation networks inside STPs.

Finally, specific Product Data Management and Legacy systems can contribute some of the innovation **Processes** inside STPs. As innovation networks grow and become more dynamic, they require specific KM technologies that can ease the product development process and ensure quality management of artifacts and deliverables. In parallel Business Intelligence technology, acting as an observation tower, results a perfect complement tool for Technology Watch.

Note: for more information on innovation supporting technologies that could be used in future centers, see the sites referred to at the "reference - additional resources" section

How Information Technologies are embedded in Future Centers?

The Open Futures research project mentioned above explores the use of technologies in future centers, as one of the four perspectives or lenses used to analysis their operation (Dvir et al 2006). The application of advanced information technologies in future centers serves two objectives.

Firstly, advanced technologies are used to facilitate, support and enhance the human interactions at future centers. For example: advanced multimedia technologies in the SZW Academy Future Center, electronic group meetings systems in the Country House future center, information kiosks in Skandia future center, virtual tours in Beer Sheva future center, RFID technologies in Juensuu NetWork Oasis future center. It should be noted that these places maintain a careful Hi-Tech Hi-touch balance (following the approach of Naisbitt, 2000), and technology does not replace the human, face to face, home like interactions at the center but rather complement and sometimes enhance it.

Secondly, the future center is used as a test bed for the organization to experiment with new ways of working in general, and the use of new technologies in particular. As such, it acts as a change agent, assuming that employees and other visitors that "play" with the new technology at their visit to the center might adopt it for their day to day operation in their regular work space.

Conclusions and further Research

The paper suggested creating and integrating a Future Center in the complex structure of STPs. The new functions and place will act as a space to leverage the intellectual capital of STPs, supporting and enriching all of the building blocks of their innovation ecology.

The concept of future center is emerging, since the first center was established only 11 years ago. In the context of STPs, several dilemmas call for further exploration:

A. What might be a sustainable business model for a FC serving an STP?

B. How a FC for STPs (which are based frequently on a collection of independent and sometimes competing companies) differs from a FC which operates within a more centralized institution like a commercial corporation, or a ministry?

C. Is it possible to establish a completely virtual FC, making the physical space a redundant element of it? Are the Information Technologies presented in this paper mature enough to provide a platform for such virtual center? Can there be a future center without the direct face to face human contact?

D. Is it possible to establish a "micro FC" in each of the companies of the STP, instead of or in addition to a central FC?

E. Most of the future centers we analyzed in the Open-Futures research have been established as new organizational functions. However, in many cases it might be economically and organizationally more feasible to transform an existing function and upgrade it into a future center, rather then taking a green-field approach. How might this principle applied to the case of STP? Are there existing central functions that can be transformed into future centers?

References

Ahmed, P. K. (1998), "Culture and Climate of Innovation", *European Journal of Innovation Management*, Vol. 1, no. 1, pp. 30-43

Barrat, M.; Green, M. (2001): "*The Cultural Shift: the Need for a Collaborative Culture*". Proceedings of the Supply Chain Management Conference. Cranfield School of Management.

Brown, J. S. and Duguid, P. (2001), "Creativity vs. Structure: A useful tension", *Sloan Management Review*, Vol 42, Issue 4 (Summer), pp 93-94.

BT (2007), BT Technology Timeline 2006-2051, http://www.btplc.com/Innovation/News/timeline/

Chernenko, E., Glotova, T., Marjomaa , E., (2004), "Future Working Environments: Blending Virtual and Real", EUROPRIX Scholars Conference, Tampere, 2004

Cope, M. (1998), "The Corporate Inventor: How to foster Individual creativity and surface new ideas", *Knowledge Management Review*, Vol 1, Issue 4.

Damaskopolus, T. (2002), "From Knowledge to Innovation Ecology", White paper

Dvir, R., Kune,, H., Martniez, P, (2006), "OpenFutures – Future Centers as Collaborative Working Environments", at www.innovationecology.com

Dvir, R., Pasher, E. and Roth, N, (eds.). (2002). *"From Knowledge to Value: Unfolding the Innovation Cube"*, Tel Aviv

Dvir, R., Shwartzberg, Y, A conceptual plan for a future centre for the advanced water technologies development center, 2006 (specification document - unpublished)

Dvir, R.,Shwartzberg, Y., Avni, H., Webb, C., Lettice, F. (2006), The Future Center as an Urban Innovation Engine, Knowledge Cities special edition of Journal of Knowledge Management, Vol 10 Number 5, November 2006

Edvinsson, L. (2002). *"Corporate Longitude"*, Pearson Education Limited, Harlow.

Kanter, R.M.; Kao, J. Wiersema, F. (1997), "Innovation". HarperCollins, New York.

Kelley, T. (2000), *"The Art of Innovation*, Currency Doubleday, New York

Lakin, Steve (2001), "BT's Approach to Ideas Management", *Knowledge Management Review*, Vol 4, Issue 1.

Mintzberg, H., Ahlstrand, B., and Lampel, J. (1998), *"Strategy Safari: The Complete Guide Through the Wilds of Strategic Management"*. Prentice Hall, London.

Naimen, L. (1998), "Fostering Innovation in an IT World". *Canadian Information Processing Society Journal*, May 1998, New York (2004). http://www.nycfuture.org

Naisbitt, N, Philips, D., Naisbitt, J. (2000), High Tech/High Touch: Technology and Our Accelerated Search for Meaning, Nicholas Brealey Publishing

Nonaka, I. and Konno, N. (1998). "The concept of "ba": Building a foundation for knowledge creation". *California Management Review*, Vol 40, No 3, pp. 40-54.

LaMonica, M. (2006), "IBM breaks down in Second Life", CNet news, http://news.com.com/2061-10809_3-6127448.html

Orielly, T. (2005), "What is Web2.0?. Design Patterns and Business Models for the Next Generation of Software", http://www.oreillynet.com/lpt/a/6228

Pinchot, G., and Pellman, R. (1999), *Intrapreneuring in Action*, Berrett Kehler, San Francisco.

Por, G. (2001), "Introduction to Knowledge Ecology", www.knowledgecology.com

Ruggles, R. and Ross, L. (1997), "*Knowledge Management and Innovation: An Initial Exploration*", Working paper, Ernst & Young

Stewart, A. (2001). "The Conversing Company – Its Power, Culture and Potential", *1st World Conference of Systematic Management,* Vienna, May 2001, www.knowledgeboard.com

Tiwana, A.: "*The Knowledge Management Tool kit: practical techniques for building a Knowledge Management system*". Prentice Hall, 2000.

Tuoami, I (2002), " The future of knowledge management"
http://ec.europa.eu/employment_social/knowledge_society/docs/tuomi_fkm.pdf

Ward, Victoria (1999): "Victoria Ward asks: Can the design of physical space influence collaboration?", *Knowledge Management Review*, Vol 2, Issue 10

Additional Resources

Technologies for Innovation
http://www.cio.com/archive/020107/innovation_procter_sb1.html

Innovation Management Tools
http://www.innovationtools.com/resources/ideamanagement.asp

Societal Trends
http://www.trendwatching.com/
http://www.springspotters.com/springspotters/