

Sources of Innovative Opportunity and Mass-Customization – An Analysis of EMF & Health Business Area

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Abstract. Systematic innovation means monitoring changes in existing business structures and early entrepreneurs often take risks in entering a new business area. Therefore, the Seven Sources of Innovative Opportunity, an innovation monitoring framework from Peter Drucker is presented. Within this paper we investigate how this framework is related to mass-customization and personalization. First we test this framework in real context by evaluating three health product companies and their innovation activities. These companies operate in a new business area called the EMF (Electro-Magnetic Fields) and Health. Recently, several scientists, governments and the European Parliament have emphasized precautionary principle and indicated health risks in mobile phones, base stations and other technologies. At the same time authorities and standard setting bodies (like ICNIRP, IEEE and WHO) have not officially recognized such risks. This tension provides a starting point for the evaluation. At the end of this paper we discuss how crowdsourcing and mass-customization toolkits could be utilized more effectively by entrepreneurs. Open innovation paradigm and the challenges in knowledge brokering in R&D are also introduced.

Keywords. Open innovation, crowdsourcing, EMF, health, risk, management, entrepreneurship, intermediary

1. Introduction

Systematic innovation ... consists in the purposeful and organized search for changes, and in the systematic analysis of the opportunities such changes might offer for economic and social innovation. (Drucker, 1985, 31)

An entrepreneur looks at changes as a possibility for business. Even in a situation where health risks are addressed, like currently. In 2007 the European Environmental Agency recommended precautionary approach with wireless technologies and referred to conclusions of the BioInitiative report (EEA, 2007; BioInitiative, 2007). In 2008 the European Parliament commented that the existing ICNIRP guidance levels for non-ionizing radiation in base stations and mobile devices are ‘obsolete’ (European Parliament, 2008). Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) recommends maximum 3 minutes long mobile phone calls for adults when the device is pressed against the head (WHO, 2003).

These kinds of events provide a new start for R&D, production, marketing and mass-customization. In times of uncertainty, it is interesting to observe how companies are utilizing this kind of business opportunity. For this observation we will use an evaluation framework called the Seven Sources of Innovative Opportunity (Drucker, 1985). This evaluation framework will be presented in chapter 3. Thereafter, in chapter 4, we will introduce three companies (Gigahertz Solutions, EMFields and Maxicom) whose products are used to minimize risks in this new EMF & Health business area. To provide some additional information about EMFs and risk management, we will discuss about thermal and non-thermal views in the chapter 5. Case companies and their innovation opportunities are illustrated and validated with the Drucker-framework in the chapter 6.

Since the evaluation framework of Drucker (1985) is rather old and not complete, we will also demonstrate how communities and crowds could be utilized in innovation activity and how this area is partly missing from the EMF & Health business. Pine (1993) describes mass customization as one type of production system where all the employees share the goal of developing, producing, marketing, and delivering competitive offering (i.e. combination of goods and services with some variety and customization so that valuable offering is developed). Lately, the importance of crowds in product design and product marketing is emphasized (Prandelli, Verona and Raccagnani 2006). Crowds are also emphasized in the Open innovation paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology (Chesbrough, 2006a, 16). For these reasons we will look at the emerging Open innovation paradigm, mass-customization and toolkits in chapter 7. This paper will end in conclusions and discussion.

2. Research method

Our study is a multiple case study including three cases. We chose our cases based on the available data as well as their appropriateness from the viewpoint of this study. The cases originate in different countries, e.g. one case is from Germany, one from the UK and one from Sweden. All of the cases are companies who have recently opened / will be opening Internet-based web shops and all of them have different backgrounds and objectives, and therefore they offer multiple views on the phenomenon. The data was gathered with multiple methods by using a triangulated research strategy, which means using different types of materials, theories, methods and investigators in the same study (e.g. Brewer and Hunter, 1989; Denzin, 1978)

We evaluate these cases using the ‘sources of innovative opportunity’ –framework from Peter Drucker (1985). This framework will be presented in the next chapter 3.

This paper is also a conceptual paper, since we enter a new area. According to Hirschheim (2008) conceptual papers emphasize assumptions, premises, axioms, assertions, etc.; and these need to be made as explicit as possible so they can be evaluated. Toulmin (1958) created an evaluation framework for conceptual papers. For Toulmin, there are six aspects of an argument: three necessary components and three optional ones. The necessary components are Claims, Grounds, and Warrants. The additional components are Backing, Rebuttal and Qualifier.

Claims refer to the statement or thesis that the authors are asking the reader to accept as true. An example might be the assertion that mass-customization is related to the Drucker innovation evaluation framework. *The grounds* (or support) is the method of persuasion used by the authors and is comprised of data plus the reasoning behind the claim. Fundamentally, this is the evidence or grounds by which the claim is supported or justified. The support for a claim may take the form of facts and statistics, mathematical proofs, expert opinion, examples, explanations, prior literature, and logical reasoning. In the case of the claim for existence of mass-customization connection, the authors might cite a variety of research articles that indicate that the Drucker framework has been used in mass-customization literature or expert opinions. *A warrant* links the data (grounds) to a claim. Ostensibly, warrants are the assumptions or presuppositions underlying the argument. (Toulmin, 1958; Hirschheim, 2008) Next chapter will describe the utilized innovation evaluation framework in detail.

3. Systematic innovation and seven sources of innovative opportunity

Drucker (1985) encourages entrepreneurs to practice systematic innovation. The overwhelming majority of successful innovations exploit change. The discipline of innovation is a diagnostic discipline: a systematic examination of the areas of change that typically offer entrepreneurial opportunities. Systematic innovation means monitoring seven sources for innovative opportunity (Drucker, 1985, 31). Asoh, Rivers, McCleary and Sarvela (2005) illustrate the use of this Drucker framework in the health care industry. They state that very high entrepreneurial propensity is needed for major innovations.

According to Drucker, the first four sources of innovation lie within the enterprise, whether business or public-service institution, or within an industry or service sector. The second set of sources for innovative opportunity, a set of three, involves changes outside the enterprise or industry. (Drucker, 1985, 32) The following table provides explanations to the Seven Sources of Innovative Opportunity.

Sources of Innovative Opportunity	Description
1. The Unexpected	The unexpected success, the unexpected failure, the unexpected outside event. ... such opportunities require more than mere luck or intuition. They demand that the enterprise search for innovation, be organized for it, and be managed so as to exploit it.
2. The Incongruity	Between reality as it actually is and reality as it is assumed to be or as it 'ought to be'. The assumptions on which a product or service, its design or its marketing strategy, were based may no longer fit reality.
3. Innovation Based on Process Need	In innovation that is based on process need, everybody in the organization always knows that the need exists. Yet usually no one does anything about it. However, when the innovation appears, it is immediately accepted as 'obvious' and soon becomes 'standard'.

4. Changes in Industry Structure or Market Structure that catch everyone unawares	When market or industry structure changes, the producers or suppliers who are today’s industry leaders will be found neglecting the fastest-growing market segments.
5. Demographics	Of all external changes, demographics – defined as changes in population, its size, structure, composition, employment, educational status, and income – are the clearest. They are unambiguous. They have the most predictable consequences.
6. Changes in perception, mood and meaning	Timing is of the essence. In exploiting changes in perception, ‘creative imitation’ does not work. One has to be first. ... because it is so uncertain whether a change of perception is a fad or permanent, and what the consequences really are, perception-based innovation has to start small and be very specific.
7. New knowledge, both scientific and non-scientific	Knowledge-based innovation differs from all other innovations in its basic characteristics: time span, casualty rate, predictability, and in the challenges it poses to the entrepreneur. Like most ‘super-stars’, knowledge-based innovation is temperamental, capricious, and hard to manage.

Table 1. Seven sources of innovative opportunity (Drucker, 1985), descriptions also by Drucker.

Drucker (1985) attributes a firm’s competence in new product development to its capability of creating knowledge about its customers and competitors and integrating such knowledge with technology. Before we use the above mentioned evaluation framework of Drucker (1985) to evaluate our case companies, an introduction to health debate and risk management will be provided.

4. The dilemma: thermal versus non-thermal

Currently, the health debate around mobile phones, base stations and power lines is heated in many countries. We will provide here two alternative views, both with strong supporter groups. Thereafter we will illustrate the business implications and risk management practices.

4.1. The thermal view

After the Second World War, a German biophysicist, Professor Herman Schwan moved to the USA to work for the US defense department contracts in the area of electro-magnetic fields. Like infrared radiation, radio waves and microwaves produce heat when they're absorbed in sufficient quantity. Although not a biologist, Schwan assumed this heating was the only effect EMR would have on living tissue. In this respect he considered living things no different from the hot dogs that World War II radarmen used to roast in their microwave beams, so cooking was the only harm he foresaw.

Schwan then estimated danger levels based on how much energy was needed to measurably heat metal balls and beakers of salt water, which he used to represent the size and presumed electrical characteristics of various animals. Appreciable heating occurred in these models only at levels of 100.000 microwatts / cm² or above, so, incorporating a safety factor of ten, Schwan in 1953 proposed an exposure limit of 10.000 microwatts / cm² for humans. By showing soon afterward that it took more than this intensity to cause burns in real animals, Solomon Michaelson seemed to have confirmed the safety of "nonthermal" dosages. No one tested for subtler effects, and the 10,000-microwatt level was uncritically accepted on an informal basis by industry and the military. In 1965 the Army and Air Force formally adopted the Schwan limit, and a year later the industry-sponsored American National Standards Institute recommended it as a guideline for worker safety. (Becker and Selden, 305, 1985)

Currently, the guidance levels for non-ionizing radiation in most of the Western countries are based on thermal effects. In other words, the current guidelines only restrict the intensity of the radiation to prevent tissue heating in excess of what the body's thermoregulatory mechanism can cope with (Hyland, 2000). A specific organization is responsible for maintaining these guidelines, namely ICNIRP (International Committee on Non-Ionizing Radiation Protection), (ICNIRP, 1998).

The WHO (World Health Organization) International EMF Project and ICNIRP see that there are no other mechanisms than heating that may affect health and therefore current safety limits are valid:

Examination of the magnitude of the possible biophysical interactions (thermal, photon, force) of electromagnetic fields with living matter shows that, under modulated RF exposure conditions allowed by the current safety limits, there does not appear to be an overlooked hazard specific to RF modulation, with the possible exception of RF in the form of very short, high-intensity pulses, which are far more energetic than any pulses encountered in cellular telephone technology. For RF levels below the established standards (modulated or not), scientific research has not identified reproducible and plausible mechanisms by which biological effects can be caused in living systems. (Valberg, Deventer & Repacholi, 420, 2007)

No increase in brain tumor rates have been observed in ICNIRP reports (Ahlbom, Feychting, Green, Kheifets, Savitz and Swerdlow, 2009).). Similarly, other symptoms and illnesses are not seen related to electro-magnetic fields (Valberg *et al.*, 2007).

Military uses microwaves for crowd control and non-lethal weapons (Trower, 2001; Becker and Selden, 1985). Bone fractures are healed using special frequencies and polarities of electro-magnetic fields (Becker, 1990). Interestingly, both these activities take place at non-thermal levels and can not be explained through heating.

The independence and neutrality of ICNIRP, IEEE and WHO have been occasionally questioned (NRK, 2008; Slesin, 2005; Cherry, 2002; Radiation Research Trust, 2009).

4.2. The non-thermal view

In 1952 the German physicist, Professor W. O. Schumann of the Technical University of Munich showed that there are electromagnetic standing waves in the atmosphere, within the cavity formed by the surface of the earth and the ionosphere. There is a resonating electromagnetic oscillation between earth and ionosphere in the 10 Hz region (Schumann resonance, 7.83 Hz). The intensity and spectrum of the Schumann Resonances vary markedly from day to night and with solar activity. At night both the brainwaves of a human being (measured by EEG) and the Schumann Resonances are dominated by very low frequencies (<5 Hz). Human brains detect, use and react to natural low frequency signals, the Schumann Resonances. 7.83 Hz is the same frequency at which the hippocampus, the area of the brain responsible for short term memory, vibrates. (Cherry, 2002)

Achkasova *et al.* (1978) showed that cell division and timing is based on changes in this natural electromagnetic field. Belyaev *et al.* (1996) demonstrated that the DNA repair mechanism in coli bacteria is negatively affected when artificial microwave radiation level is above $1 \text{ uW} / \text{cm}^2$. Becker (1990) was the first doctor who demonstrated how human cells communicate electronically and how voltage and polarity is changed when for example wound healing is taking place. Already in 1970s Russian doctors diagnosed an illness called microwave syndrome, where chronic exposure to artificial electro-magnetic fields weaken human immune system (Gordon, 1979). The Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) has criticized ICNIRP guidance levels and recommended that children and pregnant women should not use mobile phone at all (RNCNIRP, 2008) and adults should limit the phone call to three minutes and utilize speaker-phone, hands-free or corded-phone (WHO, 2003).

Hyland (2000) and Cherry (2002) demonstrated that several mobile technologies operate at the same frequencies as the human brainwaves and are able to cause a stress like reaction in cells. This oxidative stress and reactive oxygen species (ROS) formation is perhaps capable of breaking the DNA molecule and creating genotoxic effects (Cherry, 2002; Friedman *et al.*, 2007; Warnke, 2008; Phillips, Singh and Lai, 2009). Other possibly harmful mechanisms include calcium-ion efflux (Bawin *et al.*, 1975), leakage of blood-brain barrier (Salford *et al.*, 2007), melatonin reduction in the pineal gland (Burch *et al.* 2002; Cherry, 2002) and reduced fertility (Makker *et al.*, 2009). Khurana *et al.* (2008) indicated an increase in brain cancer rates in their meta-analysis. 68 % of independently funded research is finding biological, non-thermal effects. Independent research project are seven times more likely to find positive results than industry-funded research projects (Huss *et al.*, 2007). Industry-funded Interphone-project inspected cancer-connection and has according to Morgan (2009) several design faults which make the result show that a mobile phone *protects* the user from a brain tumor.

If the non-thermal effects would be recognized officially, the ICNIRP guidance levels could be dropped to the 1/10.000 part of their existing value. Several French cities adopted in summer 2009 the $0,1 \text{ uW}/\text{cm}^2$ limit recommended by BioInitiative (2007).

According to Otto and von Mühlendahl (2007) the reproducibility of these non-thermal effects is usually poor, and no physiologic or pathogenic mechanism, so far, has been found to explain the alleged effects. Similarly, Lin (1997, 439) sees, that better understanding is needed of the mechanisms of interaction between RF/microwave radiation and biological systems, and of the significance of any observed effects.

4.3. Implications to business

Two of the world's largest insurance companies, Lloyds and Swiss Re, have recommended to other insurance companies to write in exclusion clauses against paying compensation for illnesses caused by non-ionizing radiation exposure. (Swiss Re, 1996; Trower, 2001).

In 2005 a brain tumor case was first time won in the court in the USA against a mobile manufacturer (Khurana, 2008). Several masts have been ordered by the court to be removed in France in 2009 because of possible health risks (Radiation Research Trust, 2009).

These kinds of events, although still rare, may increase the business risks but also litigation costs of mobile manufacturers and service providers. The situation currently is confusing, because of politics and different 'schools' (thermal vs. non-thermal). Business Week (2009) in their story asked "Is Cell-Phone Safety Assured? Or Merely Ignored?" and pointed out difficulties in balancing long-term risks with benefits of mobile technologies. Similarly, some employers already calculate the sick days of workforce and possible later compensation requirements. This kind of development and health awareness may create new business opportunities. The following companies are utilizing these opportunities. Some of the players in the field also consider themselves as working in the ethical and sustainable business (Csikszentmihalyi, 2004).

5. Case descriptions

Gigahertz-Solutions GmbH (<http://www.gigahertz-solutions.de>)

Gigahertz-Solutions is a device manufacturer in Langenzenn, Germany. They are specialized in metering devices, although they also produce electrical equipment and devices to minimize EMF-exposure. Their meters are provided with a scale between 0.01-20.000 uW/m² (in RF measurements) and 0-2000 nT magnetic or 2000 V/m electrical fields. Their meters can be equipped with extenders to be able to measure higher field strength up to 2.000.000 uW/m² or amplify very sensitive radiation. The company provides also digital LF-instruments with datalogger and software, measuring videos, courses, and measuring certificates. Gigahertz philosophy is to deliver 100% accurate measuring values in a still affordable price-range.

EMFields Ltd (<http://www.emfields.org>)

This company, which is more like an organization, is ethically based. The EMFields describe their operations: “We offer a number of screening products, designed to reduce your personal exposure to electromagnetic radiation from mobile phones and masts, and high electric field levels from house wiring. We have tested all the products we sell and these are highly effective, removing up to 99% of all incoming radiation.” EMFields is linked to a website called Powerwatch (<http://www.powerwatch.org.uk>) which is a long-time industry ‘watchdog’.

Maxicom AB (<http://www.maxicom.se/Produkter.htm>)

Maxicom’s owner has a 50 years experience with wireless technologies. They sell and install communication systems and accessories to various clients and industries, mostly in Sweden. They have also security and surveillance products. While Maxicom sells various wireless products, they also openly inform about risks and advice about ways to reduce personal exposure.

6. Cases analyzed with Seven Sources of Innovative Opportunity -evaluation framework

The framework of Drucker (1985) will be next used to evaluate the innovation strategies of Gigahertz-Solutions, EMFields and Maxicom. Purposefully, these cases are selected so that they differ greatly from each other in business models, business activity and target groups.

	Gigahertz Solutions	EMFields	Maxicom
1. The Unexpected	German, Swiss and Austrian doctor initiatives warn about high EMF-levels http://appelle.diagnose-funk.org/ This has created unexpected demand for measuring devices and related services.	Originally EHS-patients were their biggest customer group, now more and more ordinary families with children.	POTS is shut down in the countryside in Nordic countries and wireless connections are offered as replacement. Far from a base station a mobile terminal increases its power significantly. Therefore, solutions to minimizing radiation exposure are being requested.
2. The Incongruity	The ICNIRP guidance levels have been criticized and alternative guidance levels have been taken in use (BioInitiative 2007, Baubiologie 2009)	Traditionally, houses have been measured for mold and radon. EMF measurements in houses provide a new viewpoint.	Since mobile phone manufacturers and service providers deny risks, there are not many players effectively marketing safer mobile systems.
3. Innovation Based on Process Need	Gigahertz Solutions started producing ELF-meters, but the expertise was later utilized in RF-meters when market need emerged. The isolation and shielding expertise is used with other products (mains disconnection relays etc.)	Powerwatch, a non-profit independent organization received requests to sell shielding products and measurement services. Eventually, EMFields was established as a separate company.	Maxicom has a long experience as a supplier of wireless systems for power industry, communities, police, ambulance and transportation companies. This experience is utilized when they started to market low radiation products.
4. Changes in Industry Structure or Market Structure that catch everyone unawares	The other metering manufacturers have difficulties in providing sensitive enough meters to measure biologically-relevant levels with alternative guidance levels.	Sleep quality is possibly related to EMF levels. Currently, there are not many companies which provide materials to shield / reduce EMF-levels in bedrooms.	The traditional handsfree equipment has several limitations. Some older models may even increase the radiation exposure of user's ear channel. So, a new approach is needed.
5. Demographics (population changes)	Meters appeal also to technically oriented people (engineers). A new professional group of experts is established and growing. Meters are used mostly in heavily populated areas where EMF-levels are higher.	The United Kingdom has recently become the most heavily populated country in Europe with dense powerline and base station network. EMFields operates from the UK.	The population is becoming older in many European countries. Older people, children and adults with certain illnesses are more susceptible to effects of electromagnetic fields.
6. Changes in perception, mood and meaning	Employers are getting interested to meter and reduce EMFs. Currently, an EU directive makes these measurements obligatory.	Consumers are becoming more and more concerned about the electrical pollution. Additionally, people who get symptoms or have become ill from electricity are their customer group.	More and more employers are aware of need to reduce exposure. Maxicom targets the Corporate Wellness Programs.
7. New knowledge, both scientific and non-scientific	Information about increasing passive exposure (Frey <i>et al.</i> , 2009). The effects of dirty electricity element, incl. transients and harmonic overwaves (Genuis, 2007).	Anecdotal and scientific evidence, symptoms relieved, less headaches and better sleep quality after screening (Hutter <i>et al.</i> , 2006).	Latest brain tumor research (Khurana <i>et al.</i> , 2009) and radiation absorption child vs. adult (Gandhi <i>et al.</i> 1995; Wiart <i>et al.</i> , 2008)

Table 2. Three cases analyzed with the innovation evaluation framework of Drucker (1985)

7. Mass-customization, toolkits and open innovation

Above we evaluated three companies with the Drucker (1985) evaluation framework. Since the evaluation framework is quite old, we will next describe how it possibly integrates to mass-customization and generally in open innovation activity.

Mass-customization originates from 1970s (Toffler, 1970; Davis, 1987; Pine, 1993). In the online environment, the term personalization often replaces customization or more specifically mass customization, although the definitions of these terms are not similar (Santanen *et al.*, 2008). Personalization generally refers to making a site more responsive to the unique and individual needs of each user (e.g. Cingil *et al.*, 2000) while in a mass customization management system the goal is to develop, produce, market, and deliver affordable goods and services with enough variety and customization that nearly everyone will find exactly what they want (Pine, 1993). When we look at the evaluation framework of Drucker (1985) and the outcome in the previous chapter 6, there does not seem to be a mass-customization or personalization focus. However, personalized websites can be used to collect important information from customers. Therefore, the Drucker evaluation elements like changes in perception, new knowledge and changes in market structure can be obtained from customers.

Another concept often linked to mass-customization is customer co-design. Customer co-design describes a process that allows customers to express their product requirements and carry out product realization processes by mapping the requirements into the physical domain of the product (Khalid & Helander, 2003; von Hippel, 1998). The customer can choose from an infinite set of options an individualized combination or even extend the options and even invent new ones. During this process of elicitation, the customer is being integrated into the value creation of the supplier (Piller *et al.*, 2005). Toolkits are seen important in the customer co-design (von Hippel, 1998; Piller *et al.*, 2005).

Thrift (2006) describes the needs behind those toolkits that companies provide for their customers:

Companies may offer various toolkits for collaboration and mass-customization, which can be seen here as devices supporting collective mind and distributed cognition. The establishment of distributed cognition devices, intended to organize real life experiments as preferences, tends to blur habitual distinctions between production, distribution and consumption (Thrift, 2006, 279).

Prandelli *et al.*, (2006) analyzed over 200 brand and corporate sites and summarized that web-based tools are not always implemented to accelerate and improve new product development through customer involvement. In fact, only specific stages of the innovation process are supported by the web, a limited set of two-way communication tools are still included and not all companies seem to show an optimal level of interest in leveraging these tools. (pp. 124)

Chesbrough (2003) encourages changing the role of R&D (from earlier creating new knowledge), to focusing on knowledge brokering. Innovation marketplaces have arisen along with the open innovation paradigm. These marketplaces, or innovation intermediaries, act as brokers between different actors (companies, customers, users, enthusiasts, etc.). A good example of such marketplaces is InnoCentive which has managed to change the face of R&D for many corporations, government agencies, and not-for-profits by employing their price-based method to engage innovators in many industries from around the world (Tapscott and Williams, 2006). We may ask where are the marketplaces and especially R&D for EMF&Health? What incentives are needed to establish a marketplace for healthier device and service development? According to Chesbrough (2006b) there are real difficulties that companies encounter when they seek external markets for their technologies. Among these difficulties are: (a) Managing and protecting identity (b) Managing contamination risk (c) Identifying useful, nonobvious sources (d) Fostering a two-sided market and (e) Scaling efficiently with volume (pp. 137). The limitation of this view of Chesbrough (2006b) lies in traditional intellectual property (IP) focus. Crowds are utilized more and more to develop sophisticated products (e.g. www.eurekamed.com) and the view of intellectual property and licensing has similarly changed. We may also ask that where the difference between product improvement and invention is.

8. Conclusions

Entrepreneurs take controlled risks and this paper described how entrepreneurs can scan the emerging business opportunities systematically. The international health risk debate and the precautionary approach (BioInitiative, 2007; EEA, 2007) has created new business opportunities and market for products that minimize EMF exposure of individuals and employees. Both thermal and non-thermal (biological) viewpoints of the scientific debate were illustrated. The Seven Sources of Innovative Opportunity evaluation framework of Drucker (1985) was introduced. This instrument was then utilized to evaluate three companies (Gigahertz-Solutions, EMField and Maxicom) and their opportunities in this new market. All evaluation levels of the Drucker framework proved relevant for the case companies. The EMF & Health business area is still at its infancy, so, mass-customization and personalization services were not extensively used by the case companies. The possible, future mass-customization efforts of these companies will provide more information and also new research opportunities.

9. Discussion

The crowds were not extensively utilized in product development and recommending in our case companies, except perhaps by the EMFields company whose website included a member-only discussion forum related to products and ways to shield and reduce EMF exposure. Since the case companies market products to improve health, the success stories or at least recommendations from satisfied customers would provide a powerful marketing message. Similarly, satisfied customers could be used more extensively to recommend products to their friends. No intermediaries currently exist in the EMF & Health area. More like, there are many independent merchants and online shops. Mass-customization processes seem to be limited and toolkits do not yet exist. Most of the products can not be tailored (no personal color, no pattern or no coating). However, Maxicom has tailored, even re-assembled many of their products to suit their various customer groups based on their requests.

Marketing of health-related products is challenging. The customer should be neutrally informed about risks while no fear or panic should be created. Since the scientific community is split with opinion about electromagnetic fields, the marketing message is difficult to keep informative and satisfactory to all customer groups. The EMF&Health market is still at its infancy. The future of this market will be dependent on changes in legislation and guidance levels. Additionally, EMF and Health is not often discussed from business perspective in academic papers. Therefore, we see our approach unique.

The Drucker framework we used is not scientifically validated from the beginning (ref. Drucker, 1985). To our understanding this framework has only been used in the papers of Asoh *et al.* (2005) and Moore and Coddington (1999) to describe health business. We have not seen this framework integrated to mass-customization or personalization. When we as researcher utilize the framework, it is not the same thing if the companies themselves utilize it. For this reason, we asked the case companies to look at their company description in this paper and how they see the evaluation framework of Drucker. Based on their comments, we modified the Table 2. When Peter Drucker afterwards, in the book “Managing for the Future”, inspected his Seven Sources of Innovative Opportunity, he came to an interesting conclusion:

“The most useful of the seven ‘windows’ of innovation ... is always the unexpected, especially the unexpected success. It is the least risky and the least arduous. Yet it is almost totally neglected. What is even worse, managers often actively reject it.” (Drucker, 1992, 275)

This little citation tells us that mass-customization is about understanding customers, but also about understanding history and management practices.

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