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ABSTRACT

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Supervisor(s)	Dr.Soc.Sci. Teija Mankkinen, Professor Petri Tapio		

Abstract

In the current world uncertainty is more dominant than it used to be. One of the key forces for constant change is innovation. Innovations can be radical and create surprising effects. Can there be ways of anticipating these unforeseen effects of innovation? Or can the course of future innovations be managed somehow? Innovation foresight processes are required to communicate between different stakeholders on an extensive scale to be able to build comprehensive and understandable future options. Knowledge on future and innovation is no more the exclusive right of experts. This study tries to find new ways of engaging people with the innovation foresight work as well as get new audiences to participate in it. Games and crowdsourcing are two possible solutions to this. Theories covering innovation, foreisght and crowdsourcing are plentiful but scattered, and do not form a coherent framework for innovation foresight. Study is approaching the research topic from two perspectives: what kind of innovation foresight knowledge can we create with games, and what innovation foresight activities can we crowdsource with games? For these targets study has used two different methods, an innovation game case study experiment and a questionnaire targeted to Finnish innovation experts. Game case study consisted of a foresight analysis of 310 ”future thing” ideas generated with an innovation card game. The results revealed that games can enhance the creativity of the players and generate many unexpected uses of future technologies and services. Ideas were also rich with future hopes and fears and they had multidimensional content including different PESTE-variables. Questionnaire was targeted to map views related to the usability of games in different phases of the innovation foresight process. According to responses gaming can be used to observe weak signals, to form wild cards, perceive hopes and fears, and to develop new visions for the future. But games are not seen as suitable for decision-making nor forecasting future trends. Crowdsourcing can enhance the ”crowd wisdom” of the foresight process. Crowd wisdom means that groups are often smarter than the smartest people in them. This phenomenon is based on the thought that “no one knows everything, but everyone knows something”.
The challenge in crowdsourcing is to motivate people to participate and engage. Games can be a powerful solution to innovation foresight motivation challenge, and they may also generate different solutions than other methods. But games cannot replace the foresight process. To subject foresight to games and gamification would take too many resources, be expensive, difficult to manage, and results would be risky. Crowdsourcing innovation foresight can often be carried out more effectively when using existing social media platforms such as Facebook, Twitter etc. instead of games. In any case, crowd wisdom is too valuable resource not to be exploited in foresight.

Key words	innovation, foresight, crowdsourcing, games, knowledge on future, radical innovation, participation, foresight process
Further information	

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Tiivistelmä

Nykypäivänä muutos on jatkuvaa ja epävarmuudella on suurempi rooli kuin aiemmin. Innovaatiot ovat yksi nykypäivän keskeinen muutostekijä. Innovaatiot voivat olla radikaaleja ja luoda yllättäviä vaikutuksia. Voisimmeko löytää tapoja ennakoida näitä innovaatioiden yllättäviä vaikutuksia? Tai voisimmeko hallita innovaatioiden kehitystä jollain tavoin? Tulevaisuus- ja innovaatiotieto ei ole enää asiantuntijoiden yksinoikeutta. Innovaatio- ja ennakointiprosessien on yhä enemmän kommunikoitava eri sidosryhmien kanssa, jotta ne voisivat rakentaa kattavaa ja ymmärrettävää tulevaisuustietoa ja tulevaisuuden vaihtoehtoja. Tämä tutkimus pyrkii löytämään uusia tapoja sitouttaa ihmisiä innovaatioiden ennakointiprosessiin sekä tapoja saada uusia yleisöjä osallistumaan ennakointiin. Pelit ja joukkoistaminen ovat mahdollisia ratkaisuja näiden tavoitteiden saavuttamiseen.

Tutkimuksen keskeisiin käsitteisiin liittyviä teorioita on runsaasti, mutta ne ovat hajanaisia, eivätkä muodosta yhtenäistä teoriakehystä. Tutkimus lähestyy aihetta käytännön ennakointityöhön liittyen kahdesta näkökulmasta: millaista innovaatioihin liittyvää tulevaisuustietoa voimme luoda pelien avulla sekä mitä innovaatioiden ennakointiin liittyviä toimintoja voimme joukkoistaa pelien avulla. Tutkimuksessa käytetään kahta menetelmää näiden näkökulmien avaamiseen. Pelien käyttöä tulevaisuustiedon luomisessa tutkitaan innovaatiopelin muodossa toteutetulla kokeellisella tapaustutkimuksella. Pelien avulla tapahtuvan ennakointitoimintojen joukkoistamisen tutkimiseen käytetään suomalaisille innovaatioasiantuntijoille suunnattua verkkokyselyä. Tapaustutkimuksessa analysoidaan ennakoinnin näkökulmasta 310tä innovointipelissä luotua tulevaisuusideaa, esinekuvausta. Tulokset paljastavat, että pelit voivat parantaa pelaajien luovuutta ja luoda monenlaisia, aiemmin ennakoimattomia käyttötapoja liittyen tulevaisuuden teknologioihin ja palveluihin. Ideoissa oli myös paljon tulevaisuustoiveita ja -pelkoja, ja niiden sisällöt olivat moniulotteisia kattaen hyvin muun muassa eri PESTE-muuttujat. Kyselyn tarkoitus oli kartoittaa näkemyksiä pelien käyttökelpoisuudesta ennakointiprosessin eri vaiheissa. Vastausten mukaan pelejä voidaan käyttää havainnoimaan heikkoja signaaleja, muodostamaan villejä kortteja, välittämään tulevaisuustoiveita ja -pelkoja ja kehittämään uusia tulevaisuusvisioita. Mutta pelien ei nähty sopivan päätöksentekoon tai tulevaisuustrendien ennakointiin. Joukkoistamista puolestaan voidaan toteuttaa hyvin pelien avulla ja se voi lisätä ennakointiprosessin kollektiivista älyä. Kollektiivinen äly tarkoittaa sitä, että ryhmä on yleensä viisaampi kuin sen viisainkaan yksittäinen jäsen. Tämä perustuu ajatukselle, että kukaan ei tiedä kaikkea, mutta jokainen tietää jotakin. Joukkoistamisen suurin haaste on motivoida ihmiset osallistumaan ja sitoutumaan. Pelit voivat olla hyvä ratkaisu innovaatioiden ennakoinnin motivointihaasteeseen ja ne voivat myös luoda erilaisia ratkaisuja kuin muut menetelmät. Mutta pelit eivät voi korvata ennakointiprosessia. Ennakoinnin alistaminen peleille ja pelillistämiselle veisi liikaa resursseja, tulisi kalliiksi, vaikeaksi hallita ja tulokset olisivat riskialttiita. Ennakoinnin joukkoistamisen voi usein toteuttaa pelejä tehokkaammin olemassa olevia sosiaalisen median palveluja, kuten Facebookia tai Twitteriä hyödyntäen. Kollektiivinen äly on joka tapauksessa liian arvokas resurssi hukattavaksi ennakoinnissa.

Asiasanat	innovaatiot, ennakointi, joukkoistaminen, pelit, tulevaisuustieto, radikaalit innovaatiot, ennakointiprosessi, osallistaminen
Muita tietoja	

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THINGS FROM THE FUTURE

How can we crowdsource innovation foresight with games?

Master´s Thesis
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Table of contents

List of Figures

List of Tables

1 INTRODUCTION

1.1 Research context

What are the characteristics of the world today? Business people tend to use the military acronym VUCA, meaning that the world is Volatile, Uncertain, Complex and Ambiguous (Berinato 2014, 1). The speed of change and system interdependencies make the development of businesses and sustainable societies challenging. Uncertainty is more dominant than it used to be (Ilmola - Rovenskaya 2016, 1). We desperately miss knowledge about the future, how things will change and what we should be prepared for. Foresight is a systematic, participatory, and medium- to long-term vision-building process to gain information about the future and to help to make decisions related to the future. Foresight uses many different approaches and methods to study the mystery of the future. (Becker 2002, 7.)

The form and process of foresight can vary depending on the level and targets of the foresight program or system. Large enterprises increasingly often embed corporate foresight as a tool into their strategic planning and innovation processes. Some countries are building special national foresight networks for nation wide future programs, one example being Finland (see foresight.fi). At the same time the local communities have much autonomy to plan their own future in many fields, such as city planning or healthcare. Much work is done to gain knowledge on future.

The volatility, uncertainty and complexity of the world are often caused by innovations. Innovations can be based on new business development applications, science breakthroughs or new technologies. In the rapidly changing world innovation is one of the key forces for change. The emergence of innovations may sometimes be quite obvious when they are results of consistent development. But sometimes innovation may be radical and take unpredictable courses or create surprising effects. Can there be ways of tackling these unforeseen effects of innovation? Or can the course of future innovations be managed somehow, and what would that mean for the work on innovation and foresight? Are the current foresight and innovation approaches able to handle these changes?

In modern networked societies, different systems are deeply interdependent. Innovation and foresight functions are also intertwined with each other. Different foresight and innovation systems need to interact to be able to serve common goals. Knowledge on future and innovation is no more the exclusive right of experts. Innovation and foresight processes are increasingly required to communicate between different stakeholders on an extensive scale to be able to build comprehensive and understandable knowledge on future and future options. The participative approach needs new methods and actions to

be able to engage people in the foresight and innovation processes. And people need new motivations to commit to these processes.

During the last ten years a special participation model called crowdsourcing has gained ground in many business areas. Crowdsourcing has become a powerful mechanism for accomplishing work online. It covers a wide range of activities, outsourcing the work or some other assignment to an undefined (and generally large) network of people in the form of an open call (Howe, 2008, 1). The crowdsourcing phenomenon itself is a wide-ranging concept and can take many forms in practice. Foresight has however not yet used crowdsourcing very much, at least in a systematic way.

Many current innovation methods and processes take time, needs concentration and group performance to succeed. They are suitable especially for innovation professionals and experts. Games however are creative means targeted for the masses, for all of us. Foresight experts have been testing gaming as a method to expand the future perspectives and get more people involved.

A game is a form of play with goals, structures and rules (Richvoldsen 2009, 1). Games are entertaining, creative and interactive activities. A good game can help to crystallise difficult things into an easily understandable form. Yet, games have rules and gaming is thus controlled playing. Depending on the gameplay the level of control can vary. Games can also promote the creativity of the players and have turned out to be good learning platforms as well. Special serious and edutainment games have been designed to support learning.

So far games have not been used very often in foresight and innovation work, or they have remained on the sideline. They have been just an aid for the "real" and more serious and structured foresight methods like Delphi. This is regrettable, as games could enrich the ways in which people involved in foresight work can raise or face many kinds of “What if…” questions (Rausch - Catanzaro 2009, 1). Thus, games could expand the spectrum of alternatives by enlarging the mental framework. This is one of the basic tasks of innovation and foresight experts.

1.2 Research design

In this study I want to map the power of games in foresight work, especially when anticipating future innovations with widescale participation. I try to find the strengths games may have as well as their limitations and improvement potential. I first study theories, features and interconnections of foresight and innovation with a literature review. Then I concentrate on existing innovation game platforms to see how they perform with the theories and targets of innovation foresight.

To deepen my understanding related to games in practical innovation foresight I arranged an experiment in the form of innovation game sessions. This experimental case study was needed, as there are very few innovation foresight games and literature related to them is rare. The basic idea of the gaming sessions was to innovate future "things". I used these ideas for the future as research material in order to examine how they and the games in question relate to the innovation foresight targets and the corresponding theories. Next I created a questionnaire for innovation and foresight experts to collect views related to the usability of games in different phases of the innovation foresight process. Finally I summarised my views in the discussion and conclusion.

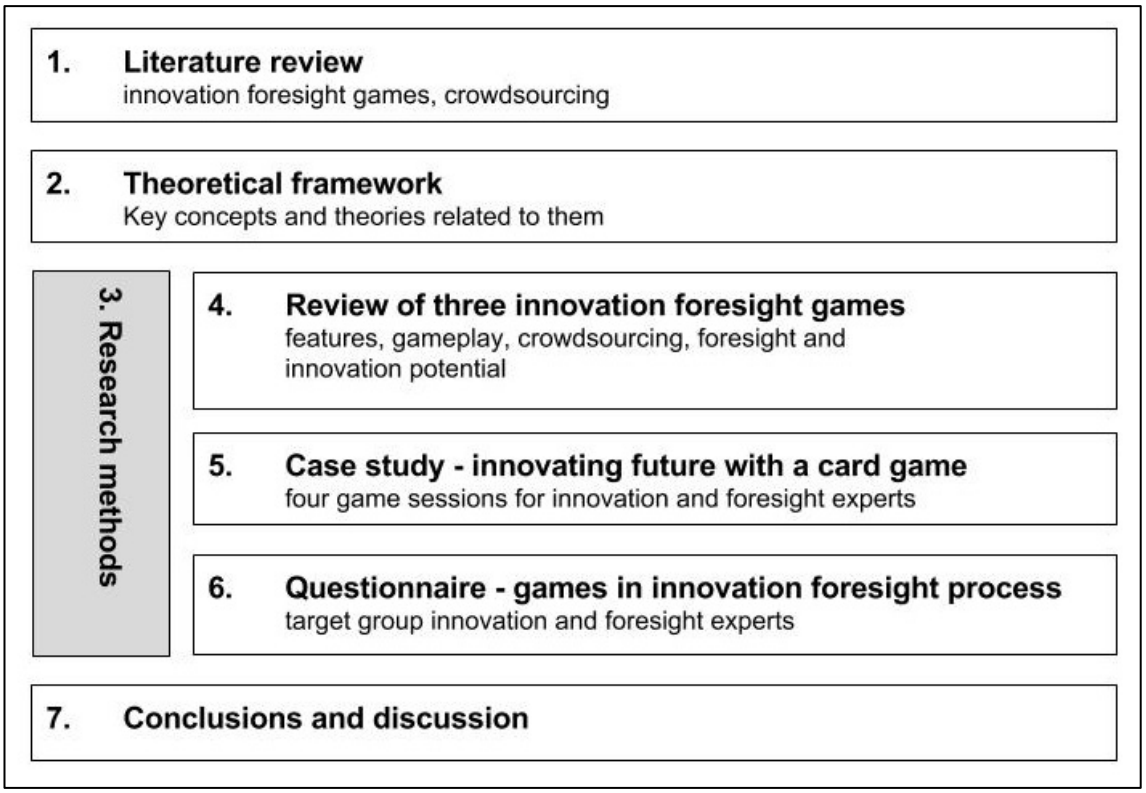

Figure 1 Research process outline

1.3 Research questions

This study focuses on the confluences of innovation foresight, crowdsourcing and games from the perspective of practical innovation foresight. The main research question is the following:

- How do games work as an innovation foresight tool?

The backbone for the study is formed by the knowledge concerning innovation and foresight and theories related to them. I map the key features of innovation foresight and study existing innovation foresight games suitable for widescale participation such as crowdsourcing. What are the characteristics of innovation foresight? What are the features, strengths and limitations of games as innovation foresight tools? And what is needed for the games to work in crowdsourcing?

However, literature covering the topics of this study is scattered. Therefore, in the next phase I study the connections between innovation, foresight and games from an empirical point of view. The study is approaching the main research question from two perspectives:

1. What kind of innovation foresight knowledge - such as visions and ideas - can we create with games?
2. What innovation foresight activities can we crowdsource with games?

The foresight process aims to generate relevant knowledge on future. My hypothesis concerning the first sub-question is that games can considerably enhance creating the content, the knowledge on future, for innovation foresight. So, with this question I am studying what kind of future visions, designs and ideas can be created with games and what kind of questions can they answer? The research material consists of over 300 ideas, potential future innovations created with a future innovation game. I study how they synchronize with the foresight targets, whether they meaningfully expand the boundaries of the imaginable futures and how different elements of the game affect the nature of these visions.

My hypothesis covering the second sub-question is that gaming can enhance the innovation foresight process. To map this field I created a questionnaire targeting innovation experts familiar with foresight games. The content of the questionnaire relates to issues about games and anticipation, games and innovation, and games and participation. The questionnaire contained questions such as ’How can we implement games to different foresight phases?’, ‘To whom are foresight games suited?’, and ‘To which time horizons games are suitable to foresee the future?’ Based on the responses I analyse the extent and place of the games in the innovation foresight process.

2 THEORETICAL FRAMEWORK

2.1 Key concepts

The three key theoretical concepts of this study are innovation, foresight and crowdsourcing. First, I review the basic dimensions and features of innovation. Next, regarding foresight I first review the perspectives of knowledge on future and its paradigm development, based on three different foresight approaches identified in the literature. Then I review innovation foresight against these foresight approaches. Finally, I study possibilities of crowdsourcing and its gamification in the context of innovation and foresight.

Research literature covering innovation, foresight, and crowdsourcing is plentiful but scattered, and does not form a coherent theoretical framework. In the scope of this study it is not possible to build such a framework; therefore I concentrate on the key theoretical concepts and their confluences. I will not distinguish between different levels of foresight, such as corporate foresight or nationwide foresight programs, as the scope of this study is on the general characteristics of innovation foresight.

2.2 Perspectives on the world of innovation

The importance of innovation, both for businesses and society, has increased rapidly during the last decades. To adapt to the changes in the environment we must continuously create new innovations (Rohrbeck 2012, 3). At the same time innovation research has been growing, and especially the creation and anticipation of innovations have been subject to great interest. There are numerous definitions of innovation, but in short it can be said that innovation is the process of translating an idea or invention into a good or service that creates value for which customers will pay, or which generates savings (Edison et al. 2013, 1395).

Innovations can be divided into two broad categories - *evolutionary innovations* that are brought about by many incremental advances in technologies or processes and *revolutionary innovations* (also called radical innovations) that are often disruptive and new (McDaniel 2015, 65). Revolutionary innovations may introduce first time features or exceptional performance, or they can use a substantially different technology that creates new markets (Edison et al. 2013, 1394). Within the scope of foresight, revolutionary innovations are of particular interest (Rohrbeck 2012, 3). They can change the course of business or affect societies at a fast pace, which may lead foresight to go astray. Radical innovations often emerge quite quickly and overtake the medium- and

long-term perspectives of foresight. Weak signal identification is an often used tool for anticipating radical innovations (Hiltunen 2013, 176).

On the other level, four different types of innovation have been observed. *Product innovations* are novel products or services being introduced into the market to meet customer needs, and they are market-focused and primarily customer-driven. In contrast, *process innovations* are linked to the development of intra-company production and service processes to make them more efficient. Process innovations tend to be internally sourced and require the open exchange of information to facilitate the generation of knowledge during idea development and implementation. Product innovations, in contrast, require the integration of external parties such as suppliers, distributors and customers. This is much more challenging given the costs of coordination, communication and complete trust that parties will not behave in opportunistic ways. Product innovations are thus a big challenge for foresight, and extensive stakeholder participation can enhance their anticipation. (Sarooghi et al. 2015, 5.)

Two other types of innovations are *market innovations* and *organisation innovations.* Market innovations are implementations of new or significantly modified marketing methods, strategies and concepts. They include opening up new market opportunities. Organisation innovations are new organisational methods in firms' business practices, workplace organisation or external relations. Market innovation foresight is a particularly participation intensive activity, but organisation innovations can also benefit from outside views to find new ways of doing business. (Edison et al. 2013, 1395.)

Innovation can occur anywhere. Most commonly it takes place in corporations' development and research units and is then called *business innovation*. Innovation that satisfies social needs in turn is called *social innovation* (Dailiene - Dagiliene 2015, 1-2). Social innovation can e.g. involve open data and urban development projects. Because of its origin, the process of social innovation normally differs from corporate innovation. Extensive stakeholder engagement is desirable and may be even required by legislation or regulations. In turn, too many or the wrong types of regulations and bureaucracy can also restrict social innovation from happening, or make it fail. One criticised example is the planned basic income experiments in many countries, which may remain half-finished because they are restrained by existing laws. We must remember that even if innovation can happen everywhere and at any time, many innovations are the results of goal oriented long-term work.

To be able to anticipate innovation we must first understand how it emerges or is developed. Practically an innovation process consists of two main activities: *idea generation* and *idea implementation*. Idea generation involves the generation of novel and useful ideas; idea implementation the conversion of these ideas into new products and processes. Idea implementation is more closely managed by general research and development processes, but idea generation has a different nature. Idea generation requires ex-

perimentation, organic structures, loosely coupled systems, improvisation, and autonomy. It disrupts routines, challenges common assumptions, and is closely associated with explorative activities. In contrast, idea implementation requires a process, efficiency, goal orientation, and routine execution. Factors that facilitate the generation of new ideas are likely to cause conditions that may inhibit the implementation of new ideas. Managing the tensions between creativity and innovation is a challenge that spans all levels of an organisation. (Sarooghi et al. 2015, 1-3, 5.)

2.3 Foresight concept history

Research on the process and methodologies of foresight practices has a rich and diverse tradition, but there is no coherent theory on foresight as a concept (Piirainen - Gonzalez 2015, 1). Recently there has been active discussion about the scope of foresight in general and alternative ways of working on foresight (Andersen Dahl - Andersen Dannemand 2014, 276-277). According to Tuomi (2012, 1-10; 2015) and Wilenius (2015, 20-22) we can identify three fundamentally different approaches to knowledge on future and foresight work. In chronological order they are:

1. *Probabilistic foresight*, in which the future is seen as a continuum of the past. It bases its anticipation on probabilities and for example benefits time series and other quantitative analyses as research methods.
2. *Possibilistic foresight*, in which the future is seen as different possible paths. It bases its anticipation on possibilities, often benefits qualitative methods, and communicates via narrative sense-making scenarios when handling the alternative futures and decision-making related to them.
3. *Constructivistic foresight* is the most novel approach, according to which the future is made all the time. It is an ontological expansion to the knowledge of the future and is based on self anticipating systems and creative evolutive organisms. It benefits quick experiments and learning via the analysis of their empirical results. Foresight work is seen as a construction of the prerequisites for the desired future.

For Tuomi, the main vision for the completion of the framework with the latest constructivistic approach is the course of evolution and its unpredictability. This unpredictability, which is particularly caused by radical innovation, cannot be observed with existing anticipation methods. And when radical innovation becomes frequent, ontological unpredictability becomes increasingly important. Tuomi states that policy relevant future oriented analysis needs to emphasise processes that support insight, intuition and innovation, instead of relying on information collected using historically notable categories and measuring instruments. Economic and social trends measure what used to be

important and often miss things that will be important. (Tuomi 2012, 1-10.) Tuomi aims to capture a foresight approach that could work out in the volatile and complex state of the world driven by innovation, especially by revolutional innovation.

Several parallel views can be found in the research literature on futures. In the 1990s futurist Mika Mannermaa observed three different futures research paradigms, namely *descriptive futures research, the scenario paradigm* and *evolutionary futures research* (Mannermaa 1991, 1). The foundations for the presented approach framework could already be seen in futurist Jim Dator's thoughts on futures research methods in the 1980s. Dator (1985, 1) observed four categories of futures methods:

1. Using experience and/or knowledge of history to anticipate the future
2. Forecasting the future from the present and/or past
3. Incasting from the future
4. Designing/inventing/creating the future

Strategic foresight researcher René Rohrbeck made the same type of observations. According to him, research on managing the corporate future perspective from the 1950s to the 1980s aimed particularly at forecasting future developments by using s-curves, mathematical modeling, and Delphi studies. In the 1990s, the limitations of forecasting became apparent, and future research moved away from attempting to predict the future toward identifying possible, probable, plausible, and preferable futures (scenarios). Future research today aims more at discovering undetected currents that will influence the future and at mapping uncertainty by including potential discontinuities. (Rohrbeck 2011, 6-7.)

A similar theoretical approach can be observed in other fields as well, such as urban planning. Recent theories of urban planning see the city as an adaptive system, and advocate participation by the inhabitants in the design of the urban environment. These theories stress using communication to help different interests in the process to understand each other. Public participation is largely influenced by how planning is defined, how planning problems are defined, the kinds of knowledge that planners choose to employ and how the planning context is set. The planner has the role of a distributor of information and feedback source. (Lane, M. B. 2005, 283.)

These approaches reflect the targets and needs the foresight professionals have to face in real life, and they are connected to the changes in the business environments and societies. Views have transformed from expert driven preactive forecast approaches to participative proactive future shaping approaches (see Figure 2). In my view, despite their different concepts, the three foresight approaches can co-exist, and depending on the foresight case they can get different roles in the process. In the following parts of this study I will especially concentrate on reviewing the latest approach - the constructivistic foresight, and how it challenges the current foresight and innovation management practices and methods.

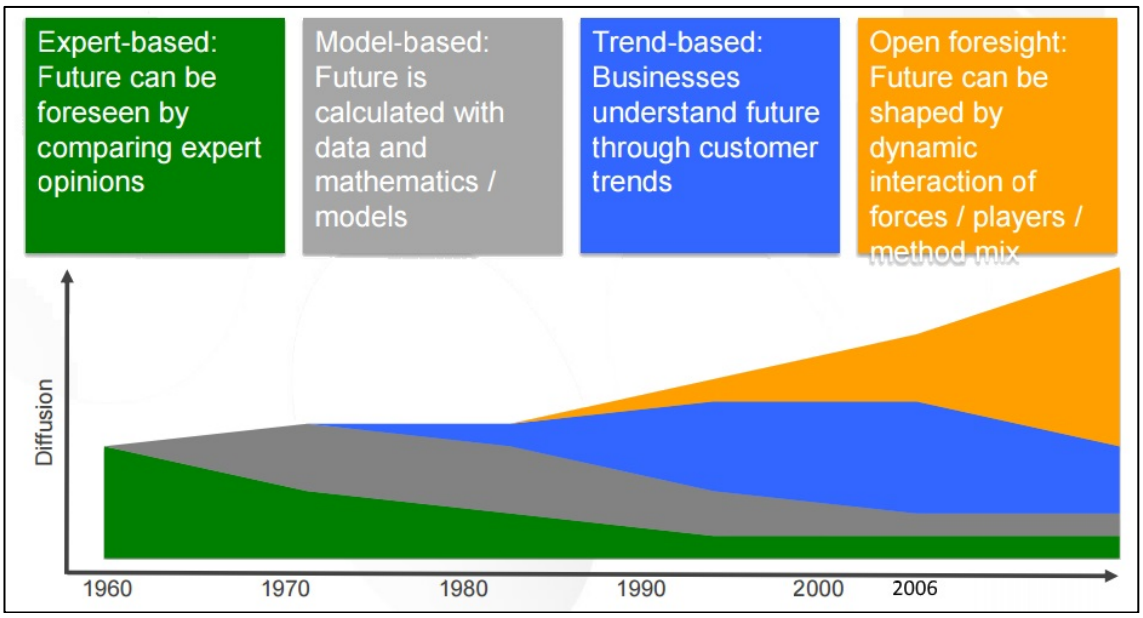

Figure 2 A perspective on corporate foresight paradigm development (Daheim-Uertz 2006, 11 and Jokinen 2015, 8)

2.4 Features of innovation foresight

Challenges the business meets today can result in failing foresight and failing innovations. In such a situation the innovation process can benefit some foresight views to meet the challenges a business faces in the volatile world. Discontinuous and product innovations demand different kinds of foresight support compared to evolutionary and process innovations. Diverse solutions have been proposed, including the construction and maintenance of sensory and intelligence systems (such as weak signals), the search for creative destruction, and the cultivation of connections. These suggestions aim to increase organisations' resilience and their capacity to deal with the unexpected. To be able to implement the above principles, organisations need to establish a strategic vision and decentralize decision-making in order to create an infrastructure where improvisation can take place, informed by people "on the spot". (Pina e Cunha et al. 2012, 5.)

There is a significant body of literature and studies that cover the intertwined nature of foresight and innovation. The Finnish futurist Elina Hiltunen draws a triangle consisting of anticipating, communicating and innovating as a backbone for foresight and innovation. The concept of innovation that Hiltunen (2013, xiv) has formed is built around:

- methods of anticipation,
- active future creation with innovation and
- provocative, visionary, interactive and interesting communication of the future to media and other stakeholders.

Elsewhere a special “Innovation Foresight’’ concept has also been presented for bringing the future into a holistic innovation process, in which users and other stakeholders are systematically involved to detect future opportunities and risks. This concept is an interactive, participatory and forward-looking process toward the social shaping or design of technology. It strives to integrate long-term innovation visions in decision-making and strategic thinking. (De Moor et al. 2014, 39-40.) Even if this concept fixes innovation foresight to technologies, in a broad context other types of innovation can also be targeted.

In another perspective, innovation foresight aims to go beyond the “now and here” thinking and is situated at the intersection of foresight, user and market research and human-centred product design. It places strong emphasis on wide participation in innovation, to stimulate the transfer of knowledge, mutual learning and collective visioning. It also manifests the user as an “innovator” and key stakeholder. (De Moor et al. 2014, 40-42.) With its proactive, user inclusive and design approaches this innovation foresight concept shares many perspectives with the constructivistic foresight approach.

What are the characteristics of innovation foresight processes and tools? Such a methodological framework does not yet exist, but a few case studies have revealed some important starting points. The innovation foresight concept stresses broad and deep participation. Users (key stakeholders) need empowerment and encouragement to meet the future possibilities or challenges of emerging technologies. Users are not normally aware of the features that future technologies might offer. It is important to note that the traditional user innovation process has a poor introduction of the future as a research component. However, often little attention is given to unexpected or unanticipated forms of use of a future product or technology. Users are also often perceived as a homogenous group, which they certainly are not. (De Moor et al. 2014, 41.)

An empirical case study related to the needs concerning interactive digital TV in Belgium in 2010 revealed one interesting phenomenon. Only 0.3 % of the 3,563 potential future digital TV users (so the participants) presented an idea of a need with a promising digital TV application or service (De Moor et al. 2014, 42). This is most probably the case with many other crowdsourced innovation foresight processes as well - the “hit rate” of the user ideas or views can be quite limited. Such phenomena set demands both on the empowerment of the users to enrich the idea production and on the development of the processing and interpretation systems for user interaction.

Some studies stress that foresight activities are ongoing processes. They are a constant discussion and observation of changes. The foresight information should be open to all levels of an organisation as well as to outside stakeholders, in order to enable feedback about processes and outcomes. (Hiltunen 2011, 6.)

Another view on the intersection of foresight and innovation is provided by René Rohrbeck in his corporate foresight research. He identifies three roles that corporate foresight should play to maximize the innovation capacity of a firm (Rohrbeck 2011, 6):

1. In the *initiator* role, corporate foresight triggers innovation initiatives by identifying new customer needs, technologies, and product concepts of competitors.
2. In the *strategist* role, corporate foresight directs innovation activities by creating a vision, providing strategic guidance, consolidating opinions, assessing and repositioning innovation portfolios, and identifying the new business models of competitors.
3. In the *opponent* role, corporate foresight challenges the innovators to create better and more successful innovations by challenging basic assumptions, challenging the state-of-the-art of current resarch & development projects, and scanning for disruptions that could endanger current and future innovations.

When comparing innovation foresight concepts and the constructivistic foresight approach with Rohrbeck's views we can see many overlapping elements. Challenging basic assumptions and current resarch & development projects, scanning for disruptions, creating visions and identifying new customer needs for example can be seen as features of constructivistic innovation foresight.

Thus, recent innovation foresight research tends to favour the constructivistic foresight approach and its perspectives to innovation activities, even if the term constructivistic as such is not used. In the next chapters I review the possibilistic and constructivistic foresight approaches against the innovation function to see how they meet its needs and features. I decided to exclude the probabilistic foresight approach from the review, as its nature is "experts forecasting the future". Hence, it has traditionally relied on expert views, and the methods it uses are designed for experts. To observe and analyse trends for example requires significant volumes of past and present data as well as much know how. Therefore it would be difficult to crowdsource the tasks of probabilistic innovation foresight to non-experts.

2.5 Anticipating innovations with possibilistic foresight

Possibilistic foresight is rooted in a European tradition of futures studies that was established in the 1960s and 1970s (Andersen Dahl - Andersen Dannemand 2014, 277). It was born of the environmental awareness in 1970s - 80s and supported by the emergence of planned economies. Its scientific background is social sciences; it often benefits qualitative methods and communicates via narrative sense-making scenarios (Wilenius 2015, 21).

The core of possibilistic foresight is that there are always many options for the future. Even if these options (scenarios) are “designed” in the foresight process to be desirable or probable, the nature of this approach is declaratory and imaginary. Normally there is some action plan to be followed, but no real design process or production plan. The aim of the process is to improve decisions, which strongly connects the possibilistic approach to policy making. This may be based on the nature of the social sciences dominating this approach. Scenario working is criticised to be labour-intensive, facilitator-sensitive and expert-dominant. The main results accomplished by possibilistic foresight are to expand the range of future parameters taken into account, communicate them with different stakeholders and then to support the decision-making with alternative narrative scenarios. (Raford 2015, 2.)

Concerning the spectrum of the scenarios, futurist Jim Dator has presented four scenario archetypes, a kind of generic alternative futures. When designing these archetypes he has gone through numerous varieties and sources of different images of the future. Dator remarks that each of these scenarios have "good" and "bad" features and none of them should be considered as either a bad or a good future *per se*. Dator identifies these scenario archetypes as follows (2009, 5-10.):

1. *Continued growth* - the official view of the future of all modern governments, educational systems, and organisations
2. *Collapse* - social and/or environmental collapse from some cause or another and society’s extinction or regression to a lower stage of development than its current state
3. *Discipline* - arises when people feel that "continued economic growth" is either undesirable or unsustainable and this generates a wish to preserve or restore places, processes, or values
4. *Transformation* - emergence of a "dream society" by the power of technology, such as robotics, artificial intelligence, genetic engineering, nanotechnology, teleportation or space settlement.

These archetypes can be useful when setting up an innovation foresight framework and when envisioning possible general pathways to the future.

One problem related to scenario thinking from an innovation perspective is that many scenarios do not materialize. For example, the sort of ‘free floating’ futures mindset of the standard scenario approaches has been criticised. This mindset may give a misrepresentation of the actual power dynamics in the system and lead to false information about the possibilities of an organisation to affect the future (Slaughter 2002, 28). Again, this can decrease the plausibility and commitment to scenario thinking in general. Futures research and foresight does not have its own domain, industry or public sector with officials, legislation and regulations supervising the execution of the plans or scenarios. Innovation foresight is a subject of different innovation related industries.

And because innovation processes can often be much more goal oriented than foresight processes, this can lead to a process where the goal is fixed too early, i.e. without real anticipation of different pathways to the future, aka scenarios. To get all the benefits of possibilistic foresight, scenario thinking should be adjusted to strengthen the innovation process, not only be a mechanical tool for it.

Possibilistic foresight is currently the most frequently used approach both in corporations and the public sector. In my view, it is better suited for social innovation foresight than for corporate foresight. Social innovation may not need new technologies that often, thus residents' empowerment is not that demanding. And for social innovation it may be more natural to develop different options or scenarios from which to choose. Also, residents as members of the community have a natural motivation to engage in the social innovation process. Concerning the anticipation time horizons, possibilistic foresight seems to suit the medium- and long-term better than short-term innovation foresight. Consequently, scenario thinking can bring real advantages with different possible pathways to future innovations. One should just remember to continuously renew scenarios so they can meet radical or other unexpected changes in societies or businesses.

2.6 Creating innovations with constructivistic foresight

Concerning the current innovation foresight practices the latest, constructivistic approach is interesting and a kind of paradigm change. It claims that the best way to anticipate the future is to create it yourself. This approach is boosted by the rapid technological development and digitalising and globalising economies of the 1990s and 2000s. Issues related to economies and technologies are today subject to rapid changes, and stable planned economies and their planning tools were buried a long time ago with the collapse of the Soviet Union. Many industries have become quite volatile, and frequent changes force large stagnant companies to innovate and to move into new business fields more rapidly in order to maintain their current revenue or to generate growth (Rohrbeck 2009, 1).

The constructivistic approach manifests extensive stakeholder participation as the "core" for foresight work. This changes the role of futures researchers from "future experts" to process facilitators and interpreters of the process outcomes. Some of the novel foresight activities, like open foresight and crowdsourcing are correlating phenomenona with the constructivistic foresight approach. Similar developments can be observed in the innovation field. Some companies have launched open innovation programs to crowdsource the innovation process or some parts of it (Rohrbeck 2009, 1-7).

Constructivistic foresight demands new foresight methods and working processes. It also challenges the traditional foresight approaches with a sort of design nature. In this

approach the future is created, not just studied, in the ongoing foresight process. The design or planning aspect has also been included in the possibilistic foresight approach, but has a smaller, supportive role in decision-making. Constructivistic foresight can also apply scenario concepts, but requires a continuous process and self-correcting nature for the scenario work.

Foresight is generally used to survey medium- and long-term futures (Becker 2002, 7). This time horizon concept is challenged by the constructivistic approach and its continuous process view. This approach combined with the innovation's business targets can lead to emphasising short-term anticipation. Is there still a place for medium- and long-term innovation foresight? Certainly there are innovation projects that benefit long-term thinking, such as many infrastructure and urban innovation projects. In these cases the powers of the probabilistic and possibilistic foresight approaches, with their ability to benefit reliable quantitative analyses and to produce relevant alternative scenarios for the future, are of great importance. But as innovation often works in the short-term and foresight in the medium- and long-term, there is a certain disharmony between the timeframes of these two functions.

The constructivistic approach brings the foresight process near the modern innovation and strategic development process, or even part of it. Both require openness, interaction and knowledge sharing and both have a creative, inclusive and iterative, self-correcting nature (De Moor et al. 2014, 40). Some researchers see strategic foresight as a part of the innovation process in fast-paced business environments (Sarpong - Maclean 2016, 2812). Futurists have recently also been paying more attention to design. Design is an inherently futurist activity, planning and sketching things that do not yet exist. However, designers' time horizon normally extends to five years at the most, where futurists' time horizon is just starting. Futurists also have a wider problem setting than designers (Candy 2010, 167). However, the constructivistic approach places greater emphasis on design and creativity than earlier approaches.

2.7 Crowdsourcing foresight

Participation has been an essential part of foresight and innovation for a long time. During the last decade a new participation concept called crowdsourcing has emerged. Crowdsourcing is an online, distributed problem solving and production model that performs or mediates tasks via the internet, and thus enables wide participation. Normally it does not reject any number or types of participants. Crowdsourcing harnesses creative solutions and proposals through an open call. Winning ideas are awarded and the crowdsourcer will obtain and use the solutions as he or she wishes. (Brabham 2008, 1-

2.) Practically crowdsourcing can have many forms and new crowdx-models are constantly emerging, as shown in Figure 3.

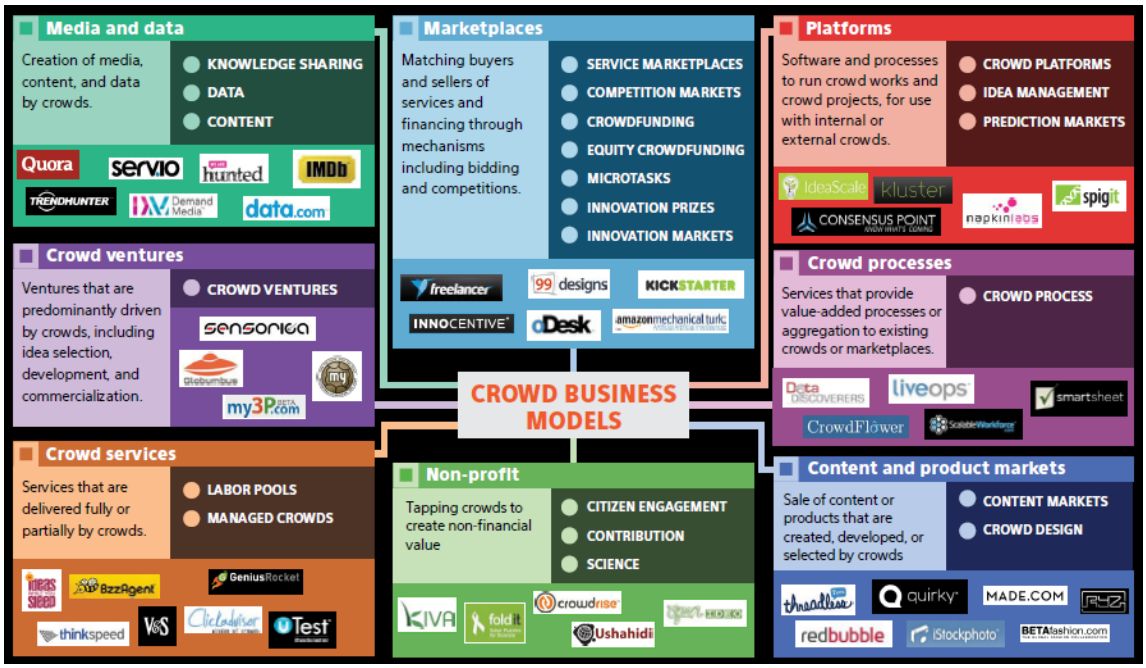

Figure 3 Different crowdsourcing business models (Dawson - Bynghall 2012, 4096)

Crowdsourcing is usually executed through a specific crowdsourcing software platform, which is tailormade for the crowdsourcing service. Crowdsourcing must be distinguished from open source or open data, as these concepts allow access to the product or data to anyone in the name of developing the product or quality and coverage of the data. In crowdsourcing the results are properties of the crowdsourcer. (Brabham 2008, 7-8.)

One interesting phenomenon related to crowdsourcing is *crowd wisdom*. Under the right circumstances, groups are remarkably intelligent, and often smarter than the smartest people in them. This crowd wisdom idea is based on the thought that “no one knows everything, everyone knows something”. From an innovation point of view this is a fascinating and powerful idea. However, diversity of opinion, independence, decentralization and aggregation of the crowd are said to be necessary conditions for crowd wisdom. (Brabham 2008, 5-7.) Some researchers moreover add openness, peering, sharing and acting globally (Hiltunen 2011, 2). These prerequisites should be implemented in the crowdsourcing service process.

The most important challenge in crowdsourcing is to motivate people. Participation motives include the desire to acquire new skills, learn, and gain respect. Important motivating elements are also training, feedback, and the simplicity of the crowdsourcing tool’s user interface. It must be easy and attractive to use. (Brabham 2008, 7-8. and Hil-

tunen 2011, 5.) We must not also forget the importance of marketing and communication. Without knowing the case and its targets it is difficult to get people involved, and a good marketing story can wake people up.

Is crowdsourcing just a shooting star or are there some more stable trends behind the phenomenon? Finnish futures research professor Markku Wilenius describes in his book 'Tulevaisuuskirja' (The book of future) the so-called sixth wave of the social and economic development phase we are currently entering. His writings are based on Russian economist Nikolai Kondratieff's theory of structural socio-technical cycles, known as Kondratieff waves, which last about 50 years each (Wilenius 2015, 55-61). According to Wilenius (2015, 108-110) the principles of the currently starting 6th wave are:

1. co-operation - for example consumers participating in product development
2. openness - transparency in innovation politics as well as in political decision-making
3. sharing – a sharing culture enabled by the internet and blogosphere, one key factor is disappearing reproduction costs
4. integrity - people's honesty, integrity and high moral
5. interdependence - globalisation and climate change reveal that we are all in a same boat

What we can see is that most of the principles of the 6th wave theory correlate well with the concept of crowdsourcing and other crowding models. So, this sharing phenomenon can exist and affect our societies and economies far into the future.

Crowdsourcing can be exploited to meet many innovation foresight demands, even if it has not been used widely. The Delphi method has some crowdsourcing dimensions but is usually targeted to dedicated groups of experts. Foresight can benefit crowdsourcing to collect weak signals or future information, some examples being trendhunter.com and trendwiki.fi (Hiltunen 2011, 2-3). Open innovation projects have the same features as crowdsourcing. Models used under the open innovation concept can also be called user innovation, cumulative innovation, know-how trading, mass innovation and distributed innovation.

Connecting gamification to crowdsourcing is another interesting concept. It can be a powerful solution to the crowdsourcing motivation challenge, and may also generate different solutions than other methods. In the next chapter I review some different games targeted for innovation foresight that are suitable for widescale participation such as crowdsourcing.

3 CROWDSOURCING INNOVATION FORESIGHT WITH GAMES

3.1 About foresight games

There is no comprehensive research material covering the different types or extensions of games used in innovation foresight work. Rausch and Catanzaro wrote an article in 2009 covering games and simulations in futuring in general. Even if this article may be somewhat outdated, some of the views expressed therein are still important. Simulations and games are considered to be powerful tools for defining, refining, analysing, and evaluating future alternatives. Games can also bring the traditional “meetings”, “events” or “workshops” to a whole new level of breakthrough performance and introduce multiple forms of intelligence. (Rausch - Catanzaro 2009, 25-28.)

Playing games enhances players’ overall creativity, and developing creative ideas is the first critical step of the innovation process (Jackson et al. 2012, 3 and Sarooghi et al. 2015, 2). Gaming can help to bring to attention a rich and varied range of possible changes that may occur in an existing or imaginary scenario, and explore the possible consequences. In turn gaming does not offer predictions or probabilities of occurrence without the use of other techniques. (Rausch - Catanzaro 2009, 2.)

In foresight, games can be designed to aid decisions, planning, and policy implementation by clarifying the possible reactions of people involved. Gaming can be a brainstorming application, a method of realising a thought experiment, a chance to pre-test behavioural assumptions, a two-way learning mechanism, and a communication platform between different parties of foresight. Games can be particularly helpful tool if foresight deals with complex social structures and several stakeholders. However, there is usually no specific output other than increased awareness, preliminary design proposals or an agenda for any future initiatives needed. (EFP 2010, 1.)

The literature however don’t reveal very much about the practice of implementing gaming into innovation foresight. To see the dimensions of gamification in the innovation foresight practice I studied three existing games more closely to analyze the innovation foresight potential of them. I selected very different games to be able to understand the nature and capacity the games could have in crowdsourced innovation foresight. Thus, I primarily studied the gameplay (design, rules and interaction), special characteristics, usability for innovation foresight, and crowdsourcing potential of the games.

This kind of descriptive and exploratory case study approach is useful if the knowledge in a research area is limited and the field is still developing. In such a re-

search setting, gathering rich information is expected to help identify new aspects and phenomena. (Rohrbeck et al. 2009, 2. and Raford 2015, 3.)

The games I selected for the case study are:

1. Foresight engine - a web game platform for engaging audiences in rapid conversation about pressing issues of the future
2. Cities: Skylines is an open-ended city-building simulation computer game
3. The Thing from The Future - a brainstorming card game aimed at playful innovation of future 'things'.

3.2 Foresight engine

The review is based on the material on the game publisher's website (Insitute for the Future 2016). Foresight Engine is a platform for engaging audiences in rapid conversation about pressing issues of the future, using basic card game dynamics to make it fun and to encourage participation. Conversations take place in Twitter-length (140 characters) microforecasts that players can build on by agreeing or disagreeing, or expanding on by taking them in new directions. These microforecasts are essentially crowdsourced ideas about the future, offering innovative insights about what could be.

The game starts by immersing players in a future scenario. It uses short, compelling videos to create this immersion in a future setting, inviting players to bring the best of their own experience to future challenges. On the game dashboard players can see cards already played by the community and track other players more easily. On any card played, one can play four kinds of response cards:

- Momentum: If we take this path… what happens next?
- Antagonism: Disagree? What is wrong with this path?
- Adaptation: Yes, and… how might this path play out differently in your community or region?
- Investigation: Curious? Ask or answer a follow-up question

Players compete by engaging in conversations that extend the chains of forecasts (cards). They earn points every time someone else builds on their idea. Players can level up through seven levels of achievement as well as win awards. Special game masters mark cards as super-interesting and blog about key themes emerging in the game to help people sort through the fast-paced play. Games typically last 24 - 72 hours and all one needs to play is a device with a browser and an internet connection.

The game is designed by the Institute for the Future (IFTF) which is an independent, non-profit futures research organisation. It has been used in many foresight contexts to activate discussions and views about challenging issues, some examples being global

poverty reduction and the future of hospitals. In average the game campaigns have attracted several hundreds of participants, and several thousand cards have been played.

The gameplay is clear but the players need a little time to adjust to the challenge. Pre-game challenges may also be presented weeks before the game starts to get people to address the topics in advance. As to the gameplay aspect one can join the game at any time, but of course players starting at the beginning of the game campaign have some vantage. The tempo of the gameplay also depends heavily on the campaign and the number of participants, and may be less addictive at times. If the campaign theme is engaging and enough players are involved the game may generate really good output. According to the IFTF the best players are not necessarily experts, they are people who are able to make connections between different ideas.

Even if the nature of the game is problem solving it can also be used for innovation foresight purposes with more open outcomes. Its approach is mixed with possibilistic and constructivistic foresight. The practical case approach depends on the game case design and can be adjusted to meet different foresight targets. The game is very well designed to meet the crowdsourcing targets and is actually currently the only foresight gaming platform enabling full scale crowdsourcing. A negative point is that every game campaign needs support from the IFTF, thus the game cannot be used for ad-hoc future workshops or other acute foresight activities. The price of campaigns or other qualifications needed to start a campaign is not clear. In turn, you can license the game engine as an open source and set up your own service.

3.3 Cities: Skylines - case Hämeenlinna

The review is based on the material on the game publisher's website (Cities: Skylines 2016) and in this case Hämeenlinna website (Cities: Skylines – Hämeenlinna 2016). Cities: Skylines is a city-building computer game designed by the Finnish game studio Colossal Order and published by Paradox Interactive, released in 2015. The game in its basic form is a single player open-ended city-building simulation. Players engage in urban planning by controlling zoning, road placement, taxation, public services, and public transportation of an area. Players work to maintain the city's budget, population, health, happiness, employment, pollution (land, water and noise), traffic flow, and other factors.

This game is a commercial entertainment computer game and thus in its basic form it is not an innovation foresight game. But its game engine can be used in other ways as well. The city of Hämeenlinna, Finland organised an urban development competition with Cities: Skylines platform in spring 2016. The target of this project was to find new solutions and innovations for certain urban development areas of the city. Some specific

design outlines and strategic goals were included as competition instructions. The players could call for a limited number of game licenses from the city (twelve licenses), play at a local youth centre (five licenses) or just use their own Cities: Skylines game license. Competition time was two and a half months. The criteria for winning proposals were:

- novelty value of the proposal
- originality of the proposal
- feasibility of the proposal

The gaming aspects of this case were very immersive and because of the awards it was a real crowdsourcing example. This time the target was city development, but according to the original game features the content of the game could have featured some other function of the city as well. Negative points are that the game needed much local material and it limited participation to game license owners and the limited number of license recipients. Participants also needed at least moderate knowledge of the game. Maybe because of this, the Hämeenlinna case finally only had seventeen participants. There are numerous similarly tailored social innovation gaming cases as well, for example related to the Minecraft game platform.

Naturally there are many restrictions concerning the suitability of this game for general innovation purposes, especially on product or process innovation at corporate level. It is better suited for social innovation and cases with complex systems. The Hämeenlinna case also shows concretely how scenarios, this time the planning outlines and strategic goals presented, can be realised in numerous ways. So even if the game case had a possibilistic background, with its design approach it was really a constructivistic innovation foresight game. An intresting fact is also that the Cities: Skylines game is actually a mix of a game and simulation, as it simulates the changes players make to all linked variables of the city model. Thus, it is also a tool for constant simulation of city development and can be used to study many “What if…” questions directly.

3.4 The Thing from The Future

The review is based on the material on the game project website (Situation Lab 2016). The Thing from The Future is an imagination card and brainstorming game that challenges players to collaboratively and competitively describe artifacts from a range of alternative futures. The object of the game is to come up with entertaining and thought provoking descriptions of hypothetical items from different near-, medium-, and long-term futures. The game is designed by Situation Lab and was published in 2015. Situation Lab is a research laboratory established at the Ontario College of Art and Design in 2013.

In one game table there can be 2-6 players. In each round players collectively generate a creative prompt. There are four types of cards in the game prompt: *Arc, Terrain, Object,* and *Mood.* This prompt outlines the kind of future that the thing-to-be-imagined comes from. Arc cards describe different kinds of possible futures and the game includes four Arc types - *Growth, Collapse, Discipline,* and *Transform*. Arc cards also include a "time horizon" - the distance into the future that players must project their imaginations. Terrain cards describe contexts, places, and topic areas of the 'thing'. In a completed prompt, the terrain card describes where - physically or conceptually - the thing from the future might be found. Object cards describe the basic form of the thing from the future. Mood cards describe emotions that the thing from the future might evoke in an observer from the present. There are 27 different Terrain, Object and Mood cards in each game deck.

Based on the prompt, every player will imagine a thing from the future and write it down on a piece of paper within two to five minutes. So the future thing is a short description of an object or thing that fits the constraints of the prompt. These descriptions are then read aloud (without attribution), and players vote on which description they find the most interesting, provocative, or funny. The winner of each round keeps the cards put into play for that round, and whoever has the most cards when the game ends is declared the overall winner. One game session last typically five to six rounds corresponding one hour in total.

When looking more closely at the gameplay (the design, concept and rules of the game) we can see that the Arc cards are the most essential part of the prompt concerning foresight perspectives. Arc cards describe different kinds of possible futures:

- *Growth* is a kind of future in which everything and everyone keeps climbing: population, production, consumption.
- *Transform* is a kind of future in which a profound historical transition has occurred, whether spiritual or technological in nature.
- *Discipline* is a kind of future in which things are carefully managed by concerted coordination, perhaps top-down or perhaps collaboratively.
- *Collapse* is a kind of future in which life as we know it has fallen, or is falling apart.

Arcs cards are based on futurist Jim Dator's scenario archetypes (Dator 2009, 7-10, see Chapter 2.5). Arc cards include also the time horizon options. In the game deck of this study there were the following options for the time horizon: 5, 10, 20, 30, 50 and 100 years.

Thus, basically the game has the characteristics of a normal card game combined with a quick future brainstorming workshop. It combines foresight and innovation approaches quite well in one application. Basically the game is suited to anyone who is able to read and write, but according to my experiences with different player groups the

general knowledge required for a person to imaginate different future situations limits participation to about 12 years and above.

The Thing from The Future is quite a simple game with good gameplay. It is inexpensive and customizable to different innovation foresight purposes by changing the content of the cards (which needs manual input). However, in its basic form it does not support crowdsourcing, as it is totally analog. Crowdsourcing would demand a digitalised version of the game. However, it is uncertain whether the digital online game would work as well as the analog version, as typing differs from longhand writing (Miller 2015, 1049).

The game is maybe at its best when brainstorming visions for the future are needed in innovation foresight. It directly answers “What if” questions and can certainly generate possible applications of emerging technologies as well as the unexpected or unanticipated forms of use of these technologies. And it truly supports the constructivistic foresight approach with possibilistic foresight scenario thinking as a backbone. The four scenario archetypes form a practical and comprehensive enough framework for the future options. When updated to an online version it is possible to use it for crowdsourcing as well. It is also quite a fast game with a clear user interface, which is a positive factor when thinking about the needs of crowdsourcing.

4 INNOVATING THE FUTURE WITH A CARD GAME

4.1 Case design

My first research sub-question is “What kind of innovation foresight knowledge - like visions and ideas - can we create with games?” The target of this part of the study is to examine how games can enhance the objectives of innovation foresight, particularly in the scope of the constructivistic approach (see Chapter 2.6). As there is no methodological toolbox or compilation of research for constructivistic foresight practices, I set up an experiment. I designed a case study based on one of the future innovation games reviewed in Chapter 3. Single case studies can be justified and are particularly powerful in exploring a phenomenon in its context while retaining the richness of the studied case and its context (Rohrbeck et al. 2009, 2).

I selected “The Thing from The Future” game for this experimental case study. The main reasons for the choice were the general usability of the game for foresight purposes, and its crowdsourcing and pure innovation potential. The game is an imagination card game that challenges players to collaboratively and competitively describe objects from a range of alternative futures. During the game players generate ideas of potential future ‘things’ within the outlines of the cards on the table. The game is in principle targeted at any literate person, and it can be varied and customized for different purposes. I localised the game to Finnish language and culture, so the game cards differ somewhat from the original English deck.

The research material was compiled in four game sessions in August 2015, which were organised for the innovation and foresight experts from Heureka The Finnish Science Centre and Sitra The Finnish Innovation Fund. There were fifty players in total. The purpose of these game sessions was to generate broad-based visions and ideas related to the future of Finland, and they were part of Heureka’s interactive future exhibition planning process. Even if the players were innovation and foresight experts, during the game they were just ‘players’, enjoying the gameplay and immersing themselves in the world of future innovations.

I worked as a facilitator of the game sessions, observing the gameplay, but I did not participate in the game itself. This study benefits both from the future ideas generated with the game and my own observations during the game sessions. A more detailed review of the game is presented in Chapter 3.4.

4.2 Processing Future Things

The outcome of the game sessions consisted of 310 handwritten pieces of paper, each with a description of the future 'thing' and the corresponding game prompt. Prompt is a four-card loose definition of the circumstances of the 'future thing'. Prompt *Arc* refers to future scenario, *Time horizon* to the future date for the thing to emerge, *Terrain* to the context, place or topic of the thing, *Object* to the basic form of the thing, and *Mood* to the emotions the thing might evoke. The 'future thing' idea is a kind of first sketch of a future innovation, a product, a service or a new feature for an existing product or service. I transcribed these idea descriptions and corresponding prompts to a Google Sheet worksheet for further handling (see example in Table 1).

My study approach for this material was empirical and methodologically mixed. First I made qualitative classifications for the ideas to map what kind of innovation foresight relevant content they include. Secondly I studied different relationships between the idea classifications and their corresponding game prompts by comparing prompt variables to classification variables with quantitative inductive analyses. And finally I combined my personal observations and the results of the analyses.

Table 1 An example of a future thing game prompt and corresponding "Future Thing" idea description. Original descriptions were handwritten on paper sheets in Finnish.

PROMPT					THING DESCRIPTION
ARC	TIME HORIZON	TERRAIN	OBJECT	MOOD	
Discipline	100	food	vehicle	shame	Social stigma bike. Reads the number of calories a person has consumed. If too many calories have been eaten the bike arrives and you have to ride the bike until the extra calories have been consumed. In 2115 overeating is a big indignity in society.

Ideas are quite evenly distributed to different Arcs (see Figure 4). Arcs outline the kind of future that the thing-to-be-imagined comes from and it is a sort of loose scenario. This distribution tells us that the gameplay works and that it supports versatile future thinking. In the Arc cards there are also seven selectable time horizons - 5, 10, 15, 20,

30, 50 and 100 years. The time horizon means the distance into the future that players must project their future thing ideas. Average time horizon for all descriptions is 31 years (see Figure 5). All time horizons, short-, medium- and long-term futures were covered quite well. However, different time horizons occurring evenly in the game cards in the current deck leads to dominance of medium- and long-term future ideas. This is not optimal when considering the relevant time horizons in innovation foresight. There could be more short-term ideas to make the game more balanced for innovation foresight purposes, as innovation foresight places more stress on short-term anticipation compared to general foresight programs.

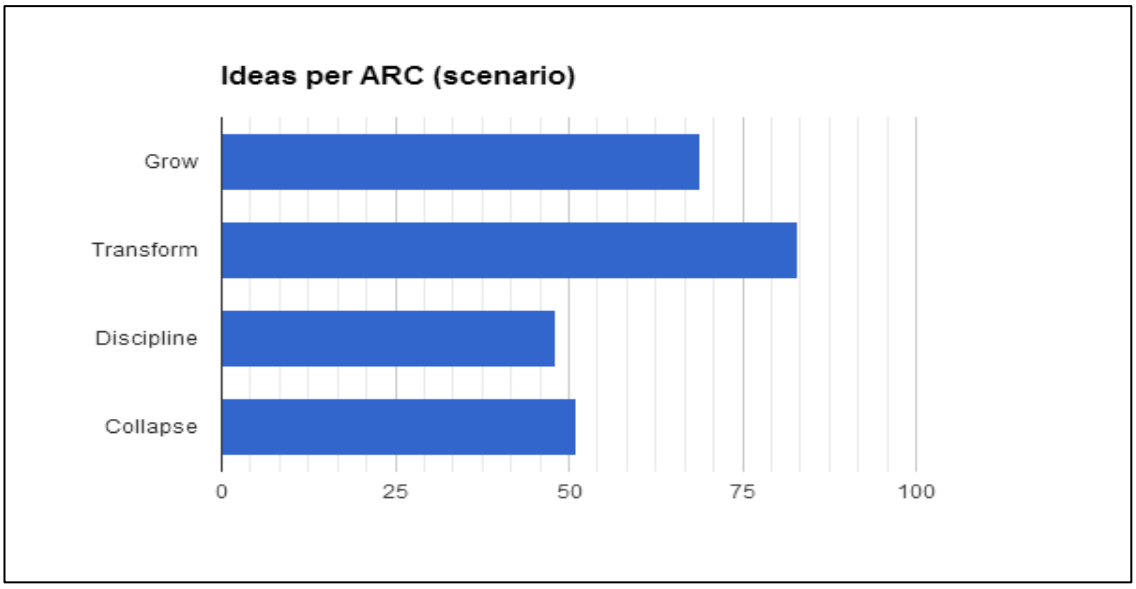

Figure 4 The number of ideas in different Arcs (scenarios)

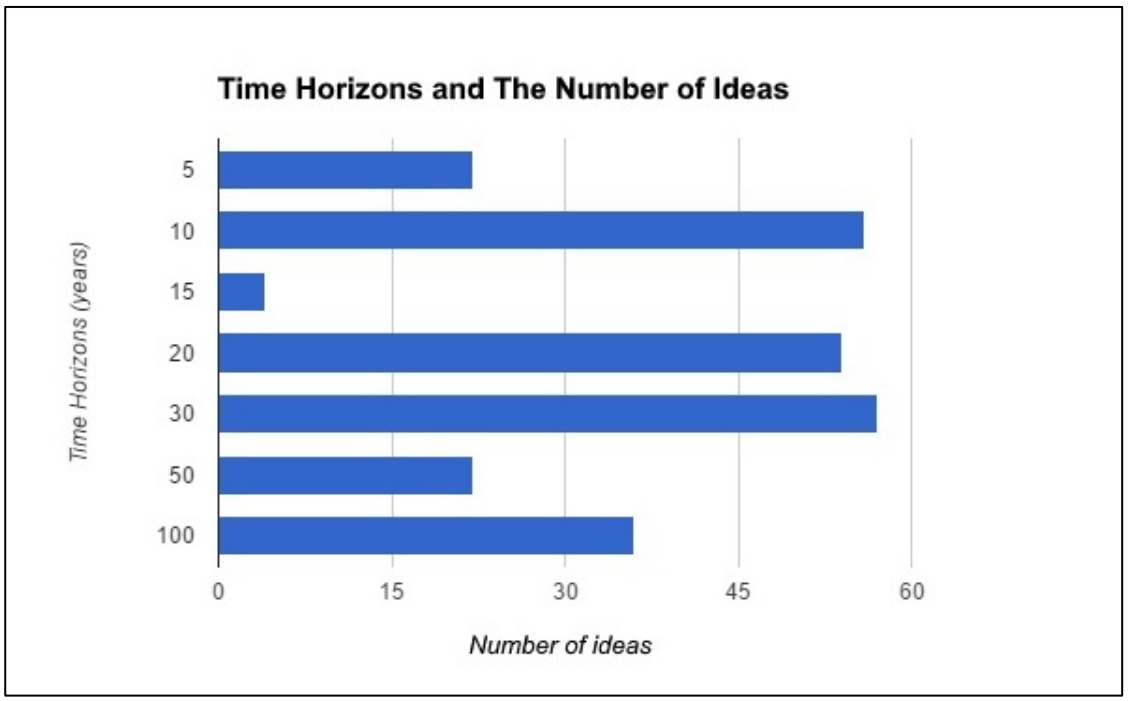

Figure 5 The number of ideas in different time horizons

Concerning the content analysis of the material I first made a general content review to find out which of these descriptions include a real idea. A real idea is of course a complex issue. In this case I simply removed descriptions that were completely empty or the content of which I did not understand, such as the description "*Esperanto. Command. Hermit.*" These three words do not form a meaningful sentence and I did not recognise the idea behind them. However, in this phase I did not evaluate the quality of the ideas in any other way. I just removed the irrelevant material to be able to classify and analyse the remaining content. As a result 60 ideas corresponding to 19 % were left out of the final analyses. A database of 250 ideas was left in the research material.

The large number of non-relevant 'zero ideas' may seem high, but is understandable when considering the speed of the idea generation in the game, which was on average three minutes per idea. Another reason may be difficult game prompt combinations. At the beginning of the game this may confuse the players, especially experts, who are used to being "in control". However, the limited content and amount of this material does not allow for more detailed analysis of the possible reasons for the failures to create ideas.

Secondly I applied a quantitative keyword analysis method on the idea descriptions. The future thing idea descriptions were mainly quite short, with 15 words in average. In a keyword analysis I picked up the most frequently used words in the descriptions, excluding the words in the prompt itself. I used free http://textalyser.net/ web service for this analysis. The analysis did not provide many outcomes (see Chapter 4.3).

Thirdly, to be able to study the content of the ideas more deeply I applied a few qualitative classifications to the ideas. I studied *PESTE variables, hopes and fears* and *creativity* of the ideas. I made PESTE-variable and hopes and fears classifications because they are often used related to foresight work, especially in environmental scanning or in visioning phases (Conway 2015, 23). It is also useful to classify and analyse creativity to see how the different game prompts have affected the quality and novelty of the ideas. Creativity is seen an essential part of the innovation process (see Chapter 2).

In the PESTE-variable classification I mapped how ideas convey different PESTE macro-environmental factors, i.e. political, economical, social, technological and environmental dimensions (see example in Table 2). Then I classified which descriptions contained hope or fear (or both). The definition hope means "A feeling of expectation and desire for a particular thing to happen" and fear "An unpleasant emotion caused by the threat of danger, pain, or harm" (Oxford University 2015). I interpreted the meaning of the descriptions and the words used in them to find out which ideas included clear hopeful or fearful expressions.

Table 2 Example of a PESTE analysis of a future thing description

THING DESCRIPTION	PESTE - dimensions				
	Political	Economical	Social / Cultural	Techno-logical	Environ-mental
Social stigma bike. Reads the number of calories a person has consumed. If too many calories have been eaten the bike arrives and you have to ride the bike until the extra calories have been consumed. In 2115 over-eating is a big indignity in society.	x		x	x	x

Finally I made a creativity classification for the ideas based on a concept by Dean et al. (2006, 30) and Kuzmickaja et al. (2015, 4-6). This concept proposes dimensions for idea creativity to be novelty and quality. They can again be broken down into two constructs: novelty to originality and paradigm relatedness and quality to workability and relevance (see Table 3 and an example in Table 4).

Table 3 Concept of idea creativity (Dean et al. 2006, 30 and Kuzmickaja et al. 2015, 4-6).

Dimensions	Constructs
Novelty	Originality
	Paradigm relatedness
Quality	Workability
	Relevance

Table 4 Example of idea creativity assessment

THING DESCRIPTION	CREATIVITY ASSESSMENT	
	Novelty (1-5)	Quality (0-2)
Social stigma bike. Reads the number of calories a person has consumed. If too many calories have been eaten the bike arrives and you have to ride the bike until the extra calories have been consumed. In 2115 overeating is a big indignity in society.	5	2

The two constructs of novelty, originality and paradigm relatedness were measured with a Likert-type scale from 1 to 5. A novelty grade of 1 was assigned to least original or least influential ideas and a grade of 5 represented the other extremes. Accordingly paradigm relatedness grade 1 was assigned to paradigm preserving ideas and 5 to paradigm breaking or shifting ideas. The detailed grade descriptions can be seen in Table 5. The novelty grade was calculated as an average of originality and paradigm relatedness, thus ranging in the interval [1, 5].

When applying this framework, the novelty of any idea must be judged in relation to how uncommon it is in the mind of the idea evaluator or how uncommon it is in the overall population of all ideas studied. I used the first one. Paradigm relatedness describes the transformation potential of ideas. It is the degree to which an idea relates to the currently prevailing paradigm, and includes such descriptions as trend setting, influential, revolutionary, and radical (Dean et al. 2006, 15 and Kuzmickaja et al. 2015, 4-6).

The idea quality was composed of two constructs: workability and relevance. Evaluated in this way, I used 1/0 dichotomous grades. Concerning workability grade 1 mean that an idea could be implemented, at least on idea level, and does not violate known constraints, 0 otherwise. As to relevance, a grade of 1 means that the idea applies to the stated game prompt, 0 otherwise. The quality grade was calculated as the sum of relevance and workability within the [0, 2] grade range (see Table 5).

The original creativity evaluation concept also suggests a third construct, namely specificity. An idea is specific if it is clear and worked out in detail. I excluded the specificity construct in this study, as it is recommended that specificity is optional and should be measured only when it is a main focus of a study (Kuzmickaja et al. 2015, 4-6). It is worth mentioning that due to the different scales used to measure novelty and quality, we cannot aggregate the novelty and quality dimensions as a single creativity grade.

Table 5 Idea creativity assessment concept (Kuzmickaja et al. 2015, 4-6)

Idea creativity assessment		
Idea novelty grade (Likert-type scale 1-5, average of two factors)	Originality-level description	Paradigm relatedness–level description
5	Surprising, ingenious, not expressed before (rare, unusual)	Paradigm breaking or shifting, introducing several new elements and changing the way people, products or services interact with each other
4	Unusual, imaginative	Major paradigm stretching, changing the interactions between people, products or services
3	Interesting, shows some imagination	Moderate paradigm stretching, introducing several new elements
2	Somehow interesting	Slight paradigm stretching, introducing few new elements
1	Common, mundane, boring	Paradigm preserving, no influence to future interactions
Idea quality grade (0-2, summed)	Workability	Relevance
1	Could be implemented (at idea level) and does not violate known constraints	Relevant idea -applies to the stated prompt
0	N/A	N/A

It is important to understand that the classifications used in this study are based on subjective interpretations of the descriptions. To estimate the reliability and generalizability of the classifications I asked for one peer review. Thus, a random 10 % sample of the database was classified by a person with a doctorate in social siences, who is an expert in innovation and familiar with foresight. Concerning hopes and fears 66% of the

classifications grades matched; concerning PESTE variables the match was 79% on average. Regarding creativity classification I calculated the number of grade matches as well as the average novelty grade deviation. 66% of the novelty classifications matched and the average deviation was 1.0 grade in Likert scale 1-5.

It could be asked whether the margin of error is too high. However, that random sample peer review is not a fully valid approach for the creativity Likert scale grades, as a review should be applied to the whole material, not just to a sample. Anyway, with classification crowdsourcing we could get better results if the crowd wisdom effect could take the place of single reviews.

The empirical case study consists of several quantitative inductive statistical analyses that were performed with the database. I have tried to form different perspectives to the material to understand how the ideas made in the game may help practical innovation foresight work, what kind of future innovation knowledge they may contain, and the benefits and weaknesses of the game when related to innovation foresight targets. Due to the lack of reference material I cannot evaluate the overall quality or dimensions of the ideas. I can only review them in the scope of general innovation foresight work and its targets.

4.3 Keyword analysis

I first tested the pure quantitative method for the idea descriptions with a keyword analysis. In this analysis I mapped the most frequently used words in the descriptions, excluding the words in the prompt itself. Keyword analysis did not reveal the nature of the descriptions. Only a few words emerged from the text (see Table 6). The words “virtual, digi-” and “automatic” may refer to the ongoing digitalisation trend and the players’ faith that this trend will continue far into the future.

Table 6 Keyword analysis of the future thing descriptions (of all 250 descriptions)

Keyword	Amount	Percentage
Virtual	19	7.6 %
Digi-something	5	1.6 %
Automatic	11	4.4 %

4.4 PESTE analysis

In the PESTE analysis I studied how ideas contain different political, economical, social, technological and environmental factors. PESTE factors are often used in futures research and foresight to categorize forces of change. PESTE model is useful to avoid tunnel vision and the specialisation that comes with the past experience of the organisation in dealing with environmental abnormalities (Mendonca et al. 2012, 9). In average the ideas contained 2.04 PESTE factors, which reveals their multidimensional nature. This can be considered as a positive result in the scope of innovation foresight.

The PESTE analysis also revealed quite a strong emphasis on technology and social ideas. 76% of the ideas included some kind of technological dimension and 71% some social dimension. One reason for the large number of social ideas may be the fact that I included health issues in this category. This may refer to Finland's aging population and different expectations and challenges related to the aging trend in general. It is also possible that the Arc and Mood alternatives of the game particularly support social ideas.

The high number of technological factors is no surprise, because innovation experts often favour technology related ideas and many players most probably had quite good technological knowledge. Still, I think that the most important outcome of this analysis is that all PESTE-variable categories were quite well covered (see Table 7). This shows that the overall content of the ideas was comprehensive, which is good in the perspective of innovation foresight targets.

Table 7 Different PESTE dimensions in the idea descriptions. Over 50% values have a green background.

	PESTE dimensions				
	Political	Economical	Social	Technological	Environmental
Number	41	40	**177**	**192**	63
%	16.3%	15.9%	**70.5%**	**76.5%**	25.1%

4.5 Hopes and fears

The idea descriptions were rich in hopes and fears. When reviewing hopes related to different Arcs (scenarios), we can see that Grow and Transform scenarios included more hopeful ideas than Discipline and Collapse (see Figure 6). If we refine the analysis by taking into account the overall distribution of the ideas to different Arcs we can see that the Grow Arc generated more hope than other Arcs and Collapse less hope than other Arcs (see Table 8).

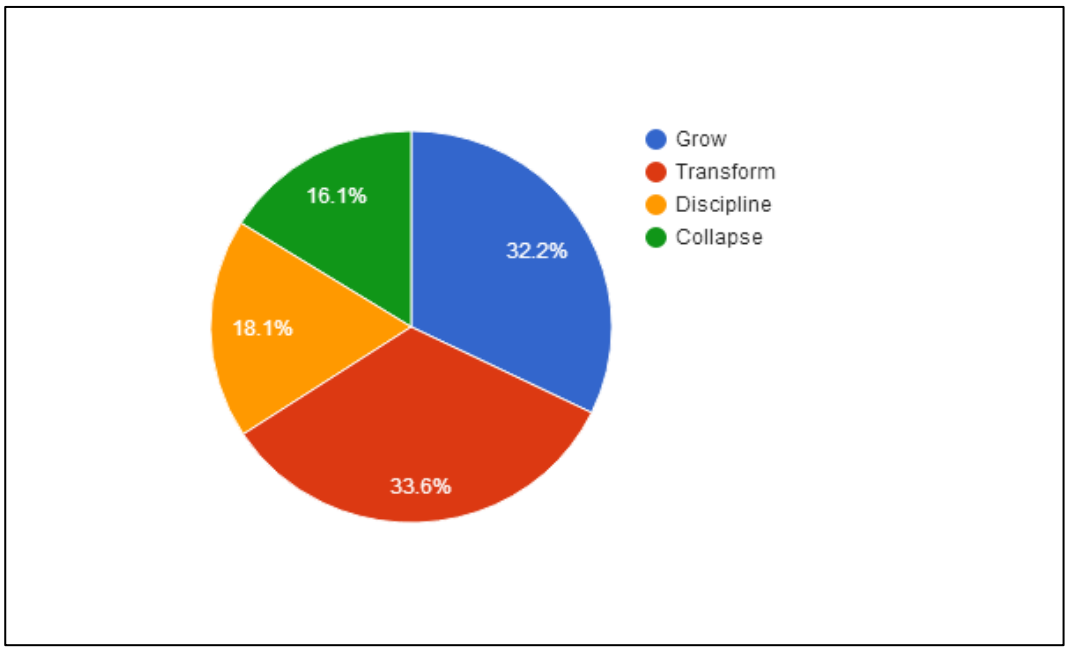

Figure 6 How hopes are distributed to different Arcs (scenarios)

Table 8 Percentage of ideas including hope in different Arcs (scenarios)

ARC	Percentage of ideas including hope
Grow	69.6%
Transform	60.2%
Discipline	56.3%
Collapse	47.1%

When looking at fears in different Arcs we can see quite opposite phenomena (see Figure 7). Collapse and Discipline Arcs generate many more fears than other Arcs. Transform has only half as many fears and Grow just a fraction of fears compared to them. All in all different Arcs generate hopes more evenly than fears. Fears are especially engaged to Discipline and Collapse Arcs (see Table 9).

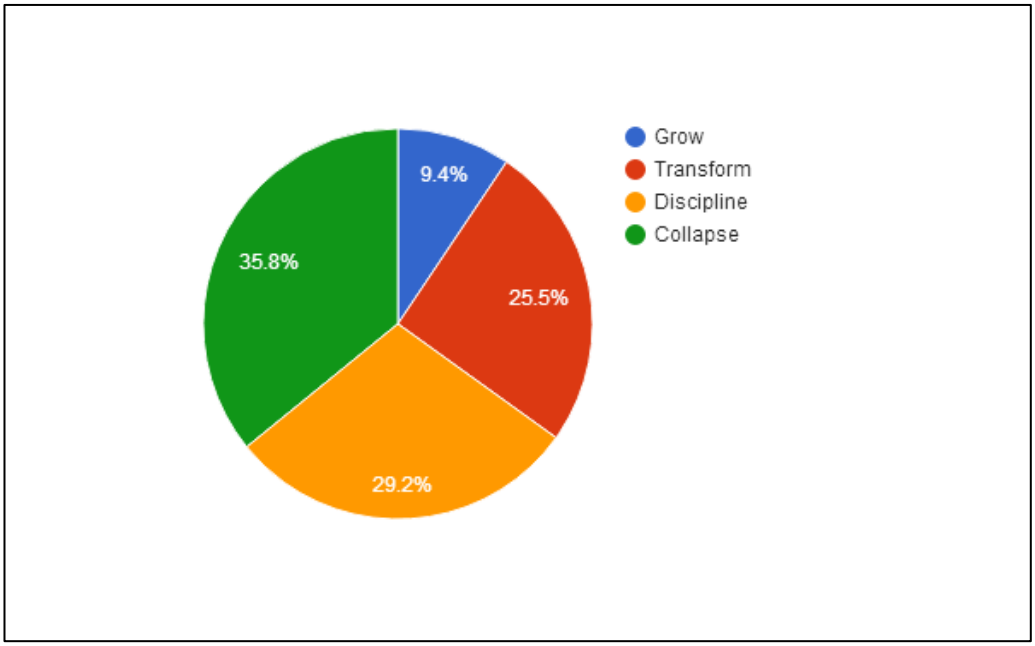

Figure 7 How fears are distributed to different Arcs (scenarios)

Table 9 Percentage of ideas including fear in different Arcs (scenarios)

ARC	Percentage of ideas including fear
Grow	14.5%
Transform	32.5%
Discipline	64.6%
Collapse	74.5%

When looking how different Mood cards in the game prompt generate hope or fear we first have to consider that the deck included 27 different Mood cards, of which 14 have a positive nature (like joy or empathy) and 13 have a negative nature (like disgust or shame). We can see some obvious results such as hope, joy, satisfaction, relaxation, empathy and serenity creating hopeful ideas (see Figure 8). But there are also some surprising factors, such as shame generating hope. This may be a random factor because the description sample is not very large. But it seems that some other 'negative' Moods, like stress, also generate hope. One explanation for this phenomenon may be a counter-effect; i.e. a negative Mood card has inspired a hopeful solution from a fearful starting point and then the description has included both fearful and hopeful elements. All in all the results concerning hopes and Moods are quite expected.

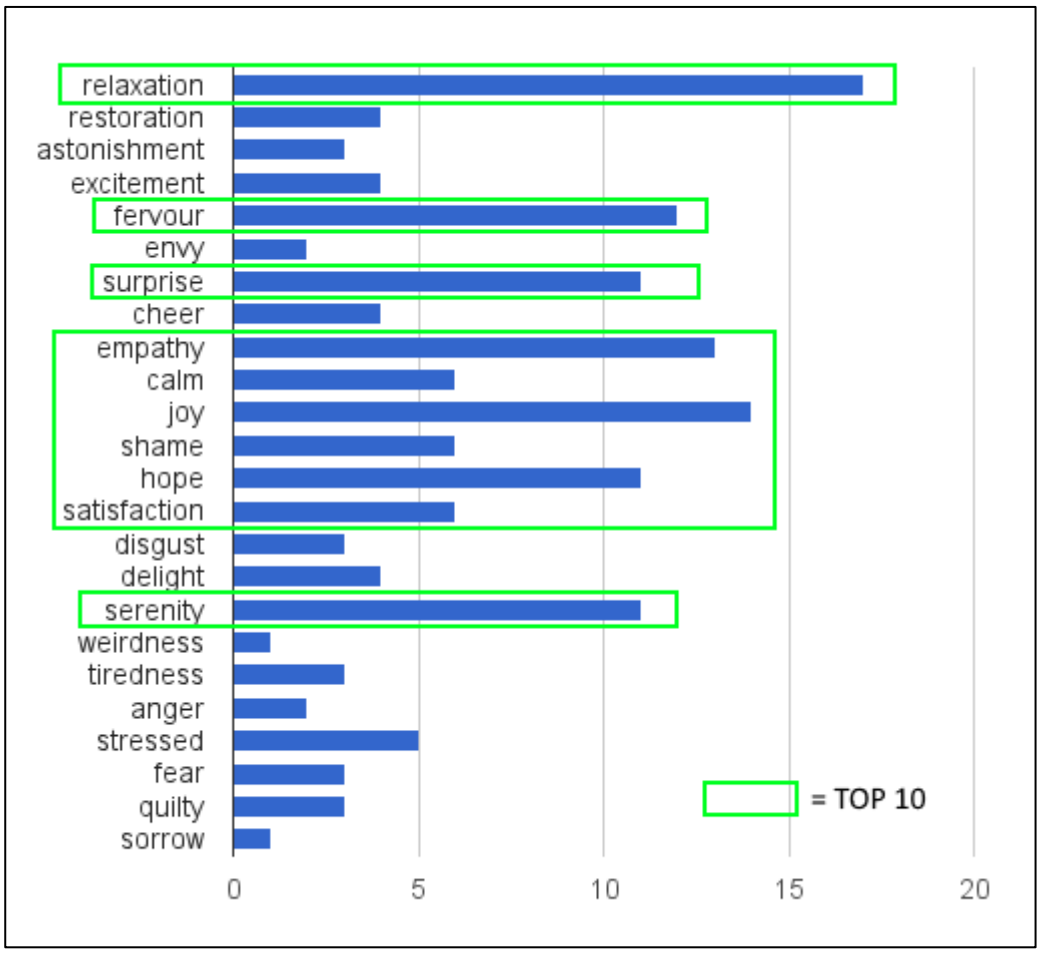

Figure 8 How different Moods in the game prompt generate future hopes (number of hopeful ideas)

The situation changes somewhat when we review how different Moods generate fearful elements. Some obvious results are that fear, disgust, stress and shame Moods have generated many fearful descriptions (see Figure 9). But quite a few 'positive' Moods such as fervour, empathy, calm and relax have also generated fearful elements for the ideas. There is no clear explanation for this phenomenon.

When looking at the contents of the hopeful and fearful descriptions more specifically, hopes are often related to better environment and new technology, especially technological innovations solving different kinds of problems or challenges (such as new cures, intelligent health food inventions, new energy inventions, an empathy chip etc). Fears are especially related to discipline and regulation by the state and to an assumed environmental collapse (e.g. new environmental police, agricultural production collapse, population control etc.).

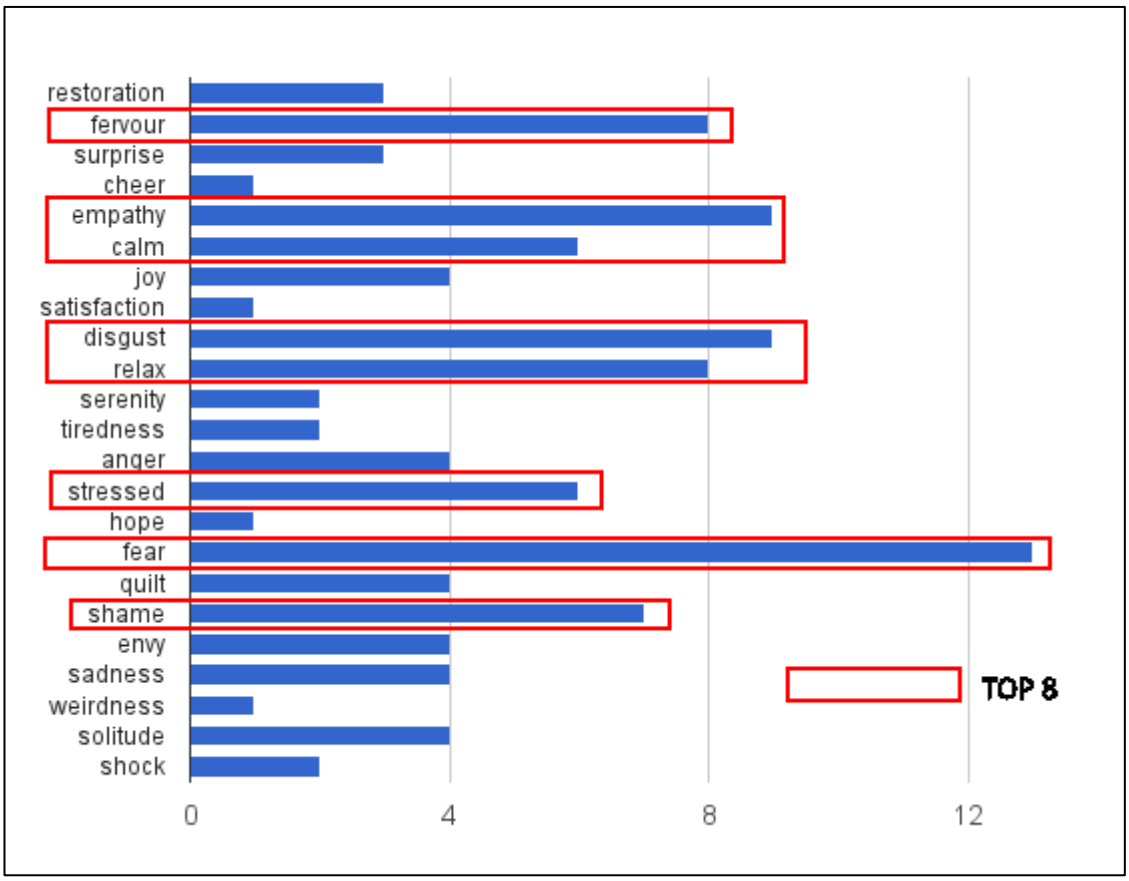

Figure 9 How different Moods in the game prompt generate future fears

To map hopes and fears related to the future is an essential part of foresight. There is no specific way of doing it. Probably the stakeholders are most often just asked to write them down on post-its. However, this kind of visioning game which offers a clear frame for hopeful and fearful thinking in the form of game prompts is quite an effective and creative solution to imagine hopes and fears. The prompts' defining factors can help to crystallise hopes and fears related to these specific "What if…" situations. And the fast-paced nature of visioning can help players to avoid restrictive everyday rational thinking. So it is important to maintain a balance between positive and negative factors in the game, in Arcs as well in Moods. It may be that the power of negative factors is sometimes underestimated in innovation foresight. They can pop up unexpected forms of use of a future product, service or technology. This is alleged to be one important factor in innovation foresight (see Chapter 2.).

4.6 Creativity of the ideas

To study the creativity of the ideas I made a creativity evaluation for the descriptions. The background for the evaluation is outlined in Chapter 4.2. Both the novelty and qual-

ity of the idea were graded. In novelty evaluation the idea gets a grade from 1-5 (5 = best category) and in quality evaluation a grade from 0-2 (2= best category). The distribution of the novelty grades is not in a normal Gaussian distribution format, as we can see in Figure 10. The average novelty grade of all ideas was 2.61 (range 1-5) and average quality grade 1.53 (range 0-2). However the form of the distribution is not so important, as we are not evaluating these ideas against any other material. In other words, creativity evaluation only has value when we compare different creativity aspects against other factors of this same research material.

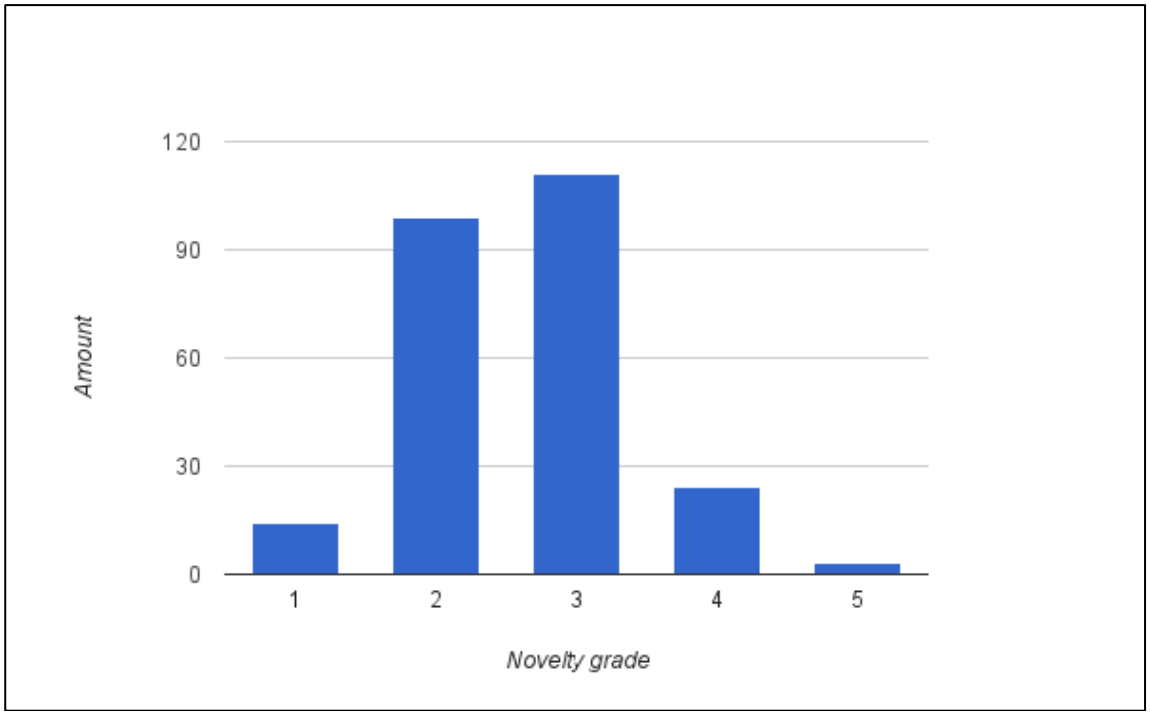

Figure 10 Distribution of idea novelty grades

Table 10 Idea creativity - game round winners versus others

Creativity	Novelty (1-5)	Quality (0-2)
Round winners (average grade)	3.2	1.9
Others (average grade)	2.4	1.4

To be able to analyse and review the creativity components of the ideas I made some statistical reviews. First I examined how the creativity of the game round winning ideas corresponded to other ideas. The total number of round winning ideas was 59 (23.5% of all ideas). There seems to be a clear positive correlation between the round winning ideas and high creativity grades - covering both idea novelties and qualities (see Table 10). Round winning ideas are high above the average creativity grades and seem to

clearly raise the average creativity grade of all ideas. Maybe the spirit of playful competition related to games can also get players to jump over their everyday rational thinking to more creative levels.

When reviewing the novelty grades of ideas in different Arcs we can identify a slight trend. Grow and Transform Arcs seem to get better novelty grades than Discipline and Collapse Arcs (see Table 11). The differences are however not vast. Concerning the quality grades there is a slightly different distribution between the Arcs. Grow Arc received slightly better average grades than Transform or Discipline (see Table 12). In turn, Collapse Arc received slightly worse grades than Transform or Discipline. All in all it seems that Grow and Transform Arcs generate more creative ideas than Discipline and particularly Collapse.

Table 11 Percentages of idea novelty grades in different Arcs. Those with a green background are the highest values in different grade categories.

	ARCs			
Novelty grade	Grow	Transform	Discipline	Collapse
1	5.8%	1.2%	8.3%	**9.8%**
2	39.1%	37.4%	39.6%	**43.1%**
3	40.6%	**49.4%**	45.8%	39.2%
4	**13.0%**	9.6%	6.3%	7.8%
5	1.5%	**2.4%**	0.0%	0.0%

Table 12 Percentages of idea quality grades in different Arcs. Those with a green background are the highest values in different grade categories.

	ARCs			
Quality grades	Grow	Transform	Discipline	Collapse
0	2.9%	1.2%	4.2%	**7.8%**
1	31.9%	**47.0%**	35.4%	43.1%
2	**65.2%**	51.8%	60.4%	49.0%

Then we take a closer look at how different Moods in the prompts have affected the creativity of the ideas. We must again remember that the deck included 27 different Mood cards, of which 14 have a positive nature (like joy or empathy) and 13 have a negative nature (like disgust or shame). To avoid random prompts to distort the results only Moods applied in more than ten idea descriptions have been included. This means they were present in least in three different game prompts and thus form a representative sample.

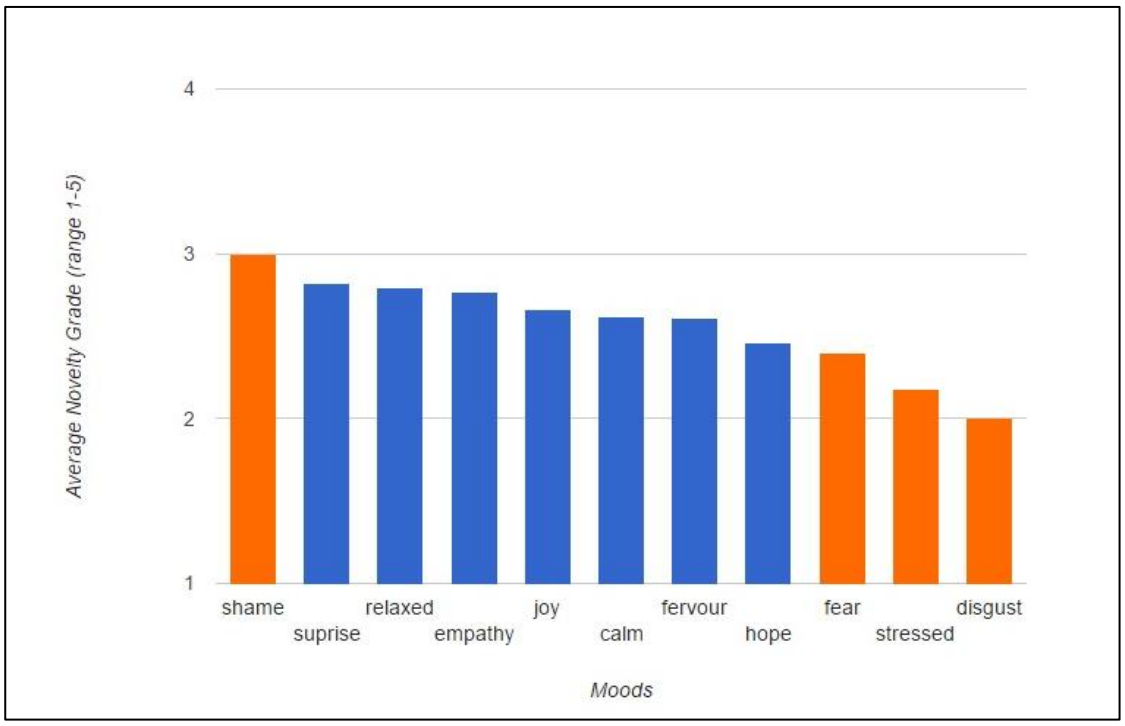

Figure 11 Idea novelty grade averages in different Moods. ‘Positive’ Moods are blue and ‘negative’ Moods are orange.

It seems that ‘positive’ Moods generate better novelty grades on average than ‘negative’ Moods (see Figure 11). Shame is a clear exception from this phenomenon - this may be just a random factor, or maybe Finnish people are just creative at generating shameful ideas.

Concerning the idea qualities in different Moods there is a parallel phenomenon to be seen (see Figure 12). Now the Fervour Mood is a minor exception, getting lower grades than the Shame Mood. This again may be just a random factor.

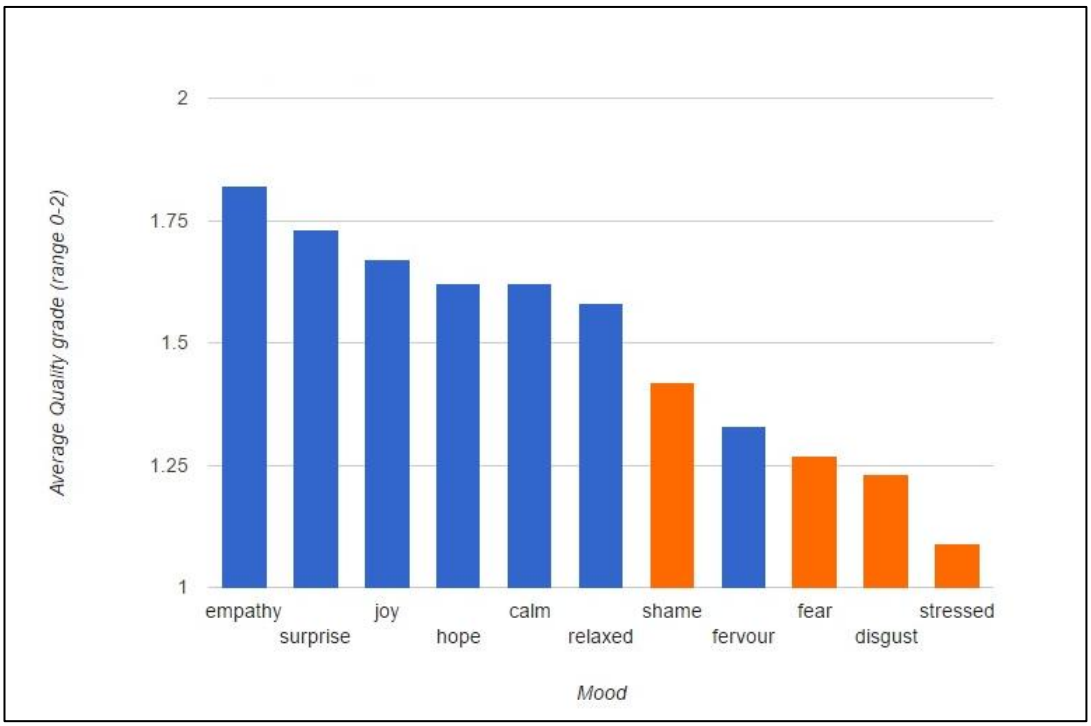

Figure 12 Idea quality grade averages in different Moods. 'Positive' Moods are blue and 'negative' Moods are orange.

Finally I analysed the idea creativity against time horizons (5, 10, 15, 20, 30, 50 or 100 years). I left out the 15 year time horizon ideas, as they only appeared in one played prompt and do not form a representative sample.

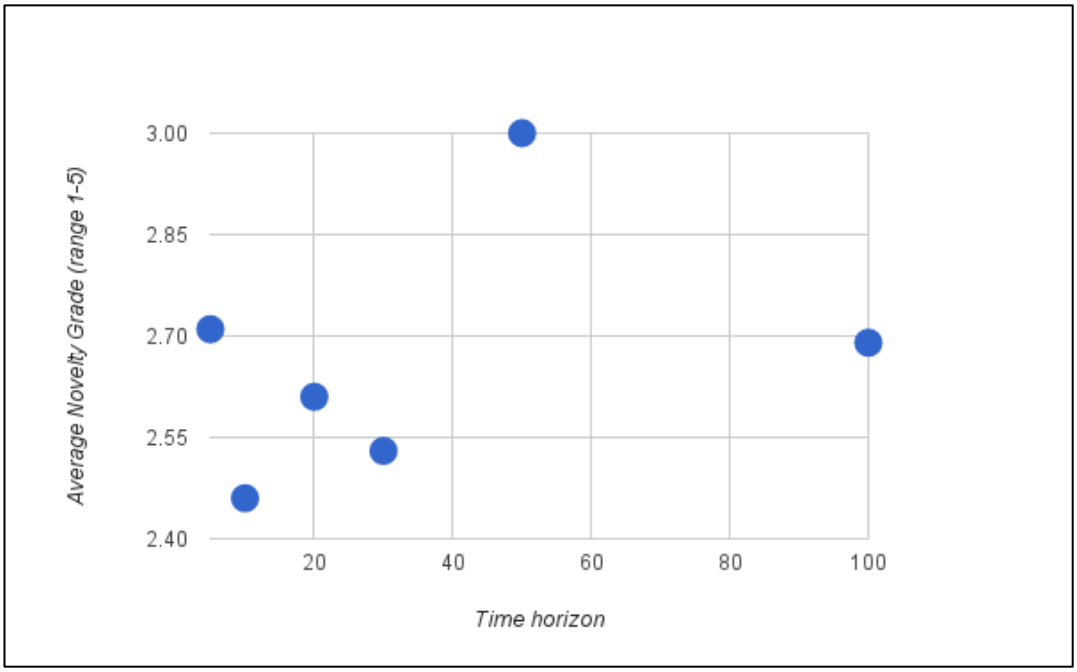

Figure 13 Idea novelty grade averages in different time horizons.

Concerning the idea novelties against different time horizons there is no clear trend to be seen (see Figure 13). Also there is lower variation in the grades than for example compared with idea novelties versus Moods (only 13.5% of the total grade range of 1-5). It may be that the players do not take the time horizon factor very much into account, because there are other more interesting or easy factors to match (such as Terrain, Object and Mood). A similar phenomenon can be seen with idea qualities versus time horizons. The very low variation of the quality grades is remarkable, only 10% of the total grade range of 0-2 (see Figure 14).

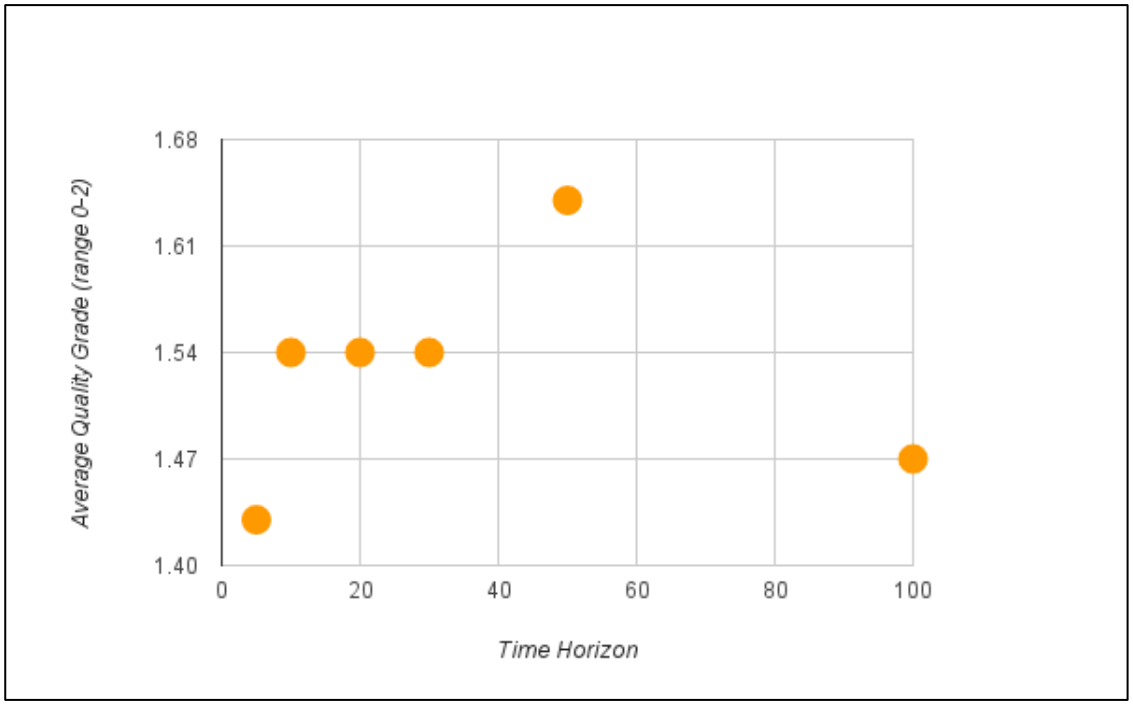

Figure 14 Idea quality grade averages in different time horizons

It is not possible to analyse the relevance of the content of these ideas against different time horizons, as there is no reference material. However, it seems that for most of the players the time horizon presented in the game prompt has been unimportant when creating the ideas. It has certainly had a meaning when evaluating the quality of the ideas and selecting the winning idea. But in such a fast-paced game the capacity of the players to deeply orientate themselves to different time horizons is limited. However, clearing this aspect would need reference material and further research.

4.7 Brainwriting and gameplay

The Thing from The Future is a collaborative brainstorming game. I have experienced that many brainstorming workshops do not produce very much added value. The litera-

ture provides the same kinds of reflections. Opportunities for brainstorming to fail are many, such as a single person dominating the discussion, cognitive narrowing in form of group fixation, and fear of failure restricting output. When people are trying to listen, think, add, collaborate and build at the same time, it is psychologically difficult (Sneed 2016, 1).

However, it seems that in The Thing from The Future game sessions the pitfalls of brainstorming have been avoided. To understand this phenomenon we have to take a closer look at the gameplay. The gameplay is not a pure brainstorming session. This game is a mix of card game and brainwriting. In brainwriting the group members write their own ideas on pieces of paper before sharing them out by discussing. This brainwriting allows for constructive group interaction, such as sharing ideas and building on them, while avoiding the pitfalls of brainstorming. Again, studies support the idea that brainwriting in a group is more creative than working alone. A very effective way seems to be alternating groupsharing and brainwriting alone (Sneed 2016, 1). And this is precisely the way in which The Thing from The Future gameplay proceeds.

I think that the playful atmosphere during the game sessions can also help to overcome the fear of failure phenomenon, which can restrict creative thinking when people are taking things “too seriously”. So the gameplay has a two-step nature, idea writing alone, which is the creative part of the game and then the shared evaluation of ideas, which is the analytical and learning part of the game. Both parts are essential concerning the overall gameplay.

5 GAMIFYING FORESIGHT WORK

5.1 Questionnaire design

To find practical views for my second research sub-question “What innovation foresight activities can we crowdsource with games?” I developed a web questionnaire targeted at innovation and foresight experts. This questionnaire was sent to 50 innovation and foresight experts who participated in the “The Thing from The Future” game sessions I arranged in August 2015. I wanted to get feedback and views from innovation experts who had played at least one future oriented game. All of these people were working as innovation experts in Sitra or as science exhibition designers in Heureka. All of them had been dealing with innovations, and most of them had experience in practical foresight work as well. Some of them were even experts on game design.

The questionnaire mapped the place and extent of games in innovation foresight work. It consisted of 13 choice or multiple-choice questions and two open questions (see Appendix 1, only in Finnish). The questions were divided into four sections

1. How The Thing from The Future game suits foresight work
2. How The Thing from The Future game suits innovation work
3. How The Thing from The Future works as a game
4. How games can be used in foresight work

The questionnaire was answered by 22 experts, which corresponds to 44%. All participants had played The Thing from The Future game and only three indicated to have played some other foresight games as well. This must be taken into account when reviewing these results against other game case studies. As the respondent group is quite coherent by profession, no personal background information was asked for. I have gathered the answers on a Google Sheet for further analysis. The questionnaire study was performed by means of basic statistical analyses.

5.2 Games and anticipation

The first part of the questionnaire covered issues related to the use of games in different tasks of anticipation in general. Some questions referred to The Thing from The Future game, as all respondents had at least played that innovation foresight game. Some questions were related to the general use of games in foresight. Answers to four seven-point Likert scale “Very well – Not at all” -type of questions were quite parallel and positive (see Figures 15 and 16). Respondents believed that games support general anticipation work quite well and none of the respondents believed that games do not

support anticipation at all. The best response was given to the games' ability to generate creative solutions for anticipation. When reviewing the feedback we have to remember that for most participants The Thing from The Future is the only foresight or innovation game they have played.

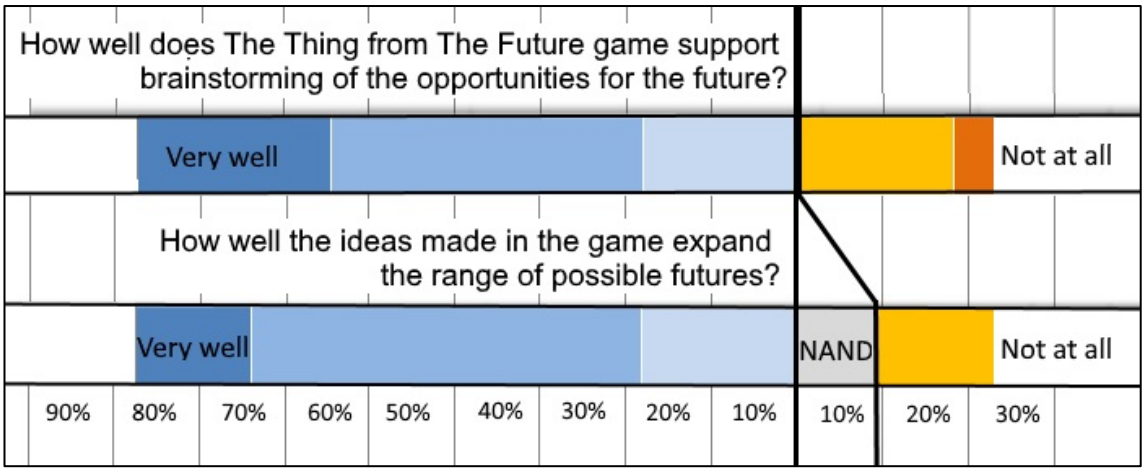

Figure 15 Expert questionnaire - How well does The Thing from The Future game support anticipating the future? Responses in seven step Likert scale. The 'Not at all' option got 0.0 % in both questions.

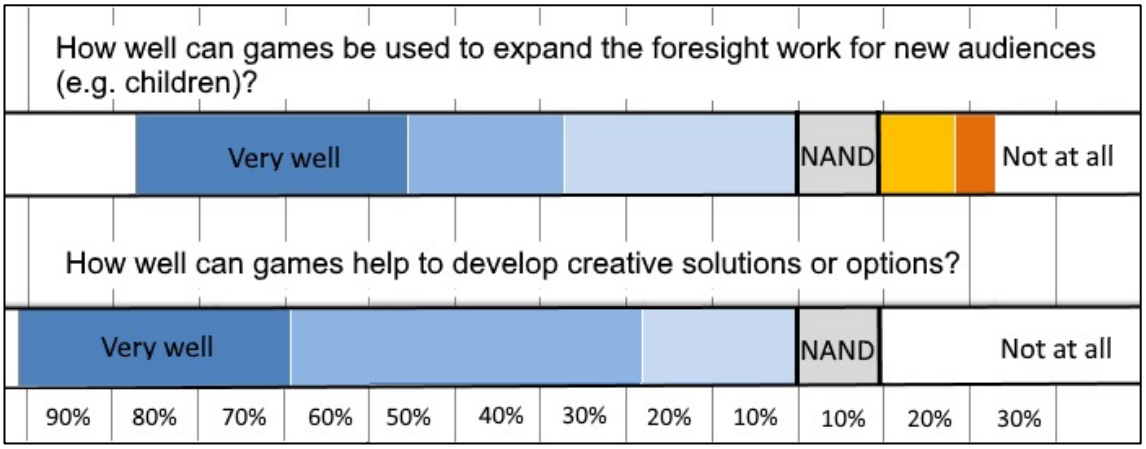

Figure 16 Expert questionnaire - How well can games help to expand participation in foresight work and support creativity? Responses in seven step Likert scale. The 'Not at all' option got 0.0 % in both questions.

5.3 Games in the foresight process

When we focus on the different practical tasks of foresight work we can see some interesting views. Concerning tasks especially “perceiving hopes and fears” pops up from the material, 77% of the respondents think that the game can perceive hopes and fears related to the future (see Table 13). This may be related to the Mood part of the game prompt. It seems that emotions related to Mood cards are strong activators of hopeful and fearful thinking. Also wild card forming, weak signal observing and future vision development have a strong positive connection with the game in the questionnaire. Instead future trend forecasting is not connected to the game ideas. Maybe respondents believe that this needs a professional futurist’s or expert’s perspective and cannot be crowdsourced to “amateurs”.

Table 13 Expert questionnaire - What kind of anticipating tasks can The Thing from The Future game support? The over 50% positive response rates have a green background.

Ideas made in the game may help to…							
observe weak signals	**form wild cards**	build future scenarios	observe previously unforeseen risks	**perceive hopes and fears related to the future**	forecast future trends	analyse the possible effects of decisions related to the future	**develop new visions for the future**
12	**14**	8	6	**17**	3	6	**13**
54.6%	**63.6 %**	36.4%	27.3%	**77.3%**	13.6%	27.3%	**59.1%**

Concerning the use of games in different foresight phases, one phenomenon can be clearly identified in the answers (see Table 14). Games are suitable for the environmental scanning phase in the early stages of the foresight process (to observe the forces for change in the business environment) and for building future visions, desirable future options in the “design” phase (to form options for the future). In other words, to enhance foresight with participation by listening to “the voices in the field”. But interestingly, games are not seen as useful in decision-making. This view can be due to at least two different factors. First, the results of this game, the ideas, are not seen as alternative decision options. Secondly, the traditional idea that playful emotions cannot be allowed to mess up “rational” decision-making may have also generated this view. Like in the previous question, responses covering scenario building are divided. This is perhaps because the game in question, The Thing from The Future, is not directly suitable for scenario building. Interpretation issues such as structuring observations also received

divided responses. For the sake of easy comprehension the foresight phases were written in simpler terms in the questionnaire than they appear in the foresight process literature (see Andersen Dahl - Andersen Dannemand 2014, 283).

Table 14 Expert questionnaire - In which phases of the foresight process can the game be useful? The over 50% positive response rates have a green background.

Choose all those foresight phases You think games are suited for…					
to observe the forces of change in the business environment	to interpret and structure the observations concerning the changes in business environment	**to form options for the future**	to make plans and scenarios for the future based on the previous phases	to future related decision-making	none of the above
16	6	**14**	5	2	1
72.7%	27.3%	**63.6%**	22.7%	9.1%	4.6%

5.4 Games and innovation

When asked about how The Thing from The Future game works as an innovation tool the overall response was again quite positive (see Figure 17). Another question related to most common innovation activities provides more detailed feedback (see Table 15). The game in question can help develop radical innovations, find previously undetected needs and particularly challenge traditional ways of thinking. The last point received a unanimous 100% positive response. The game has really convinced respondents to think in new ways.

This game is not believed to be suitable for mapping organisations' strengths, nor for roadmapping new technologies. Technology roadmapping is most probably believed to need expert know how, especially when asking innovation experts. The responses concerning observing changes in consuming trends are dispersive. It may be that the gaming experience itself has made some experts reassess their thinking, as many of the winning ideas concerned unexpected uses of technologies or services. And this may reflect potential changes in consumption. Again, the language used to describe the innovation activities in the questionnaire was simplified to aid comprehension, compared to that in innovation management literature (such as in Rohrbeck – Gemünden 2011, 17).

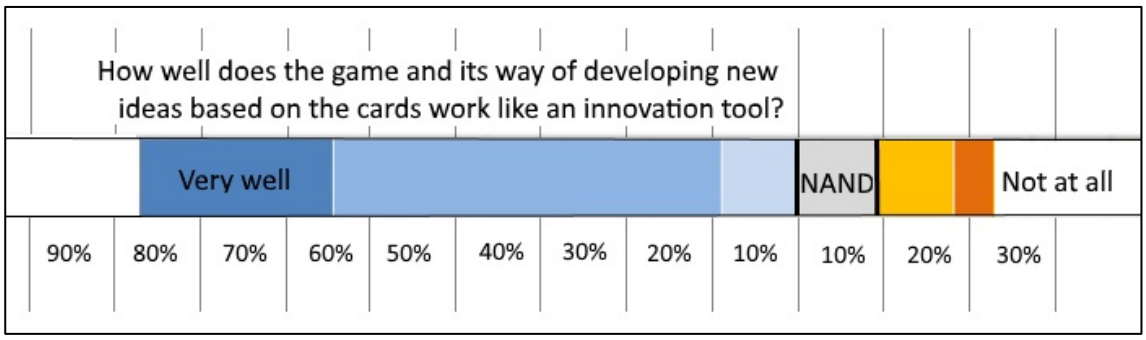

Figure 17 Expert questionnaire - How well does the Thing from The Future game work like an innovation tool? Responses in seven step Likert scale. The 'Not at all' option got 0.0% response rate.

Table 15 Expert questionnaire - What innovation activities can the ideas developed during the game contribute to? The over 50% positive response rates have a green background.

Ideas developed during the game can help to...					
Observe changes in consuming trends	Map organisations' strengths	**Develop novel, unorthodox and radical innovations**	**Challenge traditional ways of thinking**	**Find previously undetected needs**	Determine the timing of new technologies
5	1	**14**	**22**	**12**	3
22.7%	4.6%	**63.6%**	**100.00%**	**54.6%**	13.6%

5.5 Time horizons

Concerning the game's suitability for anticipation in different time horizons, respondents favoured quite long-term timeframes, mostly 30 - 50 years (see Figure 18). This may have a strong relation to the time horizons in The Thing from The Future game prompts, which have an average of 31 years in the 310 original idea descriptions. So all respondents have had these time horizons in mind and had no other references. Another reason could be the special nature this game has concerning the future - to generate a kind of science fiction style ideas. Science fiction thinking can easily lead our thoughts to distant futures. Anyhow, it is interesting that none of the respondents thought that this game could be suited to anticipate short-term futures (0-5 years).

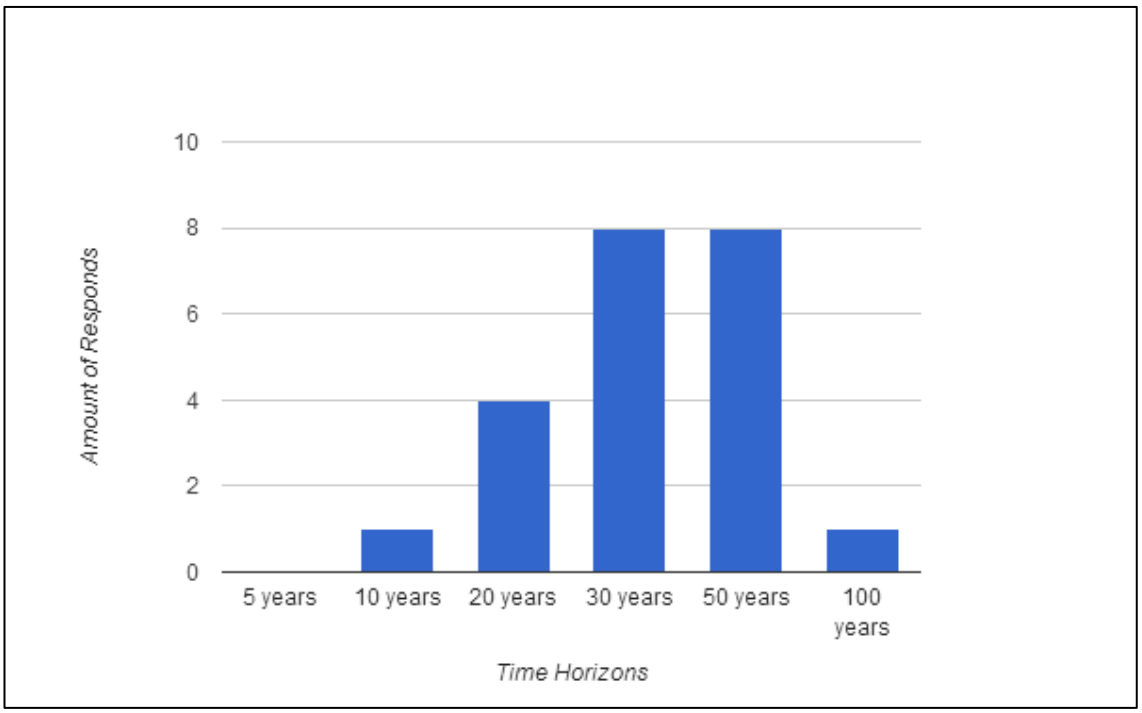

Figure 18 Expert questionnaire – To which time horizons the The Thing from The Future game is suitable to foresee the future.

5.6 Who can and will participate

To whom could we crowdsource anticipation activities with the Thing from The Future game? According to the respondents, to quite a few age groups. Only the youngest age group of 7-11 years got a positive response rate of slightly below 50% in the questionnaire (see Table 16). It is remarkable that the 31-64 year age group is thought to be as capable and interested to play than the more traditional diginatives of 20-30 years (Karvinen – Mäyrä 2011, 20-21). Responses reveal that at least according to these respondents the game is suitable for widescale participation such as crowdsourcing.

Table 16 To whom is The Thing from The Future game suitable? The over 50% positive response rates have a green background.

Mark all the age groups for which you think the game is suitable				
7-11 years	12-19 years	20-30 years	31-64 years	65 - years
10	**17**	**19**	**18**	**13**
45.5 %	**77.3%**	**86.4%**	**81.8%**	**59.1%**

The possibilities of using games to enhance the commitment of the participants to foresight work did not receive quite as positive responses. However, even if the re-

sponses are more scattered, the 3.18 average response grade is still on the positive side (see Figure 19).

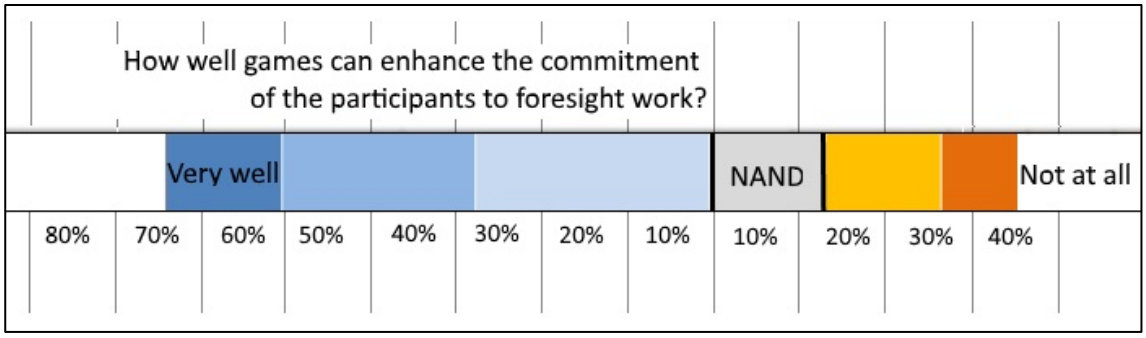

Figure 19 How well games can enhance the commitment of the participants to foresight work? Responses in seven step Likert scale. The 'Not at all' option got 0.0% response rate

5.7 Other remarks

In the last part of the questionnaire I gathered free form textual responses under the theme "Other observations related to games in innovation foresight work". Six respondents answered this question. Here are some extracts from them (translation from Finnish to English by the author):

> *"The unbalanced images the card prompts formed... and the need to combine them for a balanced idea generates startling ideas and results..."*

> *"Help to broaden your thinking and force to be - at least to some extent - creative."*

> *"When playing together people can observe different types of parsing things and learn from each other's ways of thinking."*

> *"Few people can create anything from scratch. [The Thing from The Future] Game includes ingredients that feed thinking into new directions and which would not come to one's mind spontaneously."*

> *"This game does not bring any added value to the analysis nor orbservation [of the futures]".*

> *“The [gaming] perspective easily becomes quite crazy and the results are extreme ideas or pleasantries arising from present everyday life.”*

Most comments are positive. One good remark is that the rules of the game, the need to combine different things from the prompt to synthesis, generate startling ideas. The same thing is said in other words in another response, “Few people can create anything from scratch”. Another good remark is that playing can enhance learning from each other’s ways of thinking. It seems that most of the players think that game has helped them innovate future things. Negative comments are related to “crazy” outcomes of the game as well as non existing added value of the game when “analysing” the future.

6 DISCUSSION

6.1 Reflections on results

I already made some topic specific reflections in Chapters 3-5. Here I have collected some more general thoughts related to the themes of innovation foresight, crowdsourcing and games.

Foresight is lacking a real “domain” of its own in business and society. It is most often a subject of corporate strategic foresight in the private sector, or separate projects and programs in different silos of the public sector. In a fast-paced volatile world of innovation such foresight may often fail. On the other hand, the more our economies rely on innovation, the greater is the need to anticipate it. The opportunities to combine foresight more deeply with innovation management should be studied and tested. Again, the theoretical framework for innovation foresight remains scattered. There is need for compiling discussion and further research that lean on empirical evidence and comprehensive case studies.

A novel constructivistic foresight approach is challenging existing probabilistic forecasting and possibilistic scenario working. It relies on self anticipating systems, creative evolutive organisms, and quick experiments. It helps foresight to react more quickly to changes in innovation environment than earlier approaches. But how well does it work in long-term processes or in complicated networked and interdependent businesses and societies? If it can help to combine the dynamics of crowdsourcing to innovation foresight process, it may help to overcome some pitfalls the earlier foresight approaches have. However, constructivistic approach is condemning other foresight approaches unworkable in current circumstances. In my view there is need for these different approaches to co-operate so that we can aim for common goals with foresight. The advantage of foresight is that in practical work it has been able to implement different views and methods despite their different starting points and ideologies.

Innovation foresight is maybe the most challenging form of anticipation. The need for medium- and long-term innovation foresight has not vanished, even if novel views, such as constructivistic foresight, emphasise short-term proactive action. But maybe there is disharmony between innovation and foresight time horizons. In practice foresight people tend to favour long-term thinking and time horizons; however, as innovations are often linked to business development, they favour a short-term approach. Of course there are industry-specific differences, but medium-term is maybe a somehow undervalued time horizon in innovation foresight. There can also be a danger related to emphasising short-term foresight at the expense of the medium- and long-term. This may lead to a self-reinforcing spiral, in which long-term innovation foresight is losing

relevance as short-term activities are constantly overtaking it and the realisation of long-term targets becomes more and more difficult.

Again, in corporate strategic planning processes short-term is up to one year, medium-term 3-5 years and long-term above that up to 15-25 years (Rohrbeck 2011, 157). And when foresight is traditionally targeting medium and long-term approaches, is there a growing demand to target innovation foresight to a 3-5 year time horizon? In turn, the public sector uses different time dimensions, and in many foresight projects the future horizon ranges from 15 to 50 years. In this field the time horizon disharmony is even more significant. Is there real meaning in thinking 50 years ahead? The game related to this study, The Thing from The Future, demonstrates that crowdsourcing long-term innovation foresight may be too challenging. It seems that at least in this kind of fast-paced game it is difficult for the players to place future innovations on any meaningful timeline.

Innovation foresight processes generate a continuously expanding body of information and knowledge. Crowdsourcing is a problem solving method in a networked, digitalised and global world, and crowdsourcing services are targeted for global participation and effective information processing. Thus, crowdsourcing platforms and services could be a way to manage the growing innovation foresight information streams. In turn, crowdsourcing with a game can be a good way to create knowledge on future with a discursive approach. It can help to mitigate disputes and support finding common goals. Games can also get participants to challenge their everyday thinking and thus produce creative and unpredictable solutions.

The game experiment in this study targeted the collective production of ideas related to the future, and reveals that innovating future with a fast-paced card game can be inspiring and effective. Many of the ideas produced in the four game sessions were multidimensional and surprising. Even if the players in this case were innovation experts, there is no reason for the game not to work with non-experts as well. It also seems that players learn from each other's ways of thinking. The game in its current format is not suitable for crowdsourcing, but I believe it can be used to extand the scope of participation in innovation foresight. It can improve the environmental scanning phase in generating hopes and fears and unexpected uses of future technologies and services. It is also excellent tool for future visioning and idea generation in the design phase. It can be customized to specific industries or projects, but only with game design experience. Good gameplay is the most important factor in all games, and you cannot afford to lose it.

The game sessions and their nature made me think about the role of emotions in innovation. Scientific understanding of the influence of emotions on thinking and learning has undergone a major transformation in recent years. Today emotions are considered to have a central role in learning, and that they form the basis for creativity and invention. It is impossible to build memories, engage complex thoughts, or make meaningful deci-

sions without emotions. However, it is important to note that emotions are not add-ons that are distinct from our cognitive skills. Instead emotions, such as interest, anxiety, frustration, and excitement become a dimension of the skill itself (Immordino-Yang, M.H. 2015, 10). Hence, it is possible and important to exercise our emotions like any other skill. In this perspective games can be very productive tools with their playful emotional features. With more advanced emotional skills we are able to create better innovations as well.

However, gaming experiments related to innovation foresight are still rare and patchy. Using games for other phases of innovation foresight than environmental scanning or future visioning remains challenging. In my view it would require foresight process to be a subject of the game and gamification. That would take more resources, become expensive, difficult to manage, and results would be risky. Also, the spirit of competition the games can trigger does not fit all tasks or phases of foresight. In some tasks or phases the need to extend participation with crowdsourcing can be more effective when using existing social media platforms such as Facebook, Twitter etc. However, crowd wisdom is too valuable a resource to be ignored.

This study also made me think about futurists' work. Futurists today need wide-ranging expertise in diverse sectors and they are thus matrix people in the organisational perspective. They must see across the corporate or organisation unit's borders. Today foresight as a profession is moving toward communication, participation process facilitation and interpretation of process outcomes. Futurists are changing from "Jack of All Futures" to "Master of Interaction". Futurists should be able to combine diverse outcomes into holistic pictures and communicate them to stakeholders with various digital tools. These new skills should be achieved without losing the classic ones, such as strong methodological know how. Futurists' work seems inevitably divided into different professions in different domains with narrowing knowledge. Who is then taking care of the "big picture" and understanding system dynamics? That kind of knowledge is needed in many places.

6.2 Conclusion

This thesis aims to answer the question how games can support innovation foresight work. I have approached this main research question from two perspectives: what kind of innovation foresight knowledge can we create with games, and what innovation foresight activities can we crowdsource with games? Theories covering innovation foresight are limited and research activities connecting innovation, foresight and games contain only conceptual work and few case studies. Because of the scattered literature and theories the approach of the research is explorative and descriptive.

During this study I have reviewed the ways and possibilities of combining innovation and foresight into a uniform activity. Concepts and features of this sort of innovation foresight have already been initiated in literature (for example DeMoor et al. 2014, Hiltunen 2013 and Rohrbeck - Gemünden 2011). The interplay of corporate foresight and innovation management activities is said to contribute to organisational resilience (Rohrbeck - Gemünden 2011, 26). Despite of supporting research, innovation foresight is proceeding slowly in practice.

A novel, constructivistic foresight approach has emerged in the foresight field. It is challenging the existing probabilistic forecasting and possibilistic scenario approach with a constant process, self anticipating systems, and quick learning through experiments. Constructivistic innovation foresight emphasises wide participation in innovation to stimulate the transfer of knowledge, mutual learning and collective visioning. This novel approach requires new methods and tools to enhance creativity and engagement in innovation foresight, some possible solutions being games and crowdsourcing. Even if theories and research covering constructivistic foresight are rare, innovation foresight practices already seem to be proceeding with some of its features. The consequences of the constructivistic approach to innovation foresight has guided and motivated the course of this study.

Regarding the first sub-question I had the hypothesis that games can remarkably enhance creating the content, the knowledge on future, for innovation foresight. I approached this hypothesis by using a game experiment. To study the creation of innovation foresight knowledge in authentic circumstances I made an experiment based on The Thing from The Future innovation card game. During four game sessions I gathered 310 ‘future thing’ ideas from 50 Finnish innovation experts. I subsequently classified and analysed the outcomes. According to my analysis these ideas had quite multidimensional contents. For example all PESTE -variable categories were well covered, ideas were also rich with future hopes and fears and their creativity aspects varied widely. Concerning the gamification aspect there was a positive correlation between the winning ideas and their creative novelty and quality grades. Gamification clearly enhanced the creativity of the players. According to the idea analysis the game also generates many unexpected uses of future technologies and services. It seems that games can support innovation foresight knowledge creation in many ways, but games need a good gameplay to do it.

Even if the positive cards of the game, e.g. positive Arcs (scenarios) and Moods seem to generate more creative ideas, I think it is important to sustain a balance between positive and negative factors in the game deck, i.e. an equal number of positive and negative Mood and Arc cards. The negative elements in the game may trigger some fascinating or disruptive ideas, albeit their number may be low. However, this has value in innovation foresight. And this view also applies to future hopes and fears generated

with the game. The most important foresight factor of the game, the scenario archetype collection works fine. Most probably four scenario models is the maximum number in such a game when considering the gameplay factor.

Concerning the second sub-question I had the hypothesis that gaming can enhance future visioning in the innovation foresight process. To map the expert views I sent a questionnaire to 50 Finnish innovation and foresight professionals familiar with foresight gaming. Out of these, 22 or 44% completed the questionnaire. According to these responses gaming can be used to observe weak signals, to form wild cards, perceive hopes and fears, and to develop new visions for the future. But games are not seen as suitable for decision-making or for forecasting future trends. Questions covering scenario building and interpretation tasks received divided responses. In any case, the potential of gaming in the innovation foresight process seem promising and more extensive than expected.

According to literature there is demand for extensive stakeholder participation in innovation foresight. The questionnaire responses revealed that games could remarkably enhance and extend participation and engagement. Only the group below 11 years of age was thought to be excluded from participation. So games are a good opportunity to crowdsource innovation foresight. Still, using games in foresight does not seem to happen very often. Only three of the 22 questionnaire respondents said that they have played a foresight game other than the game related to this study.

According to the free form feedback in the questionnaire, and my own observations during the experiment game sessions, one important aspect is that players learn from each other's ways of future thinking during the game. Another phenomenon which emerged from the responses is that games can inspire unexpected or unanticipated forms of use of a future innovation or technology. And games can generate creative answers to many "What if…" questions. I also learnt that the rules of the game do not restrict innovation. Instead, good gameplay supports creativity and the playful atmosphere can encourage players to go beyond the limits of their everyday thinking. This creative "flow" is an important innovation factor.

However, games also have limitations and restrictions. Games cannot replace the foresight process. They can be embedded into suitable phases of the process, but to subject foresight to games and gamification would take too many resources, be expensive, difficult to manage, and results would be risky. And the basic competitive nature of gaming may not be the optimum framework for the overall foresight process, even if gaming can be very playful. Foresight is not by nature competitive. The potential of foresight crowdsourcing can often be carried out more effectively when using existing social media platforms such as Facebook, Twitter etc. instead of games. In any case, crowd wisdom is a too valuable and powerful resource not to be exploited.

6.3 Limitations

The most obvious limitations of this study are related to the research approaches. The empirical research section consists of three parts and they all use different approaches, a case study, an experiment and a questionnaire. Case studies and experiments tend to have a strictly limited focus and they are not generalisable in the conventional sense. We do not know to what extent the case games in this study are similar or different from other existing games. Another limitation is related to the objectivity of the case reviews. Case study researchers must constantly make subjective judgments about the significance of the data (Hodkinson – Hodkinson 2001, 9). Moreover, the classifications made in part 4 are subjective, even if one peer review was performed. That kind of material would need more reviews or crowd wisdom to be really generalisable. As concerns the questionnaire, the limited number of participants and their limited experience related to foresight games also restrict the generalisation of the results.

Another limitation is related to the theoretical framework of the study. Research literature covering the key concepts of the study is scattered. Innovation foresight is currently just a conceptual idea, crowdsourcing is constantly spreading to new fields and taking new forms, and even the foresight concept itself is lacking a coherent theoretical backbone. Case studies concerning the use of games in foresight or in innovation are few. Because of these limitations the study may bypass some important, even fundamental views. When more research and case studies are available the bigger picture will come into focus.

The scope of this study is to map the general features and principles when practising foresight related to innovation or when combining these two activities into one coherent process. The content of different innovation foresight processes and programs can be very different depending on their fields, targets and levels. This of course imposes limits on the application of the results and conclusions presented in this study.

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APPENDIX 1 QUESTIONNAIRE FORM

I Pelin hyödyntäminen ennakoinnissa

1. Kuinka hyvin Esine tulevaisuudesta -peli sopii tulevaisuuden mahdollisuuksien ideointiin?

	1	2	3	4	5	6	7	
Erittäin hyvin	○	○	○	○	○	○	○	Ei sovi ollenkaan

2. Kuinka hyvin pelattaessa kirjoitettavat ideat laajentavat ennakointityössä tarvittavaa tulevaisuuden vaihtoehtojen kirjoa?

	1	2	3	4	5	6	7	
Erittäin hyvin	○	○	○	○	○	○	○	Ei ollenkaan

3. Pelissä kehitetyt ideat voivat auttaa (valitse kaikki ne vaihtoehdot, jotka mielestäsi pitävät paikkaansa)

☐ havainnoimaan heikkoja signaaleja eli merkkejä uusista nousevista asioista, joista voi tulevaisuudessa tulla jotain merkittävää ja suurta

☐ muodostamaan villejä kortteja eli äkillisesti kehityskulun muuttavia tekijöitä - villi kortti voi olla luonteeltaan yllättävä tai sellainen asia, joka tiedostetaan, mutta josta ei haluta puhua (tabu)

☐ muodostamaan skenaarioita eli vaihtoehtoisia tulevaisuuspolkuja

☐ havainnoimaan aiemmin ennakoimattomia riskejä

☐ hahmottamaan tulevaisuuteen liittyviä toiveita ja pelkoja

☐ ennakoimaan tulevaisuuden muutosvoimien kehityssuuntia ja painotuksia

☐ analysoimaan tulevaisuuteen liittyvien päätösten mahdollisia vaikutuksia

☐ kehittämään uusia tulevaisuusvisioita

II Pelin hyödyntäminen innovoinnissa

4. Kuinka hyvin pelin tapa kehittää nopeasti ideoita korttien muodostamien tulevaisuuskuvien pohjalta toimii innovointityökaluna?

	1	2	3	4	5	6	7	
Erittäin hyvin	○	○	○	○	○	○	○	Ei ollenkaan

5. Pelissä kehitetyt ideat voivat auttaa (valitse kaikki ne vaihtoehdot, jotka mielestäsi pitävät paikkaansa)

- ☐ havainnoimaan kulutustrendien muutoksia
- ☐ kartoittamaan organisaation vahvuuksia
- ☐ kehittämään aiemmista käytännöistä selkeästi poikkeavia radikaaleja innovaatioita
- ☐ haastamaan perinteisiä ajatusmalleja
- ☐ löytämään aiemmin havaitsemattomia tarpeita
- ☐ määrittämään uuden teknologian ajoittumista

III Esine tulevaisuudesta pelinä

6. Kuinka hyvin Esine tulevaisuudesta toimii pelinä ja motivoi yrittämään parhaansa?

	1	2	3	4	5	6	7	
Erittäin hyvin	○	○	○	○	○	○	○	Ei ollenkaan

7. Pelin korteissa on erilaisia aikamääreitä siitä, kuinka kaukaa tulevaisuudesta ao. esine on tulossa. Mikä on mielestäsi pisin mielekäs aika pelissä määritellyllä tavalla ennakoida tulevaisuutta?

- ○ 5 vuotta
- ○ 10 vuotta
- ○ 20 vuotta
- ○ 30 vuotta
- ○ 50 vuotta
- ○ 100 vuotta

8. Minkä ikäisille peli mielestäsi sopii - merkitse kaikki ne ikäryhmät, joille peli sopii

- ☐ 7-11 vuotta
- ☐ 12-19 vuotta
- ☐ 20-30 vuotta
- ☐ 31-64 vuotta
- ☐ 65 - vuotta

9. Muita huomioita Esine tulevaisuudesta -pelistä. Miten peliä voisi mielestäsi kehittää?

IV Pelien käyttäminen ennakointiprosessissa

10. Oletko pelannut muita ennakointiin liittyviä pelejä? Jos niin kirjoita pelien nimet alla olevaan kenttään.

11. Valitse kaikki ne ennakoinnin vaiheet, joihin pelit mielestäsi sopivat hyvin

- ☐ toimintaympäristön ja sen muutosvoimien havainnointiin
- ☐ em. havaintojen tulkitsemiseen ja jäsentelyyn
- ☐ vaihtoehtojen muotoiluun
- ☐ edellisten vaiheiden pohjalta tehtävän tulevaisuussuunnitelman laadintaan
- ☐ tulevaisuutta koskevaan päätöksentekoon
- ☐ ei mihinkään yllämainituista

12. Kuinka hyvin pelien avulla voidaan laajentaa uusien yleisöjen (mm. lapsien) osallistumista ennakointityöhön?

	1	2	3	4	5	6	7	
Erittäin hyvin	○	○	○	○	○	○	○	Ei ollenkaan

13. Kuinka hyvin pelien avulla voidaan parantaa osallistujien sitoutumista ennakointityöhön?

	1	2	3	4	5	6	7	
Erittäin hyvin	○	○	○	○	○	○	○	Ei ollenkaan

14. Kuinka paljon peleistä on apua luovien ratkaisujen kehittämisessä?

	1	2	3	4	5	6	7	
Erittäin paljon	○	○	○	○	○	○	○	Ei ollenkaan

15. Kirjoita alla olevaan kenttään muita huomioitasi peleistä ennakoinnissa ja innovoinnissa.