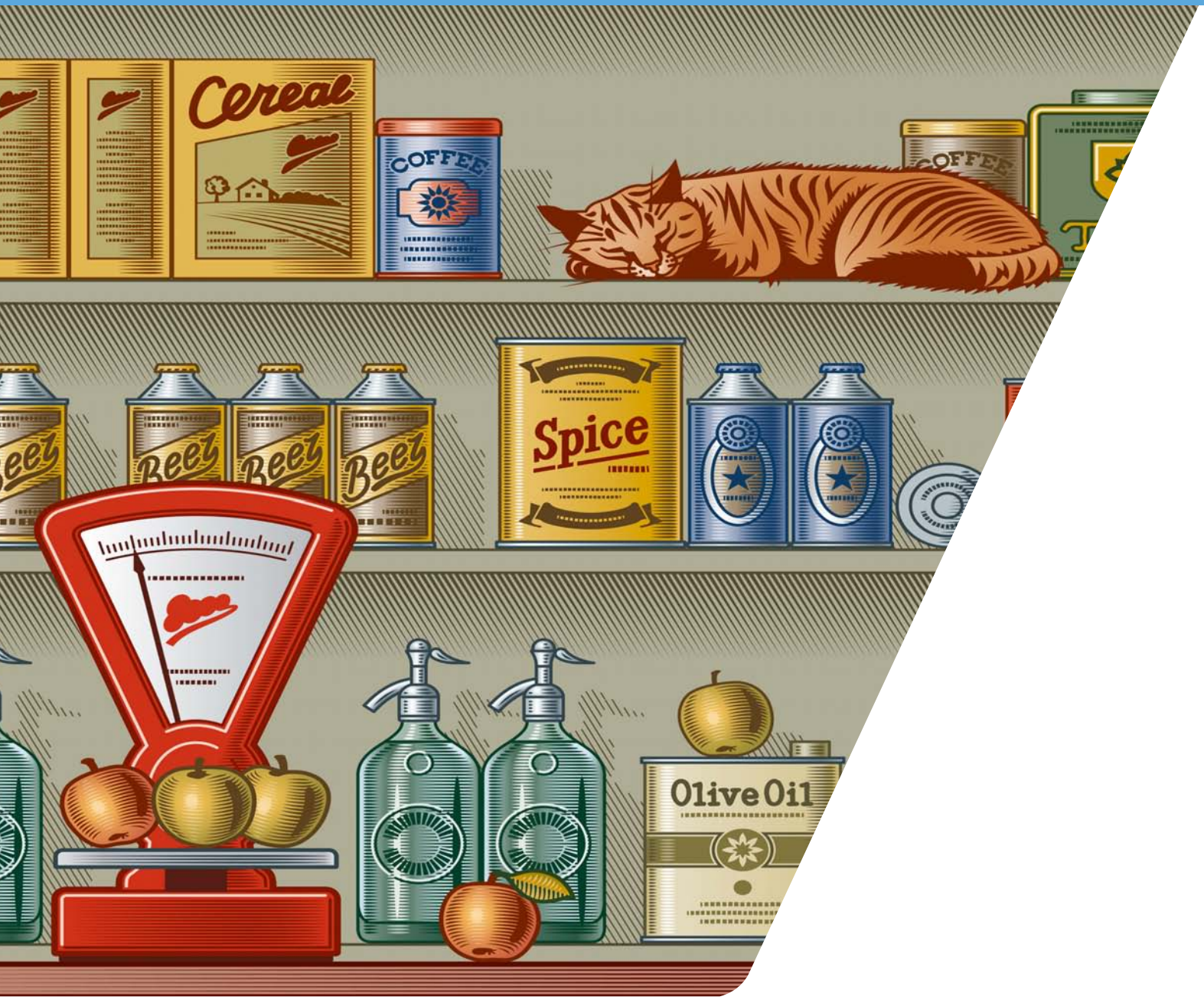
VTT WORKING PAPERS 142



Ulf Lindqvist, Maiju Aikala, Maija Federley, Liisa Hakola,
Aino Mensonen, Pertti Moilanen, Anna Viljakainen &
Mikko Laukkanen

Hybrid media in packaging

Printelligence

ISBN 978-951-38-7488-9 (URL: http://www.vtt.fi/publications/index.jsp)
ISSN 1459-7683 (URL: http://www.vtt.fi/publications/index.jsp)

JULKAISIJA – UTGIVARE – PUBLISHER

VTT, Vuorimiehentie 3, PL 1000, 02044 VTT
puh. vaihde 020 722 111, faksi 020 722 4374

VTT, Bergsmansvägen 3, PB 1000, 02044 VTT
tel. växel 020 722 111, fax 020 722 4374

VTT Technical Research Centre of Finland, Vuorimiehentie 5, P.O. Box 1000, FI-02044 VTT, Finland
phone internat. +358 20 722 111, fax +358 20 722 4374

Technical editing Mirjami Pullinen

Series title, number and report code of publication

VTT Working Papers 142
VTT-WORK-142

Author(s)
Ulf Lindqvist, Maiju Aikala, Maija Federley, Liisa Hakola, Aino Mensonen, Pertti Moilanen, Anna Viljakainen & Mikko Laukkanen

Title

Hybrid media in packaging

Printelligence

Abstract

Packages are expected to carry ever more information in a limited space. One solution is hybrid media, i.e., printing intelligent elements on packages. The aim of this study was to find the best way to produce additional business for the package value chain using existing technologies for hybrid media.

The approach included a technology survey of 2D applications, interviews with industrial experts from the package value chain, two industrial case pilots with user studies and a study tour of forerunner companies in Japan.

Hybrid media can offer benefits in the form of cost savings, new business opportunities, added value to existing business and increased customer loyalty to all players in the value chain. The available hybrid media technologies are 2D bar codes, digital watermarks, imge recognition, fibre matrix, RFID tags and magnetic codes.

The pilot tests and user studies showed that additional hybrid media services should include detailed product data, recipes, nutrient requirements and user instructions, and match user demand. Obstacles to their use are cost and complexity, and the fact that they are time-consuming.

In Japan, mobile barcodes are part of everyday life. They are well known to consumers and are used on a flat-rate basis. When they were introduced, they were based on consumers' needs, not on early profit. Today, it is a win-win situation with benefits for all the players in the value chain, and many traditional printers have created completely new service concepts for their customers.

ISBN
978-951-38-7488-9 (URL: http://www.vtt.fi/publications/index.jsp)

Series title and ISSN		Project number
VTT Working Papers 1459-7683 (URL: http://www.vtt.fi/publications/index.jsp)		15451
Date July 2010	Language English	Pages 52 p. + app. 7 p.
Name of project Printelligence	Commissioned by Tekes, GTTS, Oy Gustav Paulig Ab, Ravintoraisio Oy, StoraEnso Oyj, UPCode Ltd, PTR	
Keywords Hybrid media, packaging, 2D codes, printed functionality, value chain, business models, user study	Publisher VTT Technical Research Centre of Finland P. O. Box 1000, FI-02044 VTT, Finland Phone internat. +358 20 722 4520 Fax +358 20 722 4374	

Preface

The research project Hybrid Media in Packaging (Printelligence) was carried out by three research institutes in cooperation: VTT Technical Research Centre of Finland; Oy Keskuslaboratorio – Centrallaboratorium Ab (KCL), which merged with VTT during the project; and Helsinki School of Economics (HSE), which changed its name to Aalto University School of Economics in the course of the project, from 2008 to 2010. VTT has contributed expertise on hybrid media technology, the KCL expertise on consumer behaviour and media use, and the HSE expertise on business models.

The project was initiated as a continuation of the project Business from Printed Functionality (Funktiobisnes) with strong support from the Center of Printed Intelligence (CPI) at VTT. The project received support from Tekes – the Finnish Funding Agency for Technology and Innovation as part of the FutuPack technology programme, the Graphic Industry Research Foundation of Finland (GTTS), and the following companies/organizations: Association of Packaging Technology and Research (PTR), Oy Gustav Paulig Ab, Ravintoraisio Oy, StoraEnso Oyj and UPCode Ltd.

The project work was governed by a steering committee with the following members: Anna Alasmaa (TEKES), Kai Eira (Oy Gustav Paulig Ab), Helene Juhola (VKL), Markku Krutsin (Ravintoraisio Oy), Juha Maijala (StoraEnso Oyj), Margareetta Ollila (PTR) and Sture Udd (UPCode Ltd). A number of experts representing the package value chain were interviewed during the project; these experts are listed in Appendix A.

The Project Manager was Ulf Lindqvist, the technology survey was performed by Liisa Hakola and Pertti Moilanen, the user studies were conducted by Aino Mensonen and Maiju Aikala, the pilots were organized by Maija Federley and Liisa Hakola, and the business models were analyzed by Mikko Laukkanen and Anna Viljakainen.

Espoo, 30 June 2010

Ulf Lindqvist, Maija Federley, Mikko Laukkanen, Liisa Hakola, Pertti Moilanen,
Aino Mensonen, Maiju Aikala & Anna Viljakainen

Contents

List of symbols and abbreviations

2D	Two-dimensional
B2B	Business-to-Business
B2C	Business-to-Consumer
RFID	Radio Frequency Identification
UTZ	An international certification programme for coffee

1. Introduction

1.1 Background

The role of packages as a communication medium is growing. Packages are expected to carry more information and offer added value, not just provide cover for the product. The surface area of the package that is available for additional information – useful or amusing – is decreasing, however, as more space is needed for compulsory information set by legislation and authorities, and, for example, versions in different languages.

Hybrid media, i.e., the integration of printed and electronic media, are one way to increase the amount of information applied to a package. In its simplest form, hybrid media include printing a two-dimensional code (2D code or matrix code) on a package, reading the code with a mobile phone equipped with a camera, and accessing an Internet address via the interpreted information to receive additional information. Hybrid media may also have a wider use, however, such as interpreting an intelligent printed element like a code, image, fibre structure, active particles, etc. by a reader that provides access to an electronic service or additional information.

Hybrid media offer new business opportunities throughout the package value chain. They can give companies a competitive edge as well as the chance to monitor consumer behaviour and collect information about consumers. Logistics companies can also track material flows using hybrid media. Hybrid media allow data transfer between players in the value chain, in other words, hybrid media applications can act between companies and consumers (B2C) and between companies (B2B). Moreover, the same intelligent element may serve different goals through the value chain.

In Japan, hybrid media have been used since 2003. In Finland, the first hybrid media service was used in summer 2004. During 2008, several services were introduced in a number of countries in Europe, Asia and the Americas. The services have mostly been attached to publications, advertisements and business cards, but some services have also been tested in the package industry. The technology has been established in the past few years and has been proven to work. Consumers have also become more familiar with hybrid media applications.

VTT has actively developed hybrid media technologies and applications since 2003 in national research projects such as PrintAccess, PrintInteract, Tivik and Hyperfit. These have resulted in new business applications of hybrid media. The Funktiobisnes project

has evaluated the business potential of printed functionality for the Finnish paper and printing industry.

The KCL represents expertise on technological solutions for hybrid media, consumer media behaviour and corresponding research methods, and experience of user-centred product design and its applications for media products. Research into media use and user-centric approaches started in 2002.

The HSE (and later the Aalto University School of Economics) has actively studied e-business for more than a decade and carried out research into consumer behaviour and business models from the angle of customer service, marketing and sales. Earlier projects are Divia (2002), Pear, Fummas and Future marketing.

1.2 Scope of the research

The aim was to clarify the opportunities in hybrid media for the packaging industry and to find the best ways to produce additional business values.

The project should concentrate on existing exploitable technologies and analyse them from the aspect of applications, services, business potential and user attitudes.

The project should result in a generic analysis of applications in which hybrid media offer additional values for players in the value chain. More specifically, the project should result in

- an analysis of hybrid media technologies suitable for packaging
- the definition of the most useful applications and service forms for the package value chain
- a description of the value chain of hybrid media services, cost and benefit models, a user study including user attitudes to hybrid media and its use in packages
- new and tested hybrid media services for packages developed in cooperation with selected consumer groups
- an international view on the business potentials of hybrid media in packaging and consumer attitudes
- industrial forums.

2. Methods

2.1 Technology survey

The objective of the technology survey was to analyze available hybrid media technologies and their differences. The technologies under study were mainly limited to those that were optically readable. Camera phones were considered the primary reading device. Code contents were also analyzed.

2.2 Interviews with industrial representatives

The objectives of the interviews with the industrial representatives were to identify the needs of the package value network that can be met using hybrid media solutions and to identify new business potential. The new business potential includes using the option to change the role of the package value network that is enabled by the hybrid media technology. The interviewees are listed in Appendix A.

A semi-structured interview method, a focused interview, was used. In focused interviews, the themes for all the interviews are set beforehand, though there may be variations in the actual questions and the order in which they are posed. The following themes were of interest in this study:

1. The role of the company in the package value network and the information needs now and in the future:

    1) Needs for information flows: what is distributed, what is received?
    2) How is the information gathered? From where?
    3) What kind of added value could hybrid media bring to the company?

2. New opportunities:

    4) What kind of role would the company like to have in the package value network?
    5) Opinions on the presented applications (entertainment, personalization, additional information and security), wild ideas.

6) The role of hybrid media in brand management, sales, marketing, communication.

3. Relationship with the consumers:

7) How can hybrid media solutions be used to achieve advertising targets?
8) Which is more desirable: a higher price or a larger market share?
9) What kind of information is needed from the consumers?
10) The use of hybrid media in consumer research.

2.3 Case studies

The purpose of the case studies was to simulate an actual hybrid media service implementation process without delivering the packages to consumers through retail shops or similar delivery channels. The pilot packages with hybrid media elements were also used as demonstrators in the user study.

The pilot concepts were defined based on rough ideas collected in the interviews with the industrial representatives. These concepts are presented in Table 1. The concepts were further developed during discussions between the research group and the companies participating in the Printelligence project. As a result, the actual technology pilots were defined.

Despite the numerous technological possibilities for implementing hybrid media into packages (see the results of the technology survey in Section 4.2 and Appendix C), data matrix codes were chosen for use in the pilot packages of the study. The partners in the project wanted to promote the development of feasible, attractive applications and new business opportunities rather than demonstrate technological alternatives. The two-dimensional codes already used in many services are economical to produce and suitable for solutions targeted at consumers, though they are underutilized in Europe.

Table 1. Descriptions of the pilot concepts defined based on the company interviews.

Pilot concept	Description	Participants	Benefit
1. Consumer feedback / consumer study	Consumer questionnaire on size and functionality with a reward. The code can be hidden at the bottom of the package where it is found after use.	Brand owner, software designer, printing house (besides other content), consumer	Direct consumer feedback to brand owner, consumer receives a reward
2. Recipe (and map)	Recipe and serving suggestion as well as a shopping list and possibly a map of the shop with an indication of where the ingredients can be found.	Brand owner, software designer, retail shop (if map service is included), printing house, consumer	Package space saved, brand strengthened, additional service for consumer
3. Recycling	Which waste container to use for this particular package	Brand owner, package manufacturer (recycling information), printing house, consumer	Sustainable actions, improved recycling
4. Origin	At least batch-specific information about the origin of the product. Questionnaire can also be included with reward.	Material and product manufacturers, brand owner, printing house, consumer	Consumer-brand communication, additional information for the consumer
5. Batch-specific documents	Batch-specific documents accompanying the package	Everyone in the value chain. Personalized code.	Perfect tracking and traceability of the package.

2.4 Study tour

A study tour was undertaken to Japan in October 2009, and a number of companies with experience of hybrid package services were visited. The outcome of the study tour is described in detail in Appendix D.

2.5 User studies

The user study consisted of semi-structured interviews with the intended users and analysis of the data. Each user was interviewed individually except for four adolescents who were interviewed as a group. The interviews were lettered and analyzed with the Atlas.ti application.

The research questions to be answered by the user studies were the following:

- What kind of services behind the code will the user find interesting and useful? Why are those services interesting or useful to the user? What kind of services

could have an influence on shopping decisions? What kind of services could lead to sustainable business?

- How do the users find the functionality of the case applications?
- Which factors promote the use of codes?
- What are the obstacles to the use of codes?
- How can the customer's commitment to the brand be improved? How easily does the consumer give contact information to the brand owner? Ideas for services that improve customer commitment to the brand. Could the code help attract loyal customers?

Two different case studies were carried out. The cases are called Raisio and Paulig, indicating the products used in the interviews. The cases are presented in more detail in Chapter 3 Pilots.

The interviews consisted of five parts. They started with a discussion on food packaging in general and focused on what kind of information the interviewee looks for when buying groceries and how easily he or she finds the information on the packaging. In the second part, the conversation concentrated on consumer habits for the product in the case (cereal and snack drink or coffee). In this part, we gained valuable information on, for example, how loyal the interviewee is to the brand studied and which properties of the product the interviewee feels have an impact on his or her shopping decision.

The third part of the interview focused on the service behind the code. It was first discussed in general, and in the fourth part, the actual cases were tested. In this part, the interviewee took a snapshot of the code and became familiar with the service behind it. The interview ended with ideation of what could be behind the code.

3. Pilots

The planning of pilot packages with hybrid media elements was started in May 2009. The implementation of the services started in August, and the demonstrators were ready in the beginning of October 2009. The process was carried out in cooperation between research organizations and industrial companies participating in the Printelligence project. There were two technology pilots: 1) with Paulig and 2) with Raisio. Upcode and Stora Enso also participated in both technology pilots.

3.1 Objective

The objectives of the technology pilots in the Printelligence project were to 1) produce demonstration packages and services for user studies and 2) report exactly how an example hybrid media service is implemented. The technology pilots were designed to provide information on how willing consumers are to use hybrid media services and what the user's opinions are on usefulness, functionality and ease-of-use of these services. The results of the user studies are reported in Section 4.3.

3.2 Technology pilot with Paulig

The objective of the technology pilot carried out with Paulig was to study what kind of additional information consumers found interesting and whether this kind of service could improve brand loyalty and/or affect purchase decisions.

The roles of the Printelligence project partners in the implementation of the technology pilot were the following:

- Paulig: defining the product, service content and target group, planning the hybrid media service and providing product packages
- Upcode and Stora Enso: providing the hybrid media codes
- VTT (including the former KCL): planning and implementing the hybrid media service, adding hybrid media codes to packages with the help of stickers, and reporting.

3.2.1 Products and target group

The target group for the technology pilot was 20-45-year-old citizens with an academic degree (university/polytechnic). In addition, the person should purchase and drink coffee at home. The target group could also include persons who sometimes purchase certified products (organic food, UTZ certified, Fair Trade, etc.) or who sometimes purchase special coffees (dark roasted, country of origin, espresso, spiced, etc.).

Two products were included in the technology pilot:

- Paulig Mundo coffee is a UTZ-certified product. The product already includes an Internet service that helps the user track the origin of the coffee beans. In addition to origin tracking, the hybrid media service would include more information about the product and UTZ certification.
- Paulig Parisien is a French-style dark roasted coffee. The hybrid media service would comprise additional information about the product, instructions for making coffee, recipes and downloadable images.

3.2.2 Digital service structure

The structure of the different pages of the Paulig Mundo hybrid media service is presented in Figure 1. The start page is the page that opens after reading the hybrid media code found on the Paulig Mundo product package. The contents of the pages were largely the same as those that can be found on existing Paulig Internet pages, but they were implemented in a format suitable for mobile use.

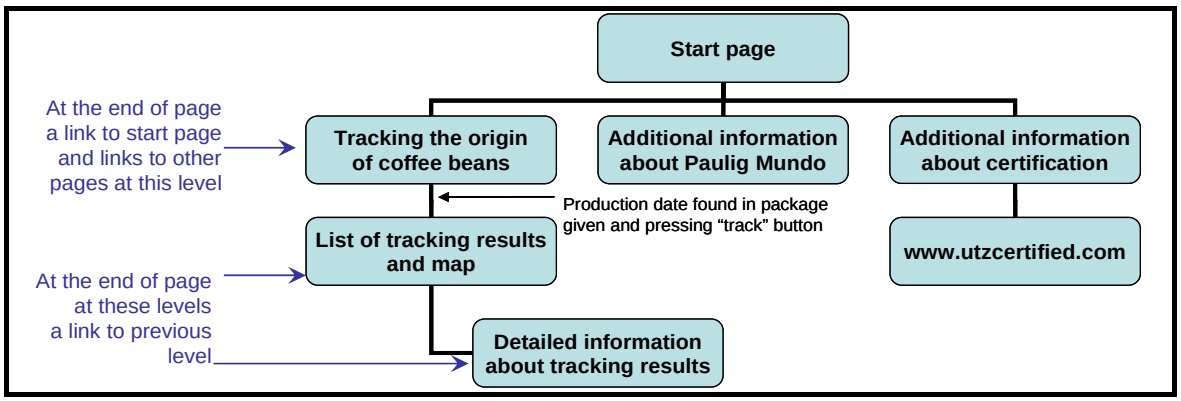


Figure 1. Structure of the different pages of the Paulig Mundo hybrid media service.

The structure of the different pages of the Paulig Parisien hybrid media service is presented in Figure 2. The start page opens after reading the hybrid media code found in the Paulig Parisien coffee package. The contents of the pages were the same as those that can be found on the existing Paulig Internet pages except for the downloadable images.

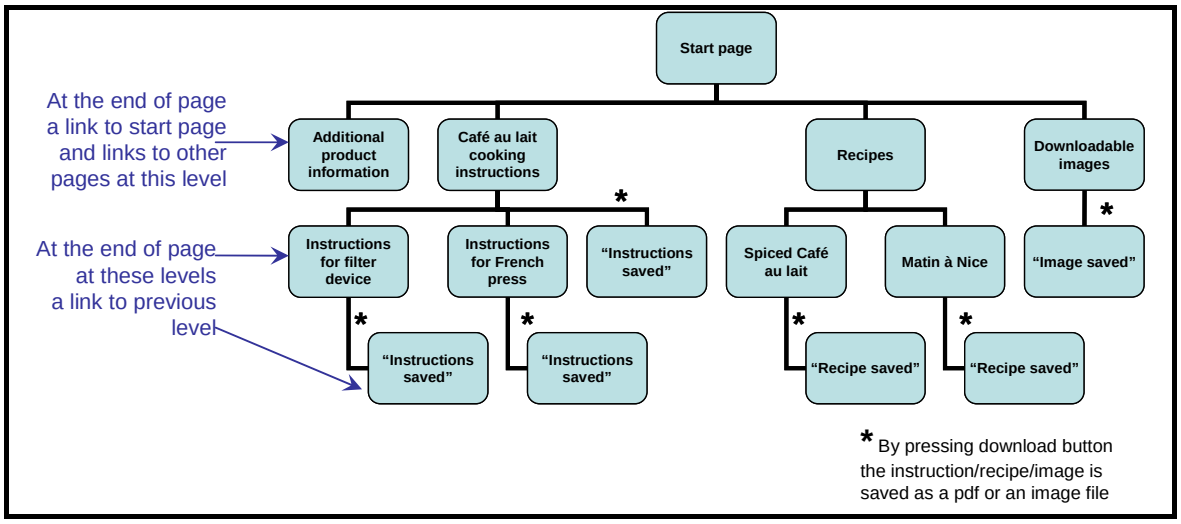


Figure 2. The structure of different pages of the Paulig Parisien hybrid media service.

Both of the hybrid media services were in Finnish and could be found at http://owela.vtt.fi/pp1 (Paulig Mundo) and http://owela.vtt.fi/pp2 (Paulig Parisien). Figure 3 shows the start pages of both services on the mobile phone screen.

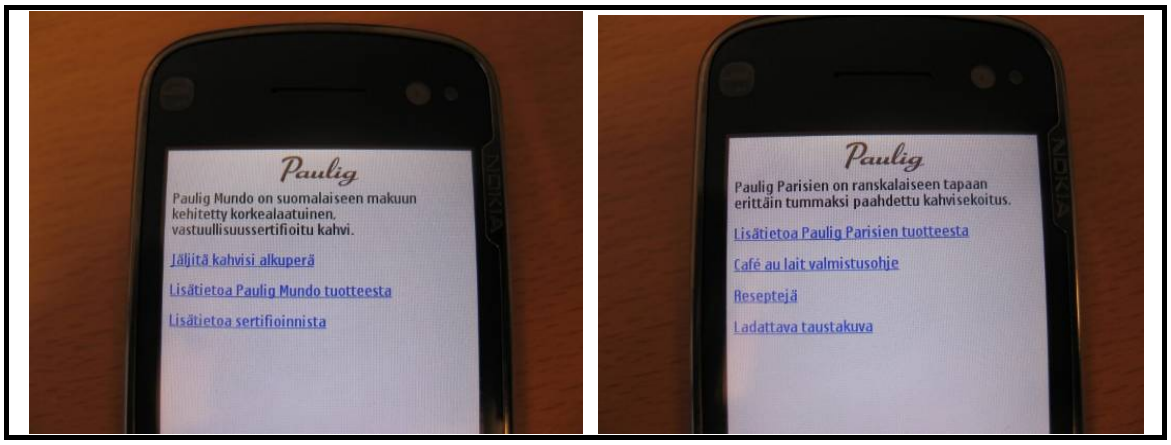


Figure 3. The start pages of the technology pilots with Paulig. From the left: Paulig Mundo and Paulig Parisien.

3.2.3 Package design

Hybrid media codes were added to the product packages with the help of stickers, so there was no re-designing of the package. Two potential locations for the hybrid media code were found on both packages. The narrow sides of the packages were chosen, as shown in Figure 4.

Figure 4. From the left: Paulig Mundo and Paulig Parisien packages with hybrid media codes.

Black and white hybrid media codes with yellow frames and the Upcode logo were used. In addition, a short text giving use instructions was added next to the codes.

3.3 Technology Pilot with Ravintoraisio Oy

The objectives of the technology pilot carried out with Ravintoraisio Oy were similar to those of the Paulig pilot: to study what kind of digital services the consumers find interesting and whether this kind of service could improve brand loyalty and/or affect purchase decisions.

The preparation processes for the two pilot cases, one for an Elovena cereal product and one for an Elovena snack drink, were carried out separately in two different teams in which the roles of the Printelligence project partners were:

- The cereals case was an actual campaign that was put into action through retail to consumers. All of the planning and implementation were carried out by Ravintoraisio Oy, Upcode and Stora Enso.
- A snack drink case was planned and the service content defined by Ravintoraisio Oy in cooperation with VTT. The implementation and reporting was carried out by VTT.

3.3.1 Products and target group

The target groups for the Ravintoraisio Oy technology pilot were divided in three age groups: 15-20-year-olds, 25-35-year-olds and 45-55-year-olds. Someone in the household of the interviewee (preferably the interviewee) should eat cereal regularly at home. No requirements for educational background or place of residence (urban/rural) were set for the target groups.

The products in the technology pilot were

- Elovena cereals
- Elovena snack drink Sunny.

The Elovena brand wants to promote healthy and ecological choices. These themes are also highlighted on the company's existing websites and packaging, and they are potential contents for hybrid media services. Year 2010 is the 85th anniversary of the Elovena brand and this is being marked with several campaigns. Consumers can join the Elovena club through which they can obtain more information about the products and receive benefits.

3.3.2 Digital services

Ravintoraisio Oy, Stora Enso and Upcode planned and implemented a full-scale campaign for Elovena cereal packaging that was available on the market in autumn 2009. This product and the digital content attached to it were also offered as a demonstrator for the study. The Elovena cereal packaging had an Upcode tag on the back of the packaging. The code resolved to a website where the buyer of the product could choose a free benefit related to well-being: a coupon entitling him or her to a discounted price at a sports shop, gym or spa hotel. The discount coupon could be saved on the mobile phone or requested to be sent to an email address and printed. Three gift vouchers worth 1000 € were also raffled among the participants.

Figure 5. Elovena cereal package with the hybrid media code.

An idea for linking the packaging with digital content through an image recognition application was demonstrated for a snack drink. The technology has been developed and tested and is also in commercial use, but in the interviews a mock-up was presented. A PowerPoint slide show was used to illustrate the solution and demonstrate the digital content attached to the packaging. The first slide was a picture of the product 'Välipala-juoma Aurinkoinen' with blue boxes (Figure 6).

Figure 6. Elovena Aurinkoinen snack drink with blue boxes referring to the areas on the package that are image links to digital content.

By clicking the boxes, the user launched new slides presenting the information behind the corresponding image on the package. The information behind the images of the packaging was mainly informative but an entertaining comic strip was also included. The informative parts included the following pages:

Figure 7. Product information, nutrition facts and information page on fibres in nutrition.

Figure 8. Carbon footprint, information on other Elovena products.

The comic strip and free competition pages were included to lead the conversation to the role of amusement on packaging.

Figure 9. Comic strip and free competition.

The contact information page was linked to the page with the feedback form. The idea was that the user could give immediate feedback with a mobile phone.

Figure 10. Contact information and a form for feedback.

Due to the use of image recognition to link the digital service to the snack drink packaging, no redesign of the demonstrators was needed. If this technology were used on consumer products on the market, however, an extensive eye-catching campaign and/or instructions on the packaging would be required to inform the consumers of the image recognition application and the link from the packaging or its symbols to the digital services.

3.4 Implementation process

This chapter discussed matters during the implementation process of the technology pilots. The list provides guidelines for issues that should be taken into account during the implementation of hybrid media services.

The implementation process included five steps:

1) planning
2) defining the content
3) implementing the digital service
4) attaching the hybrid media codes to the package
5) other matters under consideration.

These steps are pictured in Figure 11 on a timeline that also describes the main connections between different steps.

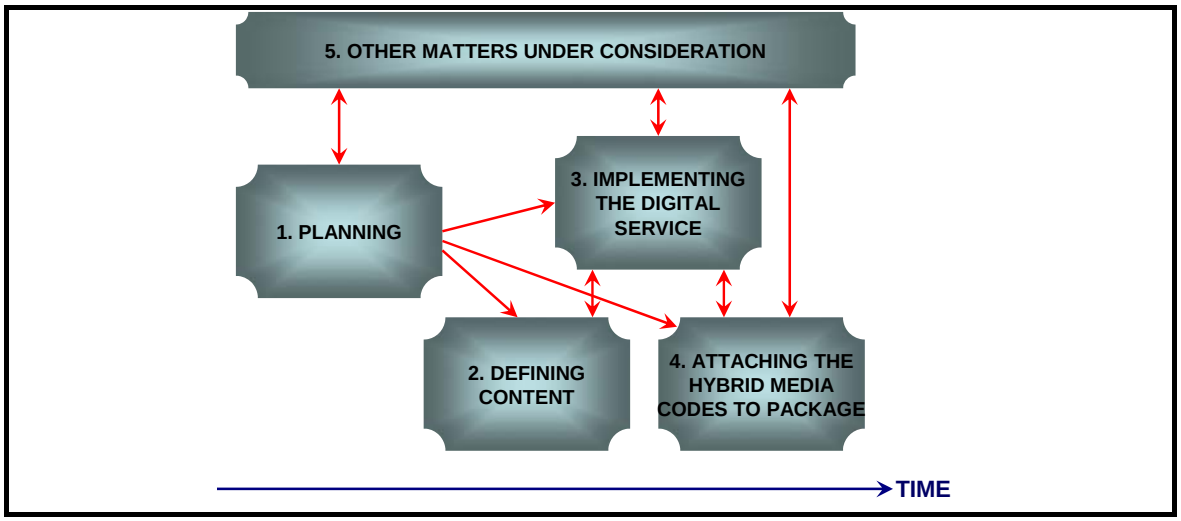


Figure 11. Steps of the implementation process and their main interactions with each other.

The matters considered during step *1) Planning* were

- definition of the objective of the hybrid media service
- selecting the product(s)
- determination of the target group of the service
- selecting the code type
- access to the service by other means than the code
- availability of the code-reading software (one/several suitable?)
- most probable use situations and circumstances (e.g., lightning, scanning distance).

The matters considered during step *2) Defining content* were

- defining the content
- using the existing content vs. new content
- presentation format of the content
- determination of the amount of content/screen
- content formats: text, images, videos, audio
- linked content from other providers?

The matters considered during step *3) Implementing the digital service* were

- definition of the structure of the service
- visual matters: background, colours, font type and size, images
- automated personalization (location, language)
- data collection on use
- suitability for different phone models
- downloadable data available to users (e.g., text or image files, contact information)

- automated interpretation of www content to mobile phone platforms
- cross-linking
- usability test (different phone models, readability, navigation, data input, download time).

The matters considered during step 4) *Attaching the hybrid media codes to the package* were

- static or personalized code
- location of the code on the package, effect on other content
- location of the use instructions
- print on the package vs. attaching a sticker
- the most rational phase in which to print the code on the package
- visual appearance of the code: colours, size, contrast, distinctiveness, reflection from printing substrate
- usability test (scanning of the code under varying conditions with different phone models and applications).

The *Other matters* under consideration were (step 5):

- maintenance and update of the service, means to engage the users
- technical support to users
- handling of the feedback
- statistics of the collected data, follow-up.

It should be noted that this chapter only describes the phases that were identified during the pilot studies, so it should not be considered a universal instruction on how to implement a hybrid media service in general. When producing an actual hybrid media service for product packages on the market, several matters could arise that could not be detected during such small-scale technology pilots. It is hoped that this documentation will serve as a starting point when planning hybrid media applications for packaging without previous experience.

4. Results and discussions

4.1 The package value chain

The general package value chain was defined based on the company interviews (Figure 12). The information flows between the different parties were also defined based on the interviews (Figures 13-17).

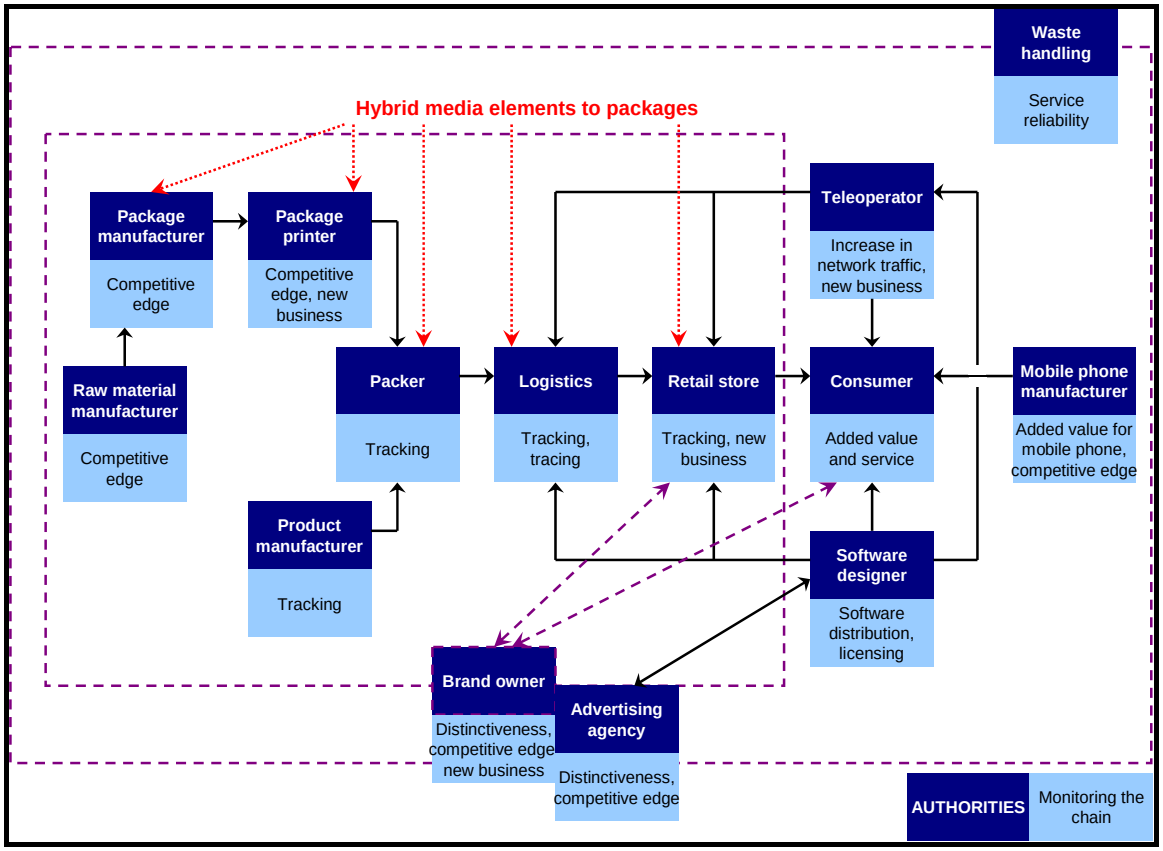


Figure 12. Package value chain with potential parties that could add the hybrid media elements and benefits that hybrid media could bring.

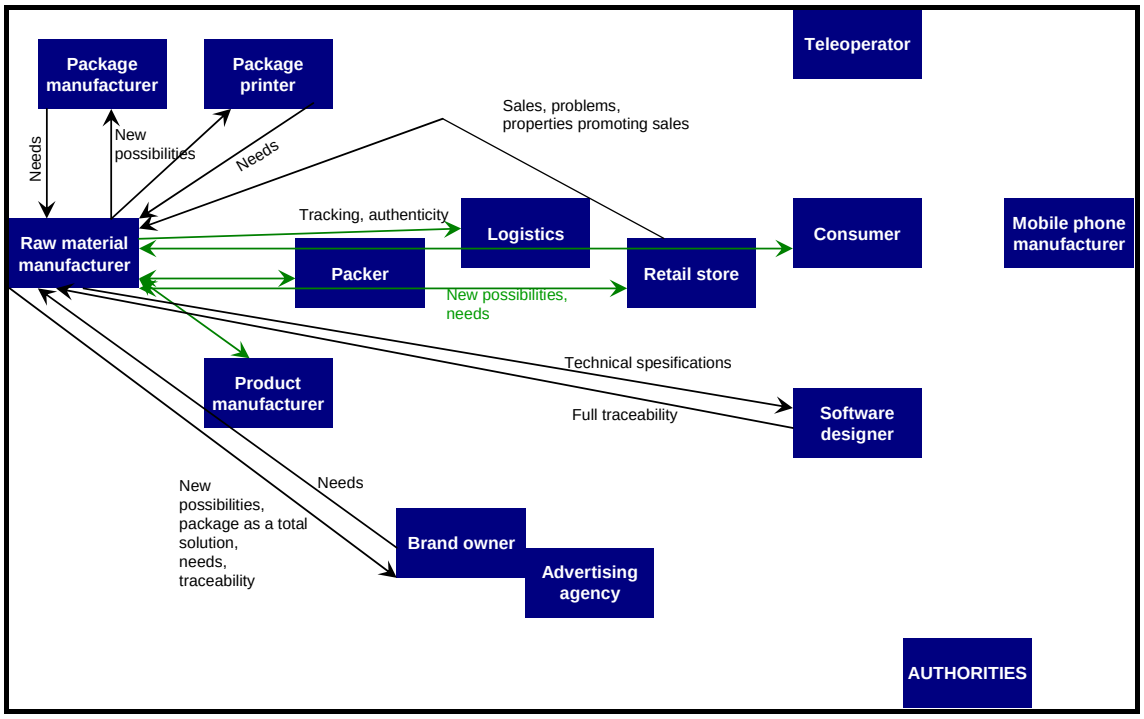


Figure 13. Information flows in the package value chain from the raw material manufacturer's point of view.

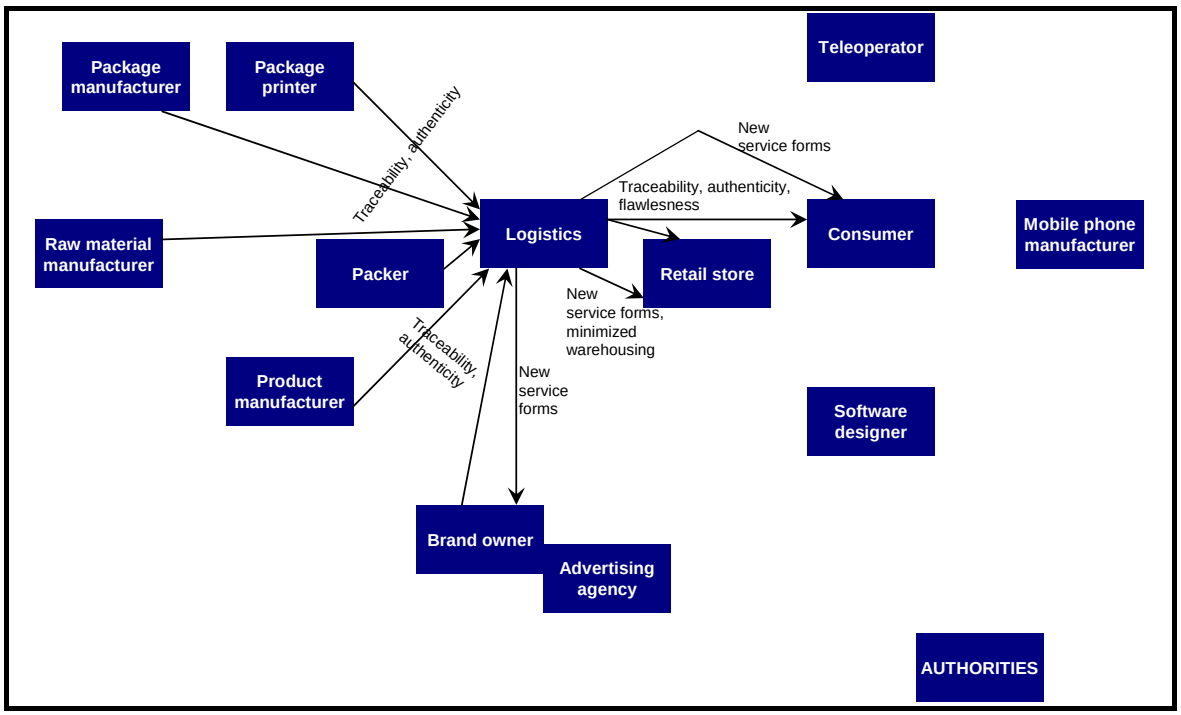


Figure 14. Information flows in the package value chain from a logistics point of view.

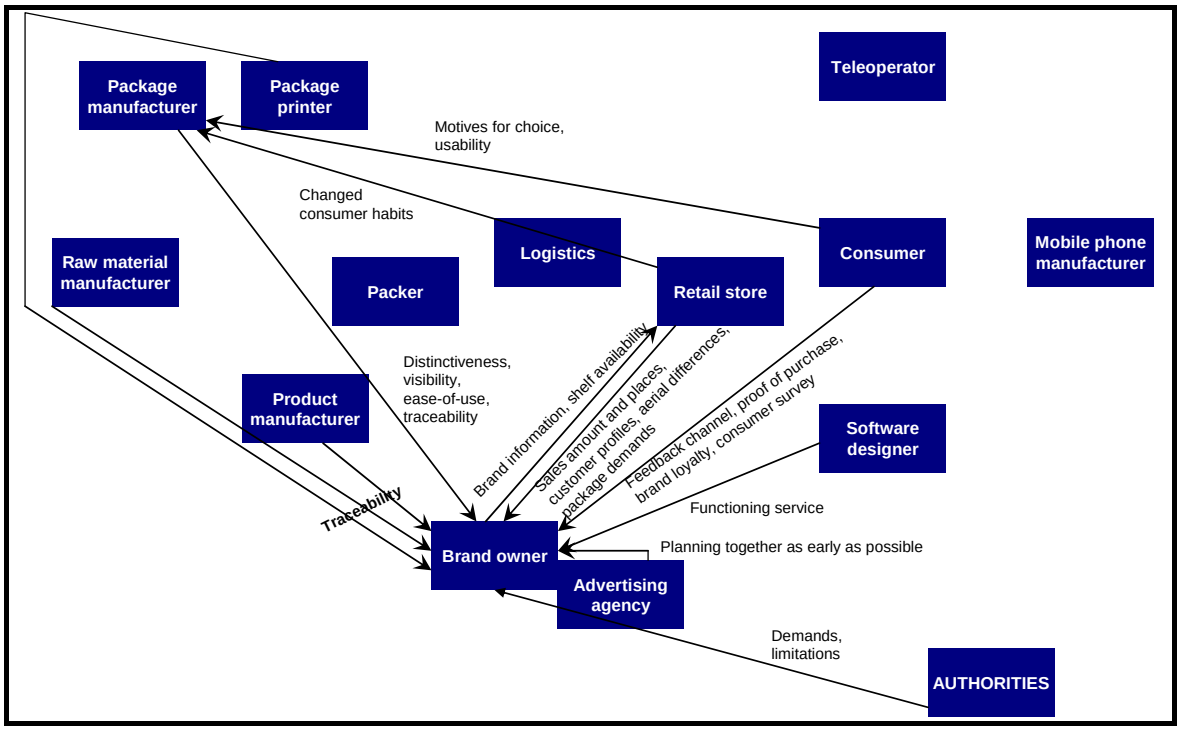


Figure 15. Information flows in the package value chain from a brand owner's point of view.

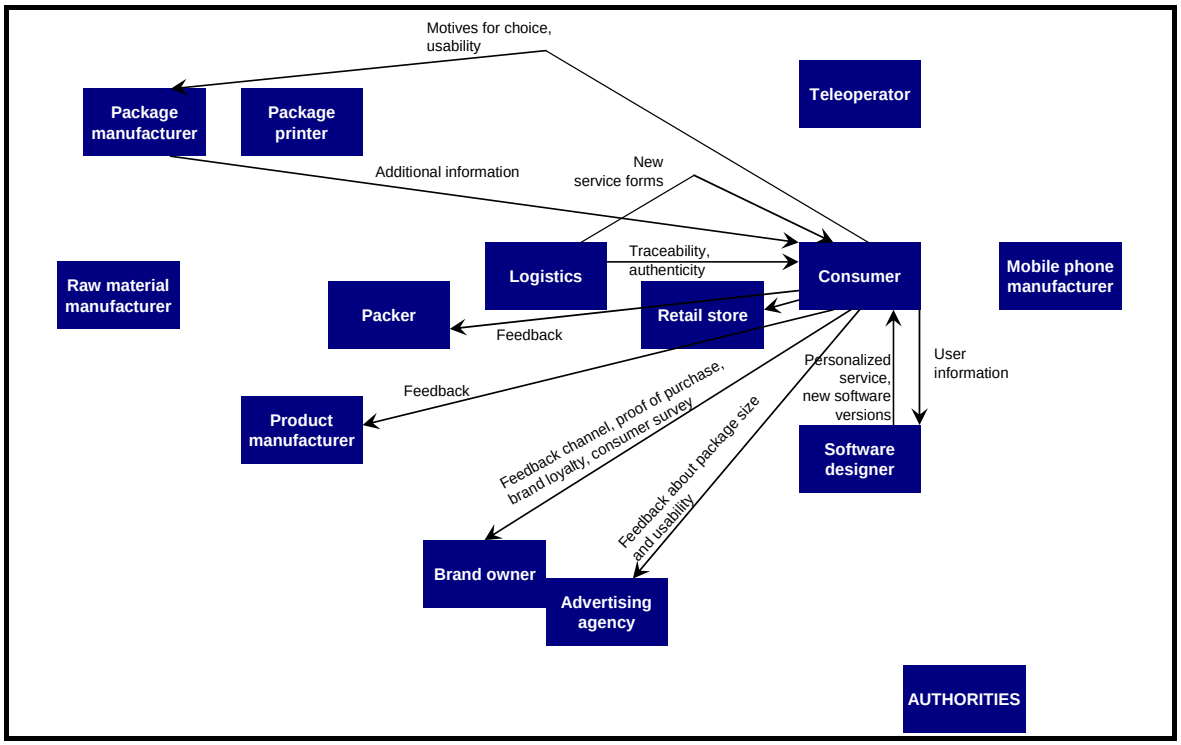


Figure 16. Information flows in the package value chain from the consumer's point of view.

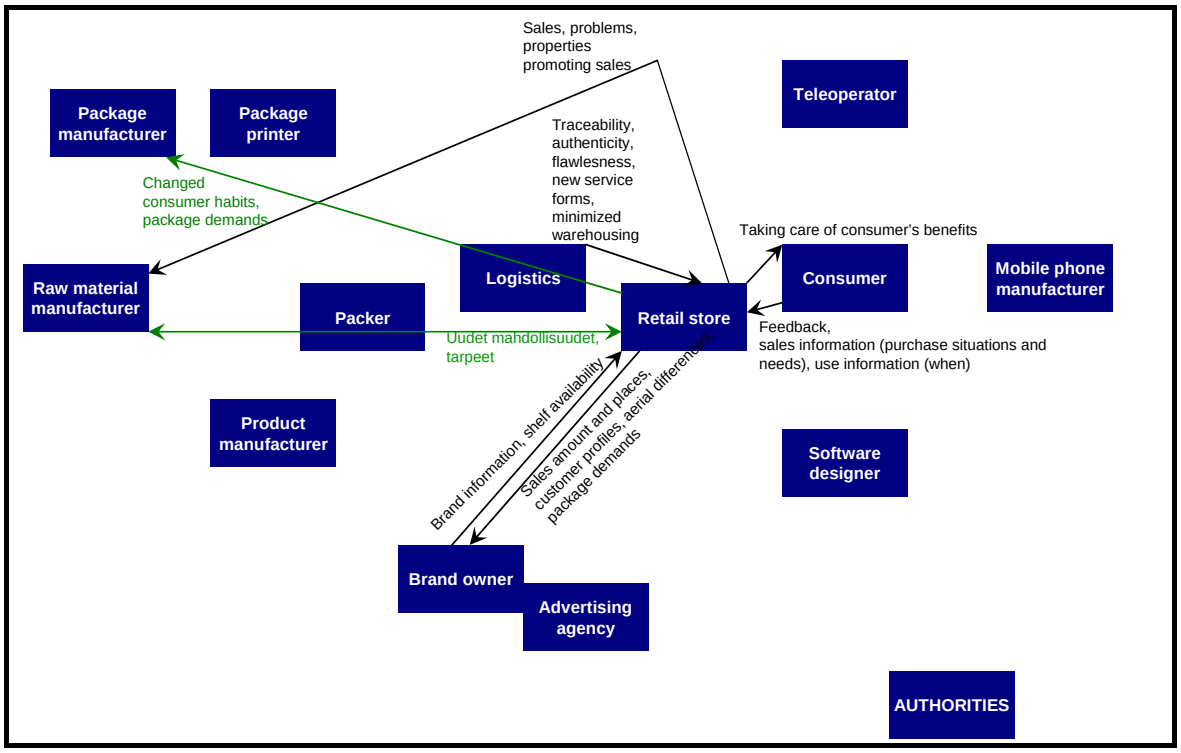


Figure 17. Information flows in the package value chain from the retail shop's point of view.

The topics discussed most during the company interviews were packages in general, hybrid media and codes, logistics, retail shop and consumers. The most significant citations from the interviewees for each topic are presented in Appendix B.

4.2 Technologies for hybrid media in packaging

This chapter provides a short summary of the technology survey. The complete technology survey is found in Appendix C (in Finnish).

The available hybrid media technologies include 2D bar codes, digital watermarks, image recognition, use of a fibre matrix, RFID tags and magnetic codes. These can all be used for hybrid media services on packages although they are dependent on service type. RFID tags and magnetic codes are particularly suitable for logistics and security applications. For consumer applications, 2D bar codes and digital watermarks are ideal.

Currently, 2D bar codes are the most popular hybrid media technology, and more than 20 different types of 2D bar code exist. The most popular 2D bar code types are Data Matrix and QR Code, which have already been used in several other applications besides hybrid media. Some 2D bar code types have been specially developed for hybrid media applications, for example, ShotCode and EZ Code. Several bar code reader soft-

ware programs for mobile phones are available, although most of them require the user to download and install the software.

In Japan, hybrid media have been used since 2003. In Finland, the first hybrid media service was used in summer 2004. In recent years, services have been introduced in several countries in Europe, Asia and the Americas. The services have been attached mostly to publications, advertisements and business cards. In the package industry, only a few services have been tested. In Finland, however, there are services that give additional information about the packed product.

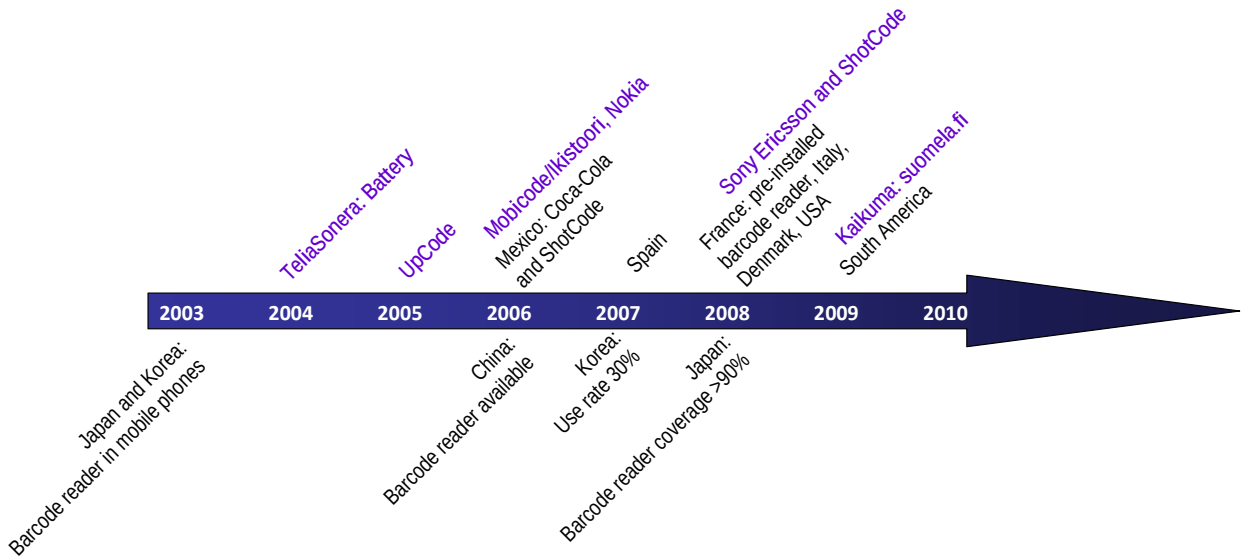


Figure 18. Hybrid media history in Finland (blue texts) and abroad (black texts).

The lack of standardization, especially with the code content, limits the use of hybrid media technologies. Hybrid media is still a technology under development, and there is currently a risk of conflicting standards that can complicate its use. In order for hybrid media to become a success story, different parties need to be able to count on the basic technology remaining unchanged.

4.3 Consumer behaviour

The user studies interviewed intended users individually, except for four adolescents who were interviewed as a group. The interviewees were recruited from three hobby sports teams and were mainly parents or other relatives of the team members, or the team members themselves. All the interviewees lived in the Helsinki area. The interviewees were selected from volunteers, using the age and consumer habits as criteria. All the interviewees also had to own a mobile phone with a camera. To be chosen for

the interview, the following consumer habits and ages had to be met. The name of the case refers to the producer of the products that were demonstrated in the interviews.

Case Raisio

1) one of the family members eats cereals, preferably the interviewee
2) optional: someone in the family uses snack drinks
3) age: 15–20 or 25–35 or 45–55.

Case Paulig

1) drinks coffee every day, preferably also at home
2) decision-maker of the coffee brand the household uses
3) university or at least polytechnic degree education
4) age: 20–45.

The interviews for the Raisio case were carried out in three age groups. Each target group consisted of ten interviewees. In all, 40 persons were interviewed.

4.3.1 Raisio 1 (15–19-year-old adolescents)

The group Raisio 1 consisted of five girls and five boys aged 15 to 19. They felt that the facts about the product had to be printed onto the packaging. Adolescents are not willing to pay a data transfer fee for this kind of information. The service behind the code must be something else but still close to the product. Table 2 shows the ideas raised by the interviews.

Table 2. Ideas that arose from the interviews.

TOPIC	IDEA
More information on nutrition	What time of the day you should eat the foodstuff; if you eat it late in the evening, it will refresh you and you will have problems falling asleep How much of different nutrients you should take daily, what portion of your daily requirements you will obtain from this foodstuff
Giveaway	Toy, game, music track, token
More information about the use of this particular food stuff	Recipes How to use this foodstuff in ways that are different to the normal one
More information on health	Other foodstuff to eat as well for a healthy way of life Ideas for gymnastic exercises, dieting and weight-watching Test; how healthy your life is; recommendations on how to live a more healthy life

Some of the adolescents were very aware of E-numbers and found them unhealthy. A valuable service for them would be information on which food additives are essential (i.e., baking powder) and which 'just' make the product look better. A common habit in this and other target groups is to count the amount of E-numbers and make the decision based on the number of E-numbers.

Although the idea of more information on health came from the interviewees, a typical comment was that there are other places to find interesting information on nutrition and healthy living. We had a comic about Harald Hirmuinen on the amusement part of the snack drink. A common comment was that it was funny. It could be something they might want to read behind the code, but more importantly, the comic should be linked to the brand. If the adolescent would like to read comics via a cell phone, he or she would find them somewhere else other than behind the code of the food packaging.

First impression of the code:

- "It looks like Pokémon."
- Extra elementary computer game.
- "I can't make anything of it."
- "This is used for the control of the product or the package – it is something for the producer, not for the consumer."

Obstacles to the use of codes can be divided into three groups: the phone, the application and the costs.

Table 3. Obstacles to the consumers using the code in practice.

The phone	The application	The costs
•"My mobile is not as fine as needed" •"I have such a basic mobile" •"I have too small memory card in my mobile"	•"I am too lazy to download such an application" •"Downloading is too complicated" •"There is always problems, if you try to download something – it get to my nerves" •"But maybe, if I got something for downloading the application – a free cereals packing – maybe I could then download it." •"The information behind the code felt difficult to reach. "	•"The data transfer fee is too costly – I rather use SMS" •"I would not pay for downloading an application – it should be in my cell phone, when purchasing it" •"Why should I pay for extra information of the product? I would not buy a product that asks for extra payment of the information." •"There is so much information for free on the internet, why would I pay for it?" •"It depends on the amount of the costs."

Package deals with a mobile phone that include data transfer fees would promote the usage of codes. Adolescents find it frustrating to write text messages; codes are simpler to use.

Situations in which the young people would use codes:

- when eating cereal, more information about the product or comics from the package or some other amusement could be read via the code
- at the bus stop, the timetables could be searched
- when travelling by bus and there is nothing else to do
- mainly at home, not at the shop.

The young people were not interested in the carbon footprint, although they thought it was fundamentally a good thing. The coupon to the sports shop was the most desired token; the adolescents were under the age to go to the spa hotel.

4.3.2 Raisio 2 (25–36 year-old parents and players)

The interviewees in this group were aged between 25 and 36. Most of them had a university or polytechnic degree; one was a graduate. Most of the interviewees were not interested in the code. One interviewee said that maybe technically oriented people would be interested in codes, but none of the interviewees in this group admitted to being such a consumer. Some said that the idea of having codes was nonetheless interesting.

The interviewees remarked that they were in a hurry when shopping for groceries. They did not have time to snap photos of codes. They might do it at home when they were eating cereal, for example. At home, they usually had an Internet connection, and they would use that instead of the mobile. A code on a package that you do not throw away after using it once could be used at home. The package for a snack drink is more likely to be thrown away and the code on it would then be useless.

The comments on using the code when shopping usually had something to do with allergies. One person would use them at the shop, as she needed to find detailed information about the foodstuff as children's food allergies and information like that cannot be distinctively printed onto the packaging. Another person needed to know if there was lactose in the product. A useful idea is a service that indicates that the product contains lactose and recommends similar products without lactose. This kind of need for nutrition/foodstuff information on new products came up often in the interviews.

What kind of information or services could be added to the package behind a code?

Table 4. Ideas about services to add behind the code.

TOPIC	IDEA
Usage	Tips on how to use the product in different ways to the usual ones The information should be relevant to the moment and for daily life such as a recipe Tips for recycling, how to scrunch up the carton
Nutrients / foodstuff	Vitamins and micronutrient Sugar; added/fructose/white sugar Very detailed information on foodstuff Service that counts the amounts of the nutrients and tells the user how much of the daily requirements he or she has already had
Amusement	Benefit of collecting codes, such as the next package being free or a kitchen utensil Daily changing crosswords
Other	Information about the producer, if it is not well known (small farm) BO could start up a user group for the product: a sports club – join the Elovena club to train for the marathon next summer.

The service that gives the user the relevant information should work on request. The user needs to have control of the kind of information he or she is given. He or she does not want to have text messages during the day but as he or she walks into the shop, he or she would be interested in new recipes and suggestions for the day's meal.

Many of the interviewees complained that their mobile was not good enough to use services through a code. The information should be linked to the product; it could be recipes and tips for using the product in a new way. The interviewees would search for other kinds of information such as lotteries and comics from places other than cereal packaging. In spite of this, the rhymes that were on the milk cartons last year were regarded as a nice addition to the package. This was because the rhymes were on the packaging, not behind a printed code.

Obstacles to using the codes can be divided into four groups: costs, their time-consuming nature, mobile/application and other.

Table 5. Obstacles to consumers using the code in practice.

Costs	Time consuming	Mobile / application	Other
•Costs if you need to pay them by yourself •Costs (many comments)	•"When shopping with small children, you don't have time to use the mobile for snapping " •"Hurry - I don't have time for extra information. The service should be something that helps me in daily life – no more lotteries where you won't win anything."	•"My mobile is slow and incapable of using services via internet. I would need better phone to use this kind of services." •"Loading the application was too complicated: I did it, but I would suspect that my mother could not do it." •"Loading the application and using the service felt troublesome although it was not hard to do."	•"I don't trust that the people at the Top sport know about the coupon." •"I would feel like I am doing something illegal, if I snapshot of the code but don't buy the product" •"This reminds me text message lotteries, which are irritating"

The first impressions of the code were mainly negative:

- nothing
- laborious: "I have to do something but do not get anything good."
- EAN code
- "It is something that I will not understand."
- "It is a lottery."
- "I tried this a few years ago. It did not work and I will not try it again."

The interviewees could pay extra if the packaging contained information about the carbon footprint or other certificate for producing the product more ethically, but the extra should be included in the price of the product. People would not pay extra to use mobile phones, not even a data transfer fee. The carbon footprint was found to be interesting, though no one knew what the number meant. A typical question was, "Is this high?"
This group of people easily gives contact information to a brand owner. The information is given in order to receive benefits from the brand owner, and the users does not expect junk mail if they give their information to a trustworthy brand owner.

It was very easy for the interviewees to use the code, "*it couldn't be easier*". To receive the benefit, the interviewees would mostly use the code and save the coupon in the mobile phone. The most welcome benefit was the coupon to Top Sport. In this group, there were also persons who would not take any benefit. This was because there are too many coupons and clubs on the market and they were bored with them.

To give feedback, they could use the phone to call the brand owner's customer service or send the feedback via an Internet link behind the code. It was rare, however, that they would give feedback.

4.3.3 Raisio 3 (44–49-year-old parents)

The ages of the interviewees in this group ranged from 44 to 49 years. There were seven women and three men in this group and most of them had a university or polytechnic degree; one interviewee had vocational education.

This group was much more interested in the origin of the food than the other groups. The domestic content of the product came up many times, and a few would like to have very detailed information on the foodstuff, such as the proportion of the flour that was domestic. It also came up many times that there are foodstuffs that this group wants to avoid, for example, aspartame and soya. People underlined that the food should be clean, and many felt that domestic food was clean.

The recyclability and environmental issues were important in this group. The carbon footprint was unknown and many commented on its inability to provide valuable information – no one knew if the number was big or small. Certification that indicates that the product is produced in an ethical way, i.e., protects the environment and that no child labour is used would be certain to add brand loyalty to this group.

People like variation in the meals they cook. Recipes behind the codes would promote the use of codes. Ideas on how to use the product in ways that are different to the usual ones would interest this group.

Nutrition facts interest this group of consumers. They would like to have more guidelines on daily consumption, for example, if their child eats this snack what else should he or she eat to obtain the necessary daily vitamins. These kinds of ideas were very common in this group of consumers, as they were in the other consumer groups in the Raisio case.

The entertainment on the packaging provided no added value to the product according to this group. It was mostly found to be irritating. Brain-teasers on the other hand were welcomed.

What kind of information or services could be added to the packaging through a code?

Table 6. Ideas of information to hide behind the code.

TOPIC	IDEA
Usage	Tips on how to use the product differently to the usual way Recipe
Nutrients / foodstuff	Very detailed information on foodstuff and its origins; the domestic % of each component Service that counts the amounts of the nutrients and tells the user how much of the daily requirement he or she has already had Components to avoid: aspartame, soya, e-numbers, etc.
Amusement	Brain-teasers

The main reason this group of consumer would not use the code is that they think it is time-consuming and laborious. They do not have extra time when shopping. They could use the service at home but they did not seem interested in that. At home, they might instead look for the information on the Internet. They felt that their mobile phones were not capable of working well enough to run this kind of application. They also thought about costs. One interviewee said that he could use the service via WLAN because that would not cost him, though these interviewees would pay for the service. The costs did not appear to be an obstacle.

Table 7. Obstacles to consumers using the codes in practice.

Time consuming	Mobile / application	Costs
• No time when shopping • Maybe at home - but no interest to search information behind code	• Mobile is incapable of working properly	• It cannot cost if the information concerns the product itself

The first impression of the code was advertising, psychological test and Sudoku. Interviewees did not find the codes interesting; instead, they found them fuzzy and complex. Many commented on the small print on the packaging. They needed reading glasses to see the text. The code could help with this. It was rare that they gave feedback. The possibility of giving feedback via a code was interesting. The discount coupon was not greatly appreciated. The costs were not acceptable if the information was connected to the product itself – that kind of information should be free of charge. It cannot even cost

a data transfer fee. The information should be very valuable if it costs. There were persons who would give contact information easily and persons who did not want to give them unless they received something very valuable in return.

4.3.4 Paulig (26–43-year-old, well-educated people)

The age of the interviewees in this group ranged from 26 to 43 years. All of them had a university or polytechnic degree. The group consisted of five women and five men.

These interviewees underlined the rush they are in when shopping. They do not have time to do anything other than collect the foodstuff they have planned to buy. The idea of taking snapshots of codes when shopping seems far-fetched. These interviewees might use the code at home, but rarely, though some of the interviewees said that the recipes could be one reason for using codes when shopping.

The interviewees want to buy products for which the origin is known. Some of them favour domestic food. The conditions at the coffee plant were also the focus of some of the interviews. It was seen as meaningful to support a small coffee producer and perhaps a whole village. Another idea was to have more information about other products from this producer. If a person found one product to be very good, he or she wanted to know if there were other products that might also be worth tasting (brand loyalty). One person was very committed to the coffee her family drinks. The coffee was special; it could only be bought from France. If this coffee were sold in the local shop, she would be interested in receiving texts when it was available. Another person said that she would like to know when milk produced in her childhood hometown was available in her local shop. For this user, the coffee producer from the other side of the world was not the one to which to commit.

One idea was a service that sends a list of meals every week to the user's mobile. The user chooses the ones he or she wants to prepare and the number of dinners. The service would make a shopping list of the required foodstuffs.

What kind of information or services could be added to the packaging via a code?

Table 8. Ideas of information to hide behind the code.

TOPIC	IDEA
Usage	Recipe List of meals on request -> shopping list
Producer	Origin must be known, not just the manufacturer Conditions at the coffee plant Other products from the producer
Foodstuff	E-numbers

The origin of the Mundo Coffee was of interest but not useful to the user. This kind of information could be looked over at home if the person had time. It could be used when drinking coffee. As with drinking wine, more information would be available, as some of the interviewees said. This kind of information would not have an effect on shopping decisions.

The recipes for the Parisien coffee were found to be useful. Many of the women also thought the background pictures for the mobile phone were beautiful.

Everything to do with the codes needs to be easy. People would not spend time searching for information or downloading an application. The information cannot cost anything. If the product has a UTZ label, people might pay more for the product, but the service that tells the consumer what UTZ means cannot cost anything. The data transfer fee was not seen as an obstacle if the service was found useful, such as the list of recipes. In the interview, the application was found to be easy to use. Only the date that had to be entered was found to be troublesome.

Table 9. Obstacles to consumers using the code in practice

Mobile / application	Time	Costs
•"My mobile is too old-fashioned and the display is too small" •"I feel antipathy against all extra work with mobile" •"This is company phone, I am not allowed to download any extra applications" •"The usage is too complicated"	•"I don't have time for this."	•"How much this cost?"

The mobile is often near the user. It would be easier to use the code than to use the Internet.

These interviewees knew the code in advance. Only a few had not seen it before. Some of the interviewees had downloaded something to the mobile, for example, a map-service application or ring tones. These people used phones mostly to talk and to send text messages. Some of them would give contact information freely; some would not. The email address was the contact information given most often.

4.4 Business models

In this section, a short overview of the business models and new solutions offered by 2D/QR codes is given. The complete report is available in Appendix D.

Here, the business models and solutions related to codes are analyzed in relation to the value driver model shown below. The figure illustrates the value drivers in hybrid media solutions, and the accompanying Appendix D explains them in more detail. The table at the end of this section presents a summary of the main needs and wants related to codes that were reported by the Finnish firms.

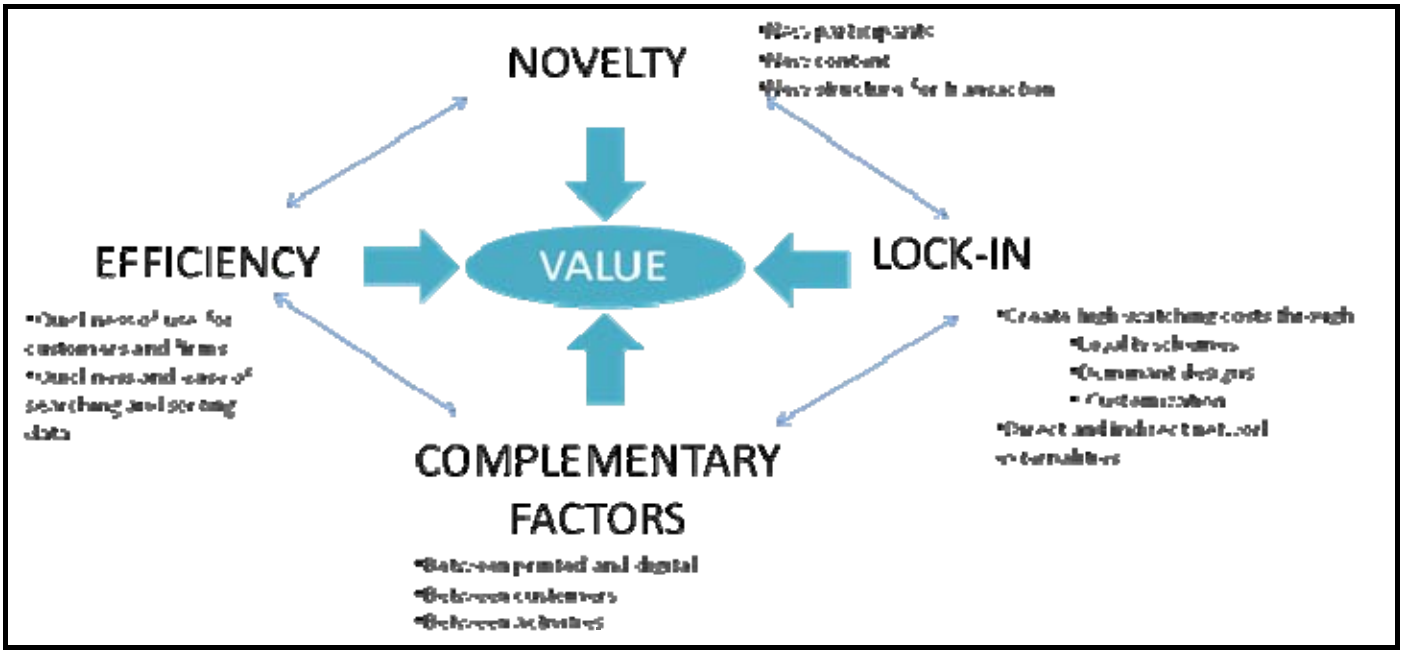


Figure 19. Value-driven model for hybrid media solutions.

Many of the 2D-code-based solutions, existing and envisioned, are concerned with replacing an older solution or service. Perhaps unsurprisingly, the contests and giveaways were seen by many as logical applications for codes. Traditionally, participation in contests or claiming of free gifts has required a postcard, text or envelope to be sent containing the required clippings. This was seen as being less than ideal for the consumer. It was suggested that the code may be offered as an alternative to the consumers but because some people might not want to use the code or have the required tools, the old methods should also be included. From the perspective of the firm, a system that operates through 2D codes could also offer a chance for more automation and therefore increase the efficiency of the related operations. In Japan, these kinds of solutions have long been the norm and they are illustrated extensively in the Toppan case in Appendix D. A notable distinction is that in Japanese cases, the QR code is sometimes the sole

means of participation. Perhaps once the consumers become more familiar with the new technology, the other means of participation may begin to be phased out, keeping in mind legal issues relating to keeping participation as open as possible.

There were also some particularly interesting ideas about incorporating mobile games into the give-away model. The games would be accessible through a code printed on the package. This could be coupled specifically to products that are typically consumed on, for example, car rides or train journeys when the user may be looking for something to pass the time. This would give the consumer an added incentive to purchase the product. The games could be linked in content to the product or brand if this were deemed appropriate.

Some examples of ideas from Finnish firms for 2D solutions

Contests

(Service provider)

…Cutting tags from packages and putting them in an envelope is a real nuisance. Then you have to go and buy stamps, ‘cause who has stamps at home anymore, and mail the things. If codes could replace that, I think it would be useful…

Give-aways

(Service provider)

Person 1: You should also be given the information that you have now bought 69 of these things and when you buy 70 you get two for free...

Person 2: Yeah, and with the code, no more collecting the lids from containers of cottage cheese.

Give-aways

(Brand owner)

…A bag of candy is a good example in that they are often consumed while sitting on a bus or something like that. So you could have a code and be able to get a game or something like that to spend the time…

Figure 20. Ideas for 2D solutions.

It is clear from looking at these examples through the value driver model where the benefits of such a service lie. Efficiency is increased for both customers and firms. For the customers, participating in the contests or claiming the prize is matter of a few clicks, while for the firms the system can be designed to run more smoothly through automation and without someone having, for instance, to spend his or her working day opening envelopes and counting clippings. Efficiency is further improved for the firms with regard to the ease with which they can search and sort the data acquired from the participants. The novelty factor would be most visible during the introduction of the new service, as some consumers may enjoy testing a new type of technological application. If the code became the most common

way of participating in contests and giveaways, value may also be created through lock-in. This would mean that consumers would be hesitant to use any other types of solutions and favour those producers that can offer a 2D-based solution. This would be especially true for some people in the case of the mobile game accessible through the code. There is also the interesting matter of lock-in as it relates to business-to-business marketing. The case of Toppan Printing, which is described in detail later, shows how a firm can also create lock-in for its business clients by developing a solution based on QR codes that integrates many different functions into a large operation. The client firms fail to develop the expertise on how to conduct the service on their own, as all parts are done by Toppan.

Another common suggestion for 2D-code-based solutions is concerned with communication in two different dimensions: relaying information from the firm to the customer and information flowing from the customer to the firm. We will start with the examples of information flows from the firm to the customers.

There are two main limitations of relaying information to the customer via product packaging. First, the space available for text or other material is extremely limited and made even smaller when some of the space is always taken up by compulsory texts determined by officials. The second has to do with the heterogeneous nature of the users. It is difficult to choose what kind of information is communicated, as it would have to be interesting to the largest possible section of the diverse target audience without alienating anyone. Both these issues are addressed in the suggested 2D solutions.

Some examples of ideas from Finnish firms for 2D solutions

Information to the customer
□-□-□-□-□-□ (Brand owner)

…We would like to tell for instance that we have our own mill and produce our own raw materials, but there's no place to tell it, 'cause there isn't space on the package. We should tell about the backgrounds of raw materials, products, and brands – you know, these kinds of brand narratives…

Information to the customer
□-□-□-□-□-□ (Brand owner)

…I was thinking that it could be so that when you open the code, you could choose what you want from that world; could be related to charity or product information or whatever…

Information to the customer
□-□-□-□-□-□ (Service provider)

... Who's ever the product is, they have an interest in making these channels and putting information in them. They have a clear interest in it – it makes the consumer have a stronger bond to the product...

Figure 21. Ideas for 2D solutions.

The interviewees, especially the ones from brand owner firms, often stressed the fact that they would like to tell their consumers about their firms, products and brands, but they find mass media too distant and limited, and the space on packages to be too constrained. 2D codes were seen as a possible medium for opening a channel through which this information could be passed to the consumer. According to the interviewees, consumers are increasingly interested in knowing all kinds of information related to the product, ranging from the origin of the raw material used in the product to the firm's corporate social responsibility issues and from the history of the firm to suggestions for uses of the product. The challenge to deliver this wide array of information could be met by a solution that used 2D codes to link the customer to various data streams provided by the firm.

Some examples of ideas from Finnish firms for 2D solutions

Information from the customer
(Brand owner)

…And also from the view of some kind of spontaneous feedback. When we do research we always have a point of view, like tell what you think about this or comment on that. But for them to be able to tell you right away when the things come to mind, and about the things which are relevant to them. Well that kind of thing would be interesting…

Information from the customer
(Service provider)

…Everyone is interested in the direct information from the consumer, and at the time of consumption. Sure, that's a big trend…

Figure 22. Ideas for 2D solutions.

Such a solution would create value through all four aspects of the value-creation model. In terms of efficiency, it would obviously increase the ease with which the consumer could look up information of interest or use to him or her. From the novelty aspect, new content could serve as a draw, as consumers may be tempted to see something new. Meanwhile, with regard to creating lock-in, customers may become so accustomed to having access to information through a code that they are unwilling to transfer to products that do not offer the same information. This kind of solution would also create value through complementary services by linking to the firm's other communications such as print advertising or CSR reports with the digital services offer on the printed product package.

The other dimension of communication and 2D codes is concerned with suggestions for solutions that enable information to move from the customers to the firm. This may be in the form of official feedback channels or information gathered through marketing research actions. With regard to feedback channels, concern was expressed in the interviews by the representatives of the firms that traditional feedback channels, such as a feedback telephone line, only tend to receive negative feedback, and usually from a specific kind of consumer. An idea suggested by more than one interviewee was that there could be a code on the product package that would link the customer directly to a channel where feedback could be given. It was said that this would lower the bar for giving feedback and make more users give feedback at a time when their emotions about the product were possibly at their strongest.

There were also very interesting thoughts on how 2D codes could be used in partnership with market research. These included ideas on identifying active users through their use of 2D codes and inviting these users to focus groups and interviews, as well as incorporating survey questionnaires into the material to which the code links. These kinds of ideas clearly create value through efficiency and complementary factors. Efficiency would be increased by easing the collection of market research data, and complementary factors would be present in linking research processes to other functions of the firm.

There was also a wide variety of other interesting types of ideas presented in the interviews, and we will focus on two of them next. First, and this may have been inspired by our use of the term *hybrid media*, there were suggestions for solutions linking printed media such as magazines or newspapers to activities and consumer decisions. One of the existing problems was defined as being when something interesting catches the attention of a consumer regarding a product, he or she is rarely in a shop and the next time he or she is in a shop, he or she will have forgotten about the one-time interest in the product. It was suggested that this could be remedied by having 2D codes on printed advertisements and generated content. For instance, it would be possible to have a code next to a recipe in a magazine and when the consumer captures the code next to the text, he or she automatically receives the shopping list transferred to his or her phone as well as instructions for making the dish once back home. When going to the shop, the consumer could recall all of the ideas he or she had saved on the phone earlier.

A similar kind of solution could also be provided on printed advertisements. A code on an advertisement linking to more information would have the added benefit that it might be possible to identify which advertisement was being read and to receive valuable information on the effectiveness of specific advertisements. An example of such a solution can be given from Japan.

According to one of the Japanese interviewees, a local firm bought outdoor advertising space at the four main entrances to Tokyo’s central railway station, or as it is offi-

cially called Tōkyō Station. These costly spots were purchased for two weeks as part of the launch of a new campaign. All four advertisements had QR codes printed on them through which interested passersby could receive more information. All four posters were identical except for their codes. The four codes all linked to the same material, but it was possible to determine from which code the contact had come. After the first week of running the campaign, the firm in question observed that two of the ads seemed to be receiving more attention than the other two. They quickly discontinued the two underperforming billboards and purchased more time on the two that seemed to have the biggest impact. The value in this case is obviously created through efficiency and complementary services. This simple example illustrates the versatility of 2D/QR code solutions.

Another interesting idea for a 2D solution from interviews in the Finnish firm concerned providing instructions for use through a 2D code solution. This could be used to complement or even replace written usage instructions. It would also provide the possibility of giving the instructions in the form of a video. The link could first direct the consumer to a place where he or she could choose the language. This way, the same code could be used for many countries.

Some examples of ideas from Finnish firms for 2D solutions

Instructions for use
(Service provider)

... Why couldn't there be such a thing that, let's say I have a new light bulb for my car's headlight. I take the code from the package and on my phone's screen it shows how you take the board off first and then shove in the new bulb. Instead of you just starting to pull stuff out and end up at the repair shop....

Figure 23. Ideas for 2D solutions.

The value delivered to the user by this solution, as seen through the value-driver model, would clearly stem from all four of the factors. It is likely that if this amount of new value can be delivered to the user, there will be many upsides for any producer able to adopt such a solution.

4. Results and discussions

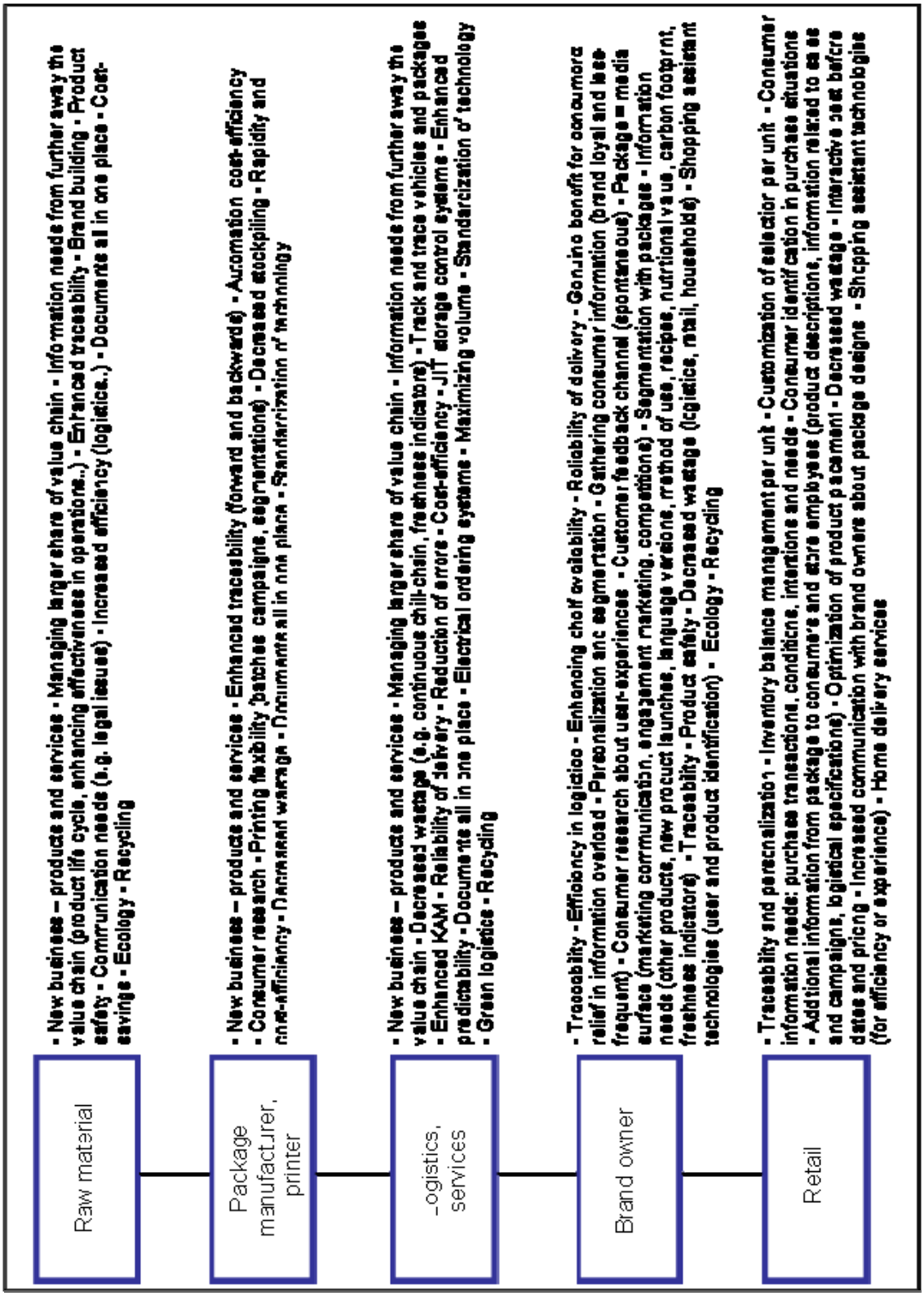


Figure 24. Needs and wants of the value chain players.

5. Conclusions and recommendations

The industry interviews showed the following things:

- The package already acts as an information carrier. The legally required information is considerable and ‘excess’ codes waste surface area on a package that should be as attractive as possible. Brand owners accept a rise in price for the sake of discernibility and visibility.
- Hybrid media are used to achieve cost savings, new business and added value for existing business. In the customer interface, they may create loyalty, information and additional sales. It is essential to motivate the customer to use them. The brand owner can receive valuable information about the using context.
- Applications in logistics give the fastest payback. The future role of logistics may include managing the entire business chain and minimizing storage at the retailer. In valuable products, RFID tags will be used.
- The retailer may motivate the consumer to additional spending by informing him or her about bonus limits over hybrid media. Transparency in the shops gives brand owners online information about sales and allows for traceability.
- The consumer has a huge need for information, which can be given via hybrid media. Consumers are conservative, however, and new services must be simple and attractive to be taken into use.

The technical status of hybrid media in packages can be summarized as follows:

- 2D codes are the most common link between packages and electronic media. 2D codes are printed simultaneously with the printing of the package or label at no extra cost. Data Matrix and QR codes are examples of proven 2D-code technologies.
- Consumers can read the data content of a code symbol with a camera phone equipped with suitable software. The data content is typically a link to a web service giving additional information about the product or access to some kind of contest etc. A 2D code requires space on a package, but methods for customizing the code symbol have been developed.

- RFID technology is widely used in applications for industry and logistics. It has also been offered for consumer use, but so far, only a limited number of mobile phones are equipped with an RFID reader.
- Other technologies have also been developed, such as image recognition, use of a fibre structure and magnetic code. Although these technologies are workable, widespread consumer use will be difficult to achieve because of the slow distribution of decoding applications.
- No one uses hybrid media technology because of the technology itself. The applications and services offered should be interesting enough for the consumer to start to use the technology.

Consumer behaviour was studied in two pilot tests, and the following conclusions could be drawn:

- Grown-ups tend to be in a hurry when shopping, and a service that eases their shopping would be useful. Such a service should only work on request. For some users, the data transfer fee is an obstacle to the use of this kind of service, but for many users it is only important to know the costs.

Based on the user studies, the service could include the following parts:

- Recipes and a shopping list based on the user's choices, for one day or a whole week depending on the user's choices.
- Service that tells the user how much of the daily requirement of each nutrient he or she has had after each meal/snack. The service could recommend healthier choices if requested.
- Ideas of new ways to use the product.
- Very detailed information on foodstuff, such as the origin of each component.
- Information on how well a new product meets the demands set by the user. The demands could be made under the user profile. Usually, allergies set limits for the products, but users also want to avoid different kinds of things, like aspartame, fat or certain e-numbers.

The biggest obstacles to using the code were the following:

- The costs: the users are not willing to pay for additional information about the product. The data transfer fee was not an obstacle for highly educated users or for users over the age of 40, if the service was considered useful.
- The mobile or application: the users found their own mobile incapable of using the services and they were lazy to download applications, while their experience of downloading was laborious.
- It is time-consuming: users are not willing to spend time on codes, particularly when it comes to time spent shopping.

The following factors would promote use of the codes are:

- Young people find it frustrating to write text messages; codes are simpler to use.
- Users tend to have their mobile available nearby.
- Middle-aged users have problems seeing small text.

From the perspective of business models, the following conclusions could be drawn:

- Japan has been said to be “the most successful and innovative test-bed market for next-generation mobile products and services” in the world. Based on our studies, some of the most important elements of this success relate to the close cooperation between mobile operators, vendors and, most of all, consumers. Services that attract consumers are the key, not technology. Consumers have been innovators of mobile internet services from the very beginning. Consequently, the penetration rate of mobile internet is high. User-friendly mobile phones are gradually being revamped, following the Kaizen culture, and consumers adapt quickly. In Japan, mobile barcodes are part of everyday life. QR codes are everywhere; they are an iconic call for action. Consumers know what they are and use them on a regular basis. Due to the high adoption rate of flat-rate data plans, it does not cost them any extra. The issue of price, however, seems to be almost too convenient an excuse not to offer new kinds of services to consumers in Finland. If you ask consumers about their willingness to pay for just about anything extra, they will say no. The challenge for firms is to make available services that provide consumers with additional value on a level at which they are willing to pay.
- In this work, we have presented the case that cultural factors do play a role in Japan’s success, but there are some striking features of the way Japanese companies do business that have made them world leaders. From the point of view of the Finnish business mentality, first and foremost, the Japanese have patience. In general, they expected profits for QR codes in the 1990s within 2-6 years. The possibilities and limitations were not clear to the value chain members in the beginning, but they understood that it takes time and effort to create this understanding. A general theme of interviews in the Finnish firms was that for hybrid media services, we must start by understanding what information, issues and benefits the consumer is prepared to pay for. The ability to calculate profits at each step of the value chain was seen as crucial. Another general theme was increased cost-efficiency of logistics. This is the opposite strategy to the Japanese mentality in which QR codes were discovered by consumers and thereafter open-sourced for anyone to use. The basic underpinning was elaborated by an interviewee in Tokyo, “Consumers are smart so they’ll figure out what they want out of it. People do not like to be locked in. Open up and they will come.’

- QR codes in Japan are seen as a means to begin a conversation with a consumer. The logic is brilliant: it does not cost anything for anyone in the value chain to add it, but it brings added value to everyone. Mobile phone vendors are able to justify the cost of the phone to the mobile operators. Operators profit, as people hold phones in their hands more they use the phone more and they buy a new one sooner. Printing houses engage in the full range of added value services, tightening their relationship with marketers. For brand owners, hybrid media solutions are one-on-one communication channels that add value for both consumers and brand owners. Furthermore, it brings cost-efficiency to operations, e.g., optimization of marketing campaigns based on results, the need to update only web pages not packages or marketing materials, a reduction in paper costs, and efficiency in inventory balance management. Consumers are given exactly what they want: convenience, information, benefits, products, services…
- It became apparent during our project that no matter how conflicting the interests involved, collaboration across the whole value chain is necessary. In Japan, the balance of power held by the value network players is quite different to that of the Finnish markets. Operators, printing houses and even advertising agencies hold dominant positions and engage in a full range of services thus forcing others to engage in one-one-one relationships. These relationships are strategic, however, not tactical, adding value for both parties. The dominant players do not ‘step on anyone else’s toes’.

In general, we can draw the following conclusions:

- Hybrid media can provide benefits in the form of cost savings, new business opportunities, added value to existing business and increased customer loyalty to all players in the value chain. Available hybrid media technologies are 2D bar codes, digital watermarks, image recognition, fibre matrix, RFID tags and magnetic codes.
- Pilot tests and user studies showed that additional hybrid media services should include detailed product data, recipes, nutrient requirements and user instructions, and match user demand. Obstacles to use are costs, their time-consuming nature and complexity.
- In Japan, mobile barcodes are part of everyday life, well known to consumers and used on a flat-rate basis. The introduction was initially based on consumer needs, not on early profit. Today, it operates on a win-win principle with benefits for all the players in the value chain, and several traditional printers have created completely new service concepts for their customers.

Acknowledgements

The study was partly financed by the Finnish Funding Agency for Technology and Innovation (TEKES) and by the Graphic Industry Research Foundation of Finland (GTTS). The following companies have participated in the study: the Association of Packaging Technology and Research (PTR), Oy Gustav Paulig Ab, Ravintoraisio Oy, StoraEnso Oyj and UPCode Ltd. The researchers are greatly indebted to the organizations for their support and permission to publish the report.

References

1. Lindqvist, U., Eiroma, K., Hakola, L., Jussila, S., Kaljunen, T., Moilanen, P., Rusko, E., Siivonen, T., Välkkynen, P., Technical innovations and business from printed functionality. VTT Research Notes 2436, Espoo, 2008, 73 p. + app. 6 p.

2. Lindqvist, U., Moilanen, P., Business from hybrid media and printed functionality. ed.: Enlund, N., Lovrecek, M., Advances in Printing and Media Technology, Vol. XXXV. Darmstadt, 2008, p. 101–106.

Appendix A: List of persons interviewed

In Finland:

- Borealis: Hanneli Seppänen, Auli Nummila-Pakarinen
- DeusPak: Robert Olkinuora
- EK Logistiikka-alat: Kyösti Orre
- Fazer Oy: Jussi Tarpila, Gun Granholm-Sinkko, Marja Hakala, Hanna Lehtonen
- GTTS: Helene Juhola, Pekka Pätynen, Juha Punnonen
- Itella Oyj: Tanja Väyrynen, Juha Koskinen, Zoran Tomic
- Kaikuma Oy: Timo Nevalainen, Mikael Bergholm
- Kesko Oyj: Jukka Koivunen
- M-real Oyj: Riikka Joukio, Jani Suomalainen
- Orion Corporation: Tuula Avonius, Susanna Salonen, Jukka Pietilä
- Paperinkeräys Oy: Kyösti Pöyry
- Pakkausteknologia PTR: Margareetta Ollila, Terhen Järvi-Kääriäinen
- Pyroll Oy: Kari Tuominen
- Oy Gustav Paulig Ab: Kai Eira
- Ravintoraisio Oy: Markku Krutsin
- RFID Lab: Sami Kalliokoski
- Sek&Grey: Petteri Järvelin, Helena Piippo
- Solver Oy: Mauri Reinilä
- StoraEnso Oyj: Juha Maijala, Pia Jäminki
- Suomen Lähikauppa Oy: Jussi Tolvanen
- UPCode Ltd: Sture Udd
- UPM Oyj: Hannu Karhuketo
- Valio Oyj: Annikka Hurme, Ari Siljander
- Wipak Oy: Esko Saaristo, Matti Koponen

In Japan:

- Dai Nippon Printing Co. Ltd.: Tsukasa Kusanagi, N. Takahashi, Hiromitsu Takai, Kiyoshi Toda, Satoko Tokunaga, Kats, Tsuchiya, Yosuke Ueda
- Denso Wave: Mitsuru Araki, Kouji Kounosu, Hiroiku Masuda, Tadao Nojiri, Hiromitsu Takai
- Dream Incubator Inc.: Takashi Iwamoto
- GS1 Japan: Hideki Ichihara, Naoko Mori, Hitomi Sekikawa
- GS1 / EPC Global Japan: Koji Asano, Michio Hamano
- Keio Graduate School of Business: Kazuhiro Asakawa
- Mitsubishi Paper Mill: Ikuo Fujita
- Mobikyo: Lawrence Cosh-Ishii
- Tekes Japan: Shigetishi Kudoh
- Toppan Printing Co. Ltd.: Kazuhiro Azuma, Tomohiko Hibino, Yoshika Nakamura
- VTT Japan: Yoshikatsu Nakagawa

Appendix B: Outcome of the interviews

Packaging

The package is already a medium, but the printing of individual data on a package is still a challenge. (Material Supplier)

The usability of the package is more important than its function as a media surface. (Brand Owner)

You can provide information about other products on the package of any product. (Brand Owner)

The brand owner is prepared to increase the price of the package to achieve real usefulness: distinguishability, closability, visibility, effects, shape and ease of use. (Brand Owner)

Today, problems with a package can be difficult to investigate. (Material Supplier)

Retailer problems are missing pallet tags and difficulties placing them on shelves. User problems are limited preservability, recycling and the lack of a return channel to the producer. (Others)

Waste is becoming crucial to providing food to all people. Waste reasons are: 1) problems with logistics: logistics that are too sensitive when nobody has time to check. Hybrid media could help to find the bottlenecks. 2) Demands cannot be estimated in advance, so the order is based on price. 3) Consumers throw large amounts of food needlessly. (Others)

Package problem: There is a huge amount of compulsory information on a package. It takes time to react to legal changes. (Material Supplier, Brand Owner)

All additional codes steal marketing space, which is an essential part of the package. (AD Agency)

The more players, the more complicated it is to make decisions, making the process slow. It is difficult to reach consensus about earning logic. (Material Supplier)

In daily consumption, the package is more important than the product itself. (Brand Owner)

Hybrid media and codes

2D codes are in use on many product types. The code contains information about makes, product number, etc. The idea is to guarantee transportation and authenticity.

Hybrid media can offer: 1) cost reduction, new business, and 2) added value to old business. (Brand Owner)

What is the goal: reduced costs or additional sales/new business? Both directions are good. It is more difficult to reach the end-consumer however; that requires risks and investments. (Material Supplier)

The code provides additional value to the customer interface in three dimensions: 1) loyalty, 2) increased sales, and 3) information. (Software Vendor)

The most important thing is to motivate the consumer, and once that has been done almost any application is possible. (Software Vendor)

How can we communicate to the user to take the system into use? (AD Agency)

It is important to make package manufacturers and printers offer new services to their customers, i.e., the brand owners. (Software Vendor)

The obstacles are the price of the code and the costs of the system. (Brand Owner)

The code can also be used as a tool in consumer studies. (Software Vendor)

Basic-for-free, i.e., the URL address should be free, and there is no big business potential here. For business, the service must be separate. Code applications are tailored solutions and always case dependent. (Software Vendor)

The media companies will hardly invest in hybrid media; fraud protection may be more likely. (Software Vendor, Brand Owner)

The package manufacturer or brand owner should add the code. (Others)

The code cannot replace legislation or marketing information. (Brand Owner)

Legislation is also an obstacle to the development of hybrid media, e.g., in package coding. (Material supplier, Brand Owner)

A functional system requires an open data bank. (Material supplier)

Print media is old-fashioned and something more than just printing 2D codes should be invented. (Software vendor)

Hybrid media offer an advantage of increased customer loyalty. The brand owner obtains more information about the buying process and sales in real time. This information is not available today. (AD Agency)

The technology is better suited to rational products (e.g., pharmacy) and not experience or amusement products. New opportunities could be found in the service sector, e.g., insurance, car rental, banking, etc. (AD Agency)

Simple is beautiful: one code per package level is appropriate. (Brand owner)

A combination of several technologies, for instance, RFID on the pallet/box and point-of-sale data on consumer packages via 2D codes. (Brand Owner)

The code must be simple to use so the consumer does not need to write anything down. The consumer is lazy. (Brand Owner)

Logistics

Applications in logistics will come first, as pecuniary benefits can be achieved immediately. The product flows are already known. (Brand Owner)

RFID will be taken into use, increasing brand loyalty, and it will be a warranty of authenticity. It is not usable for cheap products however. (Brand Owner)

In Finland, there is no point in following up logistics in too much detail. (Logistics)

The aim of logistics is often to minimize the retailers' storage. (Logistics)

Today, the role of logistics lies only in transportation, but in the future, the role will be more in systems and chain management. (Logistics)

Retailers

Retailers do not provide information about when a product is sold. This information would improve availability on the shelf however. (Brand Owner)

The brand owner wants to inform the consumer honestly about tracing data, but this requires transparency from the retailer's side. (Brand Owner)

We must motivate the retailer to take in products with codes, even though not all the information will pass via it. (Package Printer)

Logistic companies can hardly obtain any information from the retailer (about consumers), as the retailer wants to manage the logistics. (Logistics)

In practice, the big retailers decide which products are taken to the shelves and when. (Others)

The retailers would have big opportunities to use existing information and increase their sales. Informing the customer about bonus limits that have almost been reached before a campaign deadline may inspire the customer to extra spending. (Software Vendor)

Retailer chains could be the exploiters of the codes. (AD Agency)

Consumers

In the package value chain, the consumer is currently, generally the king. Previously, the foodstuff aspects may have been over-enhanced. Today, the producers are interested in the consumers, their behaviour and the role of the package as the node in between. (Others)

The producer/brand owner wants feedback directly from the consumer. Today, the feedback goes via the retailer, which the brand owner does not want as a return channel. The brand owner wants to send the consumer response to the package manufacturer. (Others)

Market studies should be developed that correspond to modern expectations. (Brand owner)

Information about the consumer's actions and ways at the transaction moment via the code is of utmost interest. With this knowledge, the producer could improve its service. (Brand Owner)

The consumers have a big need for information, but there is a risk of information over-flow. (Brand owner)

The consumer should not be bothered with extra features like codes. (Brand owner)

The consumer makes fast decisions. He or she always buys the package, i.e., the content is less important. In a blind test, consumers usually do not recognize their favourite products. The package provides imagination about the product. (Package printer)

Home transport is growing business, beside C2C business. Research shows that logistics increase, especially for consumer transportation. (Logistics)

Direct on-line consumer information could be of interest, but who would process all this information. (Package manufacturer)

Consumers are very conservative: they are excited about new things for a while, but use remains limited. When introducing new services, they must be given good bait. (AD agency)

It is old-fashioned to believe that the price would be the most important argument for the consumer, and only after that the brand itself. (Brand owner)

VTT Working Papers

132 Hannele Holttinen & Anders Stenberg. Tuulivoiman tuotantotilastot. Vuosiraportti 2008. 2009. 47 s. + liitt. 8 s.

133 Elisa Rautioaho & Leena Korkiala-Tanttu. Bentomap: Survey of bentonite and tunnel backfill knowledge – State-of-the-art. 2009. 112 p. + app. 7 p.

134 Totti Könnölä, Javier Carrillo-Hermosilla, Torsti Loikkanen & Robert van der Have. Governance of Energy System Transition. Analytical Framework and Empirical Cases in Europe and Beyond. GoReNEST Project, Task 3. 2009. 49 p.

135 Torsti Loikkanen, Annele Eerola, Tiina Koljonen, Robert Van der Have & Nina Wessberg. Nordic Energy Research within the Framework of Energy System Transition. Task 2 Working Paper of the GoReNEST project. 65 p.

136 Toni Ahonen & Markku Reunanen. Elinkaaritiedon hyödyntäminen teollisen palveluliiketoiminnan kehittämisessä. 2009. 62 s. + liitt. 8 s.

137 Eija Kupi, Jaana Keränen & Marinka Lanne. Riskienhallinta osana pk-yritysten strategista johtamista. 2009. 51 s. + liitt. 8 s.

138 Tapio Salonen, Juha Sääski, Charles Woodward, Mika Hakkarainen, Otto Korkalo & Kari Rainio. Augmented Assembly – Ohjaava kokoonpano. Loppuraportti. 2009. 32 s. + liitt. 36 s.

139 Jukka Hietaniemi & Esko Mikkola. Design Fires for Fire Safety Engineering. 2010. 100 p.

140 Juhani Hirvonen, Eija Kaasinen, Ville Kotovirta, Jussi Lahtinen, Leena Norros, Leena Salo, Mika Timonen, Teemu Tommila, Janne Valkonen, Mark van Gils & Olli Ventä. Intelligence engineering framework. 2010. 44 p. + app. 4 p.

141 Juha Forström, Esa Pursiheimo, Veikko Kekkonen & Juha Honkatukia. Ydinvoimahankkeiden periaatepäätökseen liittyvät energia- ja kansantaloudelliset selvitykset. 2010. 82 s. + liitt. 29 s.

142 Ulf Lindqvist, Maiju Aikala, Maija Federley, Liisa Hakola, Aino Mensonen, Pertti Moilanen, Anna Viljakainen & Mikko Laukkanen. Hybrid Media in Packaging. Printelligence. 2010. 52 p. + app. 7 p.

143 Olavi Lehtoranta. Knowledge flows from incumbent firms to newcomers. The growth performance of innovative SMEs and services start-ups. 2010. 36 p. + app. 2 p.

144 Katri Grenman. The future of printed school books. 2010. 42 p.

145 Anders Stenberg & Hannele Holttinen. Tuulivoiman tuotantotilastot. Vuosiraportti 2009. 2010. 47 s. + liitt. 5 s.

146 Antti Nurmi, Tuula Hakkarainen & Ari Kevarinmäki. Palosuojattujen puurakenteiden pitkäaikaistoimivuus. 2010. 39 s. + liitt. 6 s.

ISBN 978-951-38-7488-9 (URL: http://www.vtt.fi/publications/index.jsp)
ISSN 1459-7683 (URL: http://www.vtt.fi/publications/index.jsp)