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Secure Persuasive Business Models and Business Model Innovation in a World of 5G

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Abstract How will a promising world of 5G influence business model innovation and what are the strings attached? The development and innovation of business models in a world of 5G is an under-researched field. In the 'slip stream' of new technologies, which are about to be developed, it becomes more and more important to understand how business models embedded with persuasive technologies—persuasive business models—are going to be innovated and operated. The development of persuasive technologies will lead to the exponential increase of persuasive business models in the global market. This paper will focus on how to overcome security concerns linked to persuasive business models. On behalf of the inputs from SW2010–SW2016 (Strategic Workshops held by the Centre for Tele-infrastructure, Aalborg University), lab experiments in the MBIT (Multi Business Model Innovation and Technology Research Group, Aarhus University) and Stanford Peace Innovation Lab Denmark, together with state of the art persuasive business model and technology research, we give a conceptual outlook on what to expect from persuasive business models and persuasive business model innovation in a future world of 5G.

Keywords Persuasive technology · Persuasive business models · Business model innovation · 5G

1 Introduction

In the past 10 years sensor-, wireless and persuasive technologies in our everyday life have increased many-fold. We are moving towards a world of 5G, which soon will have to adjust to persuasive technologies [4, 5, 15, 16, 18, 19]. As a result, business will have to

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deal with the latter. Studying persuasive technologies evolvement and their impact on our daily lives and routines is still at an early stage of scientific achievements. However, many jump to the conclusion that the extent to which persuasive technologies will affect our future lives is presumably tremendous [6, 15]. Technologies will soon be developed so that all five human sensors technically can be embedded in e.g. any kind of product, device, material and production technology [15–20, 23] (Fig. 1).

Researchers, businesses and public players alike are devoting themselves to understanding how these different persuasive technologies might be designed, so that remunerative technologies, behavior and business models are within reach and can be created, captured, delivered, received as well as consumed [8] in a new, and hopefully sustainable, 5G world.

5G and persuasive business models go along with high expectations for better business and a noticeable impact on the global economy. Especially the health care and well care sectors are expected to overcome some of their high economic burden with the help of persuasive technologies—but also furniture, textile, tourist and service industry are expected to gain enormous benefits from these technologies and related business models.

Persuasive technology has digital components embedded and is situated within two dimensions. The first dimension contains knowledge about how people and things can be triggered to change behavior. A second dimension contains the technology, in which Information Communication Technology [ICT] is in some way embedded and can "communicate" with the human, thing or both in combination.

Technology is now capable of influencing all the senses [15, 16, 18] and in the future even more advanced [15, 17, 19–21, 23]. This could be a mobile sending certain sounds or light, so that a certain reaction—a behavior—is triggered and e.g. a biker can be prevented to be killed under a truck turning right (Fig. 2).

Right-turn accidents are a big problem in the increasingly busy traffic across Europe. The accidents often have fatal consequences and are a daily concern for truck- and bus drivers. On average in e.g. EU 3,5 people lose their lives every day due to right-turn accidents.

BlindSpotit has developed a solution that can prevent right-turn accidents from occurring. The business model uses a dynamic lighting system to illuminate the blind angle when a truck starts signaling to make a right-turn. The dynamic lighting system incorporates the use of a constantly changing pattern that appears lively and alarm the sub

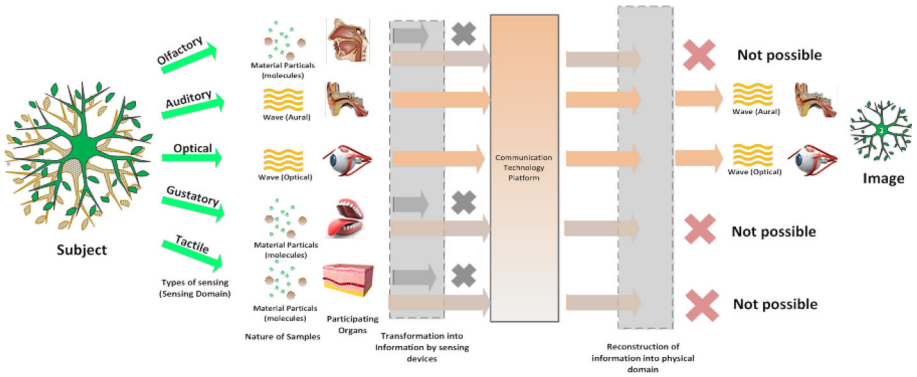


Fig. 1 Human Bond Communication Illustration Mapping adapted by Prasad [18, 19]

Fig. 2 Preventing right turn accidents via persuasive technologies

consciousness of cyclists effectively. Through extensive eyetracking tests it has been verified that the dynamic light pattern that is made up of sharp arrows has the best effect. In other words knowledge about how to persuade to a certain behavior by the cyclist.

It could also be a smell created and send by a technology device that have people to like/dislike and act on behalf of it. A well known example is the smell of bread in a retail businesses bakery department and shop "persuading" people to go and buy bread or cakes (Fig. 3).

It could further be technology that changes colours or forms to protect elderly people to fall in their home or getting hurt by changing form or alarming the elderly person to change behavior or look out. The value both in money and other values of preventing these falls are enormous. Every year about 40,000 to 50,000 elderly people are injured due to falls in their home in Denmark [7]. Most are recovering very quick, others about 13,500 (expected

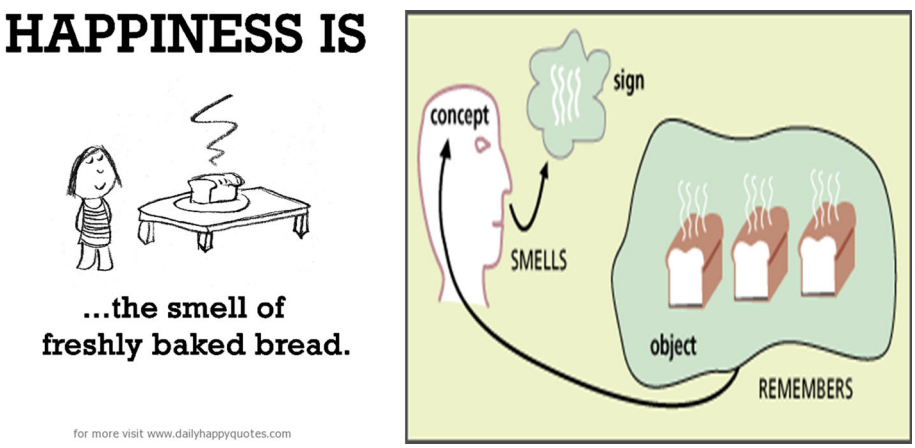


Fig. 3 Sketch figures of smell persuading human to change behavior

to increase to about 24,000 in 2040) have to be taken to hospital with broken legs, arms e.g.. However more sadly about 1300 elderly Danes dies every year because of these falls in their home. Persuasive technologies and business models can help the elderly people on 3 of the typical accidence areas (Fig. 4).

- Loose carpets
- Loose electrical lines or other devices laying on the floor
- Weet floors in the bathroom

Beyond that, persuasive technology can in the future play a much more advanced role—as it will be able to "play" and "interact" with all the five senses in combination, which obviously increases even more the business potential of persuasive technologies and persuasive business models.

Persuasive technology combined with the knowledge on behavioral change behind it can potentially steer any process—also a user or a customer buying process—in detail from starting point to desired goal. This can result in threats for the individual level (including machines which work destructively) through leading/managing markets and/or business model ecosystems [13] to the societal level. Another possible dangerous effect could be the split into a component dimension. Persuasive technology could have a combined effect on several of the following levels: on the business model portfolio level, the business level, and the business ecosystem (BMES) level. Depending on the effected level, consequences would be different. In case it was just persuasive on a component level, microstructures would be influenced. When advancing onto the business model portfolio, the business, or BMES [11, 13], it could have strong effects on macrostructures in our society and related BMES as well.

Moreover, in case persuasive technologies, which are embedded in multi business models, are not secured and controlled, they can potentially have negative outcomes. Possible scenario could be individuals taking control and persuading others to act against what is best in their interests, and that as a result people could get hurt economically—even physically and psychologically. A more radical example could be businesses or even BMES gaining monopolies.

As already touched upon, the security issue will show to become the most important factor connected to persuasive technologies and persuasive business models implementing those. In fact, businesses face a dilemma: On the one hand, persuasive business models are supposed to be secure. They are supposed to protect businesses and their users, customers, network partners and things. Though, on the other hand, they are created to persuade, and gain momentum accordingly, which can have negative effects on these and security. After elaborating on this, we deliver several proposals on how to overcome security concerns linked to persuasive technologies and persuasive business models.

Fig. 4 Elderly falling at home

2 Multi Business Model Mapping—'Do You See What I Sense?'

The development of persuasive technologies has the potential of introducing persuasive business models to the market. Today many businesses are unable to download, see, sense, act-do, scale and globalize their multi business model businesses and BMES's [8]. Many businesses could be classified as "business model illiterates" and are not fulfilling their business model potential. This results in a large waste of resources and competences—and business.

The lack of alignment and an accepted business model language is furthermore preventing businesses from taking the next step, namely to have business models and business communicating and innovating together on behalf of equal business model terms. A common business model language is urgently needed to make it possible for businesses to download, see, sense, and understand their business model dimensions and components [8] to communicate with one another. In a world of 5G, a standardized business model language needs to be introduced. Business model innovation, creation and the use of persuasive business models could then be given a new lease of life.

Today businesses often have a limited view on a small part of their business model value exchange, mostly one-sided and in a 2 D mapping, as we illustrate in Fig. 5, and mostly after the value process has taken place

Businesses can with much effort today download and observe values being exchanged to some extent (green dots). In case they have agreed on an internal business model language, this is as earlier mentioned most often limited to ad hoc viewings for one of their business models.

5G will introduce us to a more complex world of business model innovation [16], since it allows us to visualize numerous value interactions, which had not been possible before—and in real time. It will provide us with an enormous amount of new data, knowledge and insights on how business models are really functioning—and also persuasive business models. This additional information will only be comprehensible of course if agreements on a common business model language will eventually be made and agreed upon [11–13, 15].

After taking the first step of 'unwrapping' this new knowledge in a lab experiment with a small part of a business and 13 different business models, a rather complex and less

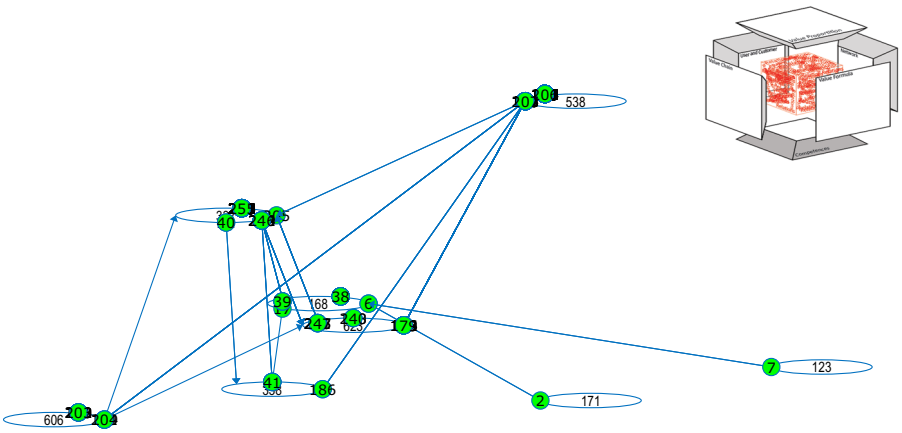


Fig. 5 2D Mapping of one business model value exchange sequence from a selected industrial business

operational picture of value exchange between business models is shown with business models that are not as such created as being persuasive (Fig. 6).

The process of business model value creation, capturing, delivering, receiving as well as consuming [8], both tangible and intangible value exchanges between business models, is very complex—as can be seen—to understand, "see" and "sense" [12]. Further every phase and business model dimension involved in this process is naturally "object" to security issues. Understanding this process fully is the second essential step to develop persuasive business models under the conditions that we have agreed on a common business model language. Hereafter it is possible to take the third step: creating persuasive business models that influence and have an impact. The fourth step is to understand how to strategically lead and manage these persuasive business models. Finally, there is the execution of the mentioned strategic plans and monitoring the results, as shown in the model beneath (Fig. 7).

From the perspective of secure business model innovation, businesses and society are facing enormous challenges in understanding these persuasive business models, and in transforming regular business models into persuasive business models. Research shows that the evolving mobile and wireless communication is going to demand more security efforts, and a new understanding of security values [18].

Crucial questions are: How can full use be made of the potential of persuasive business models and how can both security and business be achieved at the same time? How can security be embedded in persuasive business models that are built persuasively by nature and which themselves are embedded within persuasive technology?

3 Towards the 'Persuasive Business Model' Concept

Existing research on clarifying the persuasive business model concept is limited. As 3G and 4G based business ecosystems emerged, many businesses however, such as Google, Facebook, Amazon, Ebay, Zinga, and Blizzard, began rethinking their business models and

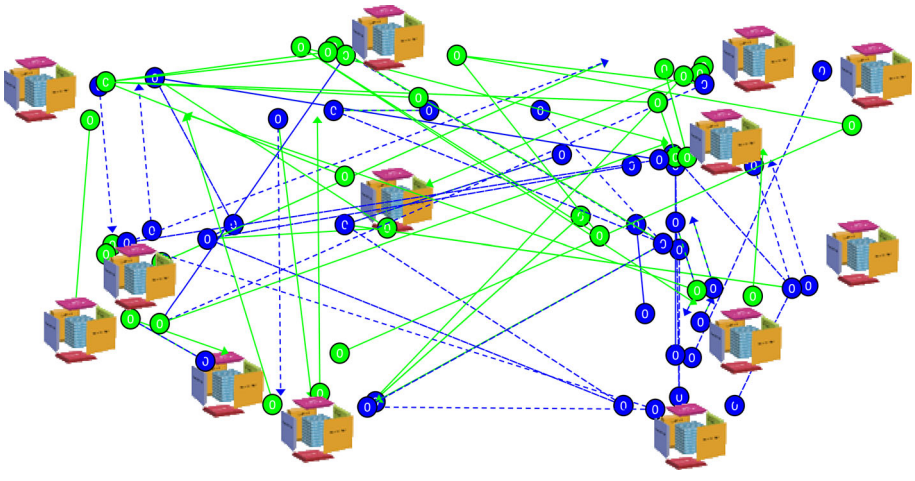


Fig. 6 2D Mapping of a multitude of business models value exchange sequences between business models inside an industrial business

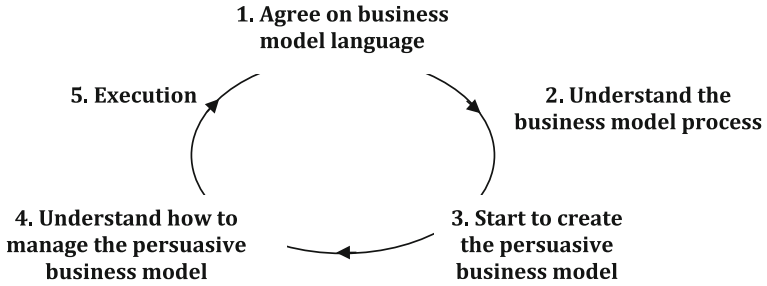


Fig. 7 Creating a persuasive Business Model (BM)

business model structure [11, 12] and testing as well as using the Internet and embedded ICT as persuasive tools. They started integrating persuasive components (colours, text, tabs, sounds in to e.g. their websites and apps), dimensions (value propositions, value chain activities, relations and networks into digital and physical products and services) and even built whole business models, which could motivate/persuade, users, customers, network and employees and things to act according to certain behaviour patterns (e.g. Pokemon as an excample) [11].

Persuasive business models are the field where large investment in business model innovation (BMI) is taking place right now with an exponential speed and where it will increase even more in the next decade. Researchers attempted defining the business model concept [2] but as mentioned before, a general language and framework concept of a business model is yet to be accepted [24–26]. Most authors have only applied a narrow innovative and financial approach in the context of business models and business model innovation, instead of one that is general, transaction and relation oriented. Many, if not all, authors have still missed to combine the terms 'business model' and 'persuasive technology', and neither have they considered them in an interactive and network business model relational perspective.

Previously *a 'business model'* was defined *as a building platform representing the business' strategic, operational and physical manifestation* [18]. *We claim that the real challenge for business model 'designers' is to first identify all dimensions and relations of the business models: to download, see and sense their key dimensions, components and key relations to their business both for 'AS-IS' and 'TO-BE' business models before they can even begin to understand, innovate and construct them interactively* [8–11].

Persuasive business models take this approach, revaluate and advance it by posing the question: What if we could use data and knowledge, which we gathered in realtime in the interaction with people and things to be able to persuade for a different behaviour within the minute and moment?

It has been argued that a business model framework must be reasonably simple, logical, measurable, comprehensive, as well as operational and meaningful [18, 28]. The persuasive business model we propose has to meet the same qualifications to have businesses, BMES and society in general to adapt and take on to the approach. We propose that the business model has seven dimensions (Table 1) to represent the generic dimensions of our proposal to the language and terminology of any business model [11].

Our previous research [8] shows that a business that want to innovate persuasive business model at optimum must adapt the approach of a multi business model approach, combining and relating different 'ingredients' from more than one business model. This

Table 1 Generic dimensions and questions to any persuasive business model

Dimensions in a generic business model (Physical, Digital, Virtual)	Core questions related to a generic business model
Value proposition/s (products, services and processes) offered by the business	What are our value propositions?
Customers and users (target users, customers, market segments that the business serves)	Who do we serve?
[Internal] value chain configuration	What value chain functions do we provide?
Competences (assets, processes and activities) that translate businesses' inputs into value for customers and/or users (outputs)	What are our competences?
Network and network partners (strategic partners, suppliers and others)	What are our networks?
Relations e.g. personal	What are our relations?
Value formula (Profit formulae and other value formulae)	What are our value formulae?

implies that persuasive business models are related with other business models and most of them have built in persuasive technology.

Although some key researchers [3, 4] include strategy in their business model definitions, it was conceptually found clearer in our previous business model research [8] to exclude strategy. When taking the role of business model innovation processes into consideration, there should be at least an analytical distinction between strategies, dimensions, components and core BMI processes of the business model [21], as shown in the model beneath (Fig. 8).

Referring to our previous discussion, it can be argued that Business Model strategy is, embedded within the generic persuasive business model, providing—if adapted—a larger platform for businesses which have strategically decided to be based upon one or more persuasive business models. With other words, a persuasive business model strategy on the contrary to previous business model strategy, includes an interactive and dynamic strategy vision, mission and goal(s), with which it seeks continuously to achieve to change the users, customers, networks, employees and things within the preference of the business models aim it may focus.

Taran et al. [23] named three approaches to define when a business model innovation implies radical change. The first approach regards change in any of the (core) business model's dimensions or the relationships between them as a form of business model innovation [23]. The second approach, in line with Abell [1] and Skarzynski [22, 26], involves considering the number of dimensions in the business model that are changed. The third approach defines innovativeness in terms of the range of the business model innovation. A suitable scale to measure the 'new to whom' of business model innovation

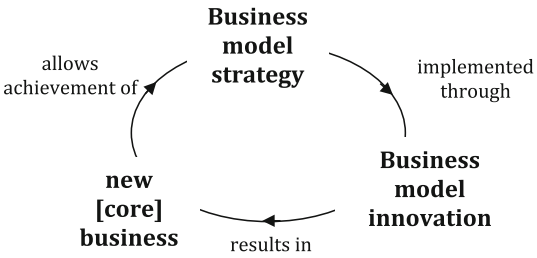


Fig. 8 Core business, business model innovation and business strategy—Taran et al. 2009 [23]

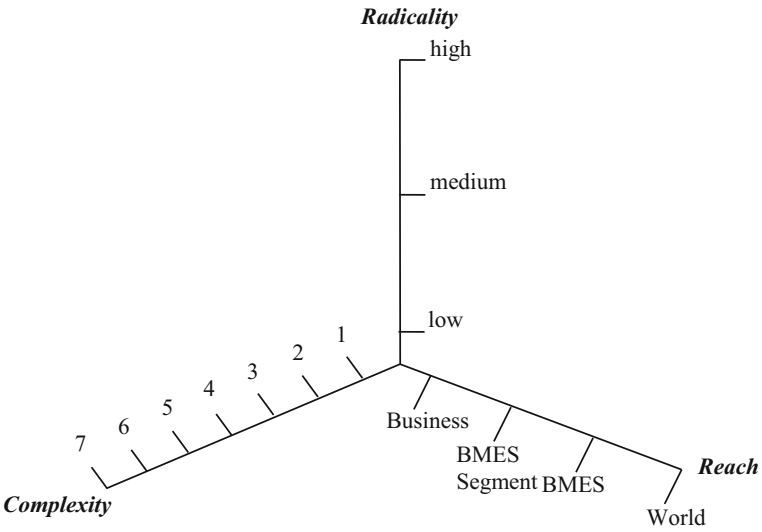


Fig. 9 A three-dimensional business model innovation scale inspired by Taran et al. [25]

could be one ranging from new to business, from new to the business model ecosystems (BMES) segment and new to the BMES to new to the world (Fig. 9).

A three-dimensional space then emerges, which helps identifying the innovativeness of a business model:

- *Radical nature* How new? Incremental versus radicalness of each business model dimension?
- *Reach* To whom is the business model innovation new?
- *Complexity* How many dimensions of a business model are changed simultaneously?

However this model did not take into consideration at that time that business models, businesses and even BMES could turn out to be persuasive—both individually and together.

To sum up, considering persuasive business model environments, persuasive business models and persuasive business model strategy should be structured and led in a more strategic way than the classical business model approach. The business has to commit itself to the strategy approach that a persuasive business model by nature should have strategy built in, are dynamic and interactive.

Furthermore, persuasive business models are strategically designed with the aim to change users', customers', network partners', employees' and technologies [8] behaviour through their value proposition(s) together with the other six business model dimensions.

4 A Proposal for a Secure Persuasive Business Model in a World of 5G

Lindgren et al. [8, 10, 11] introduced a first proposal in 2010 of how the environment for business model innovation could look like in a future society, where mobile and wireless communication technology shape daily lives to a huge extent (Fig. 10).

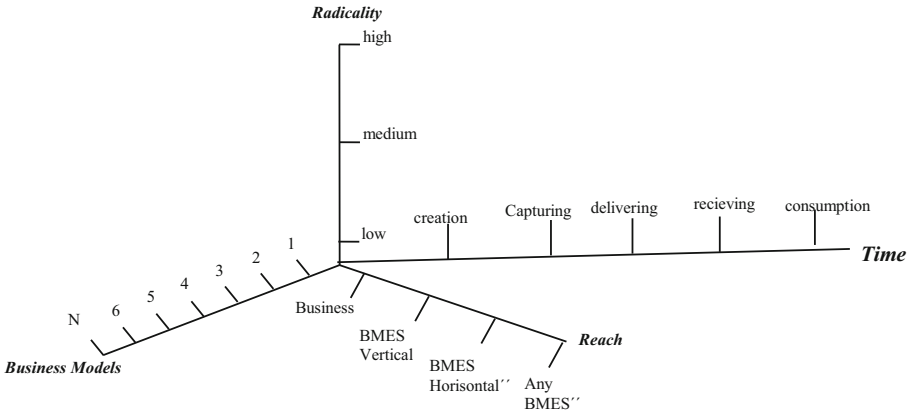


Fig. 10 A four-dimensional model for future business model innovation (Inspired by TU Delft presentation ITU, adapted from Nomura Research Institute)

A preview for the role of persuasive business models in a world of 5G and persuasive business model innovation leads to the thoughts that the persuasive business models will try to attach to anything, anybody, anywhere and anytime in the entire Business Model innovation process [8]. 5G is expected to be the backbone of most persuasive business models. There are several future developments to be predicted. First, businesses will use the expected advanced 5G sensor technologies and networks to link all seven dimensions of business models. Second, the majority of persuasive business models will form a mutual network. Third, persuasive BMI will be carried out via advanced persuasive technology, implying that businesses become increasingly dependent on 5G networks to extend their persuasive business model innovation and development of their BMES. Fourth, anything, anybody, at anytime in any place will be linked persuasively together to these business models.

We expect that persuasive business models based on networks of different persuasive business model technology platforms, software and ecosystems become reality before 2030. Still, business models will not only act in physical and digital BMES, since they are much more persuasive and powerfull in the virtual BMES level. This will result in a full integration of the persuasive physical, digital and virtual business models. 5G, and especially the advancement of sensors, enables new dimensions of persuasive business models and persuasive BMI.

In effect, the question is now raised of:

How to enable security and persuasive business models at the same time?

Soon everyone and everything at any time and in any place will have the possibility to act persuasively and to secure themselves automatically through secure persuasive business models. Tomorrow's network based persuasive business model will consist of business models with all kinds of strategies, security structures and offers, including virtual, digital and physical value propositions and security systems. In this context, we, as persuasive business model providers and developers are facing a world where we innovate and operate persuasive business models within a multitude of BMES and a variety of security systems [14].

The persuasive business model based on advanced security technology will give competitive advantage to businesses. Nevertheless, we still have challenges of security,

trust and ethics to overcome before we reach the point where all business models become persuasive.

An even stronger focus on security, as personal security and network based security technology, and business models that are persuasive, in process and changing continuously in different BMES context, sets businesses and researchers under high pressure to find solutions. Solutions, that both technologically and business-wise, will have to meet the needs of all kind of stakeholders for increasing persuasiveness, agility, flexibility, individualization, and privacy. A concept proposal for persuasive technology and business models, which are independent of time, place, bodies, things and at the same time secure, is shown in Fig. 11.

The figure shows a first proposal for a secure persuasive business model innovation framework, portraying the full integration of physical, digital and virtual persuasive business models within a secure context of any BMES.

An interesting synergy and spinoff of the above mentioned persuasive secure business model is a development to a completely new and changed understanding of persuasiveness, security and business models [18]. This development takes us from a static, physical, digital, virtual and proactive security business model context to a relational interactive persuasive business model. The latter sets individualized, integrated, automatic persuasive value propositions in motion, possibly leading to security delivery by business models. "Moving" both business model and security with time becomes suddenly imaginable and possible in a world of 5G. The business model and security will follow You—and "persuade" the surrounding business model environment to be secure according to the security profile of the person, business, thing. This could create an optimum for individuals and businesses valuing "privacy, freedom, flexibility, agility and security at the same time." [18].

When confronting the security-business nexus, security should become persuasive security embedded in the business model—a secure persuasive business model which is able to "sense" the exact timing, when the human being, the thing and the business model

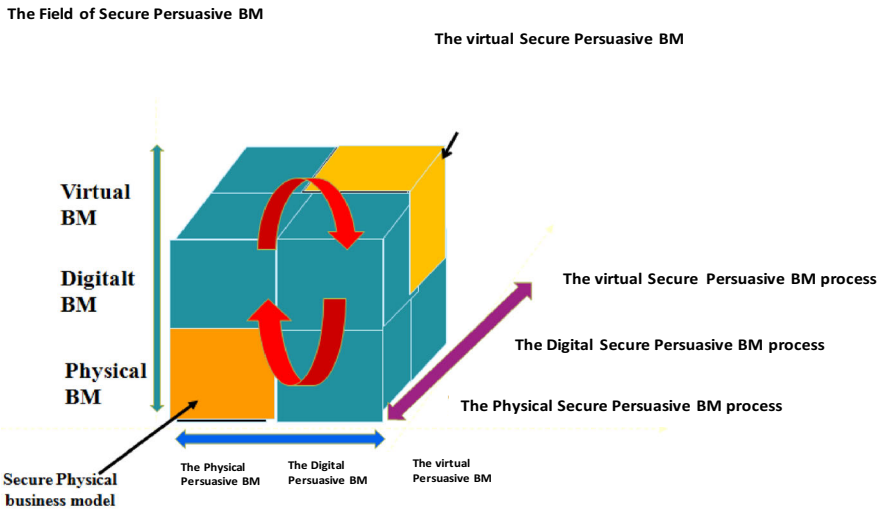
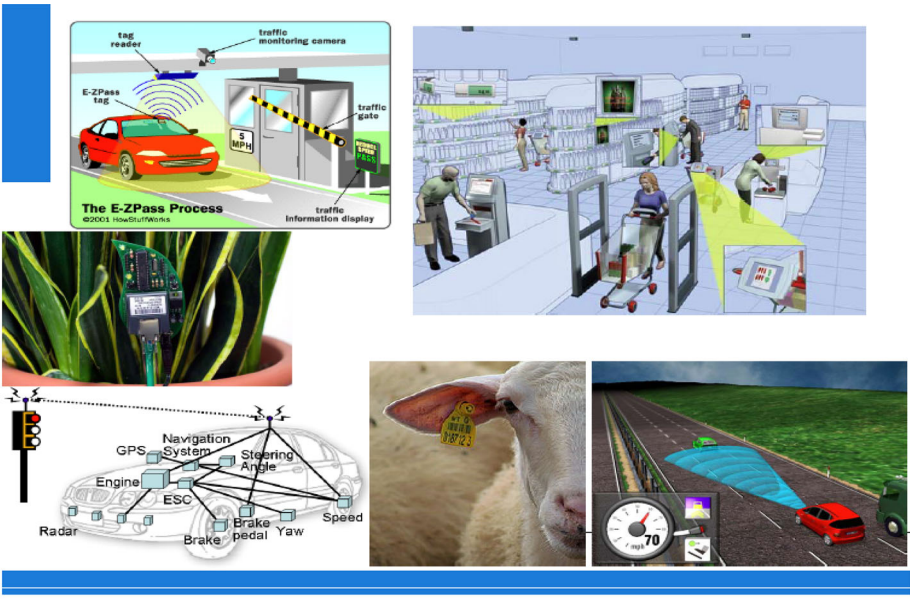
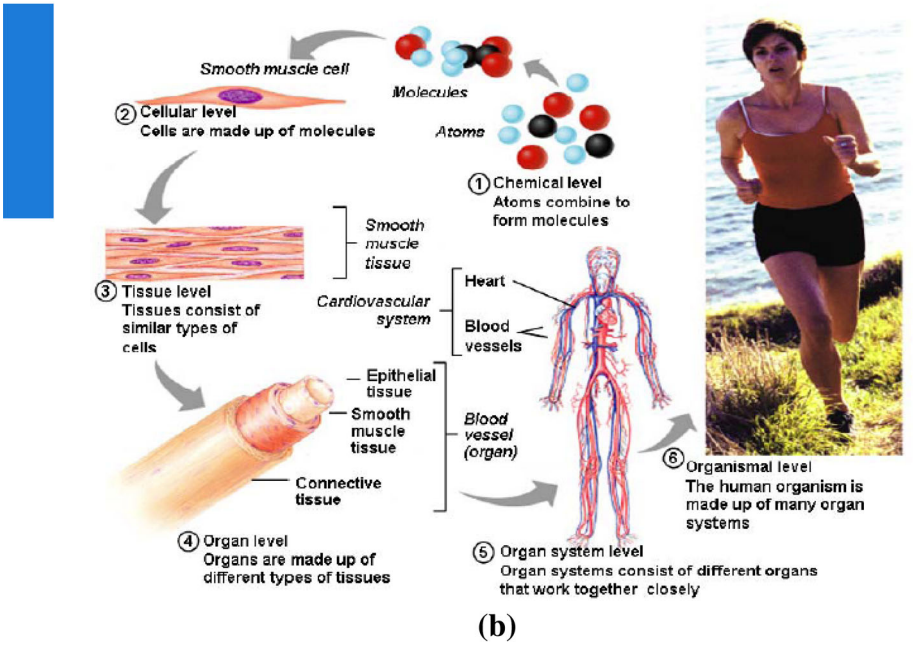


Fig. 11 The field of the secure persuasive physical, digital and virtual business model (BM) inspired by Whinston et al. [27]



(a)



(b)

Fig. 12 Persuasive BMs outside and inside things and bodies at any time, any place, with anything and anybody (Inspired by Ertan Onur [17] TU Delft presentation SW2010 [17] and speakers from SW2015 [18]). **a** Persuasive Secure Business Models outside or on the surface of things and bodies, **b** Persuasive Business Models and Security inside things and bodies

demand security. One should, of course consider challenges on the societal level, as surveillance cannot be the result. When dealing with businesses that openly focus on persuasive business models, they should be held responsible for their actions and in some cases be forced to take products back, or reverse parts of the business model (e.g. the case of stolen credit cards in the banking sector).

Security could be related to one or more chosen dimension of the business model, defining which dimensions are secure and which are not. Moreover, security should be thought about in a combination of different dimensions, different business models or different Business Model Ecosystems. An example would be the case of several business models working together or within the business model ecosystem on security and persuasion. The possibility of allowing persuasive business models to only act in certain business model ecosystems exists. Once tapped into that, from then onwards one has to be aware of moving in a world of persuasive business models.

Last but not least, the question of location is an important issue of the above mentioned models, besides security. At the same time, the term location comprises more than the geographical setting. At SW2015 [18] and at the Kickoff Operation of CTIF Global Capsule US (CGC) jointly with the Round Table Discussions on Knowledge Home New Jersey Institute of Technology [16] it became even more evident than during SW2010 [17] that future security and persuasive business models are not only a matter of security on the surface, but also of persuasive business models related to both inside and outside things, bodies and time [18] (Fig. 12).

5 Conclusions

Concluding, we expect persuasive business models to become one of the most important business model innovation concepts for future business model innovation and development. Discussions in this field related to ethics have already begun (see the case of Google and the EU Commission, Yahoo, Facebook and the China case, the Tobacco Industry and the Global Health Care Society).

Persuasive business models are integrated in advanced persuasive business model technology, and are as such either embedded in product-, service-, production-, or process technologies or in all combined. It is in this context that the fast evolvement of persuasive business models, which are related to the vision of a secure, persuasive and sustainable society should be seen.

Secure persuasive business models can be operating physically, digitally and virtually—integrated, connected and secure—and deliver value propositions, wherever and whenever the user, customer, network partner, employees, objects and businesses demand it. Persuasive business models typically operate together in a multi business model setup, in business model network collaborations outside and in future scenarios also inside objects and bodies. All seven dimensions of a business model can and will change continuously in the processes of persuasive business model innovation, related to the stakeholder's demand, as well as the strategy behind them and the multi business model environment they are developed in. This makes it extremely difficult to measure business models and their innovation process.

Future security and persuasive business models are not only a matter of security, ethics and trust on the 'surface' of things, places, people and time but also of business models related to both inside and outside things, bodies and time [15, 18]. How persuasive business models can be controlled in this context is still to investigate.

As pointed out in this article, there are still many bridges to cross before reaching an enhanced understanding of how businesses can use persuasive business models and what they can achieve by applying them in a secure way and approach. We provided in this paper a first mapping of those bridges and proposals on how to cross these challenge.

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