

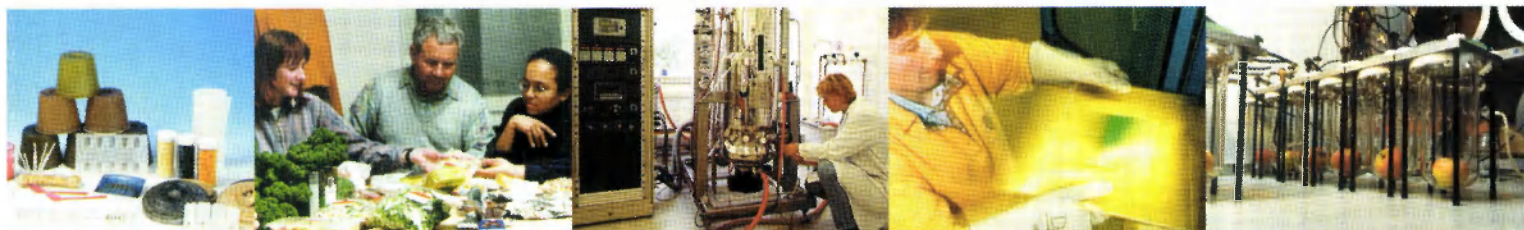
Report on the first stage of the development project for Via Management

Period: 2 April – 3 June 2002

Report no.B586 / 3 June 2002

CONFIDENTIAL

Ulphard Thoden van Velzen



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Summary

The market potential of bran-based articles and packages has been studied. Designs of final products have been made. The current products and the designs were discussed with potential end-users.

Most of the market parties interviewed are enthusiastic. Bran-based articles and packages render these entrepreneurs the possibility to position themselves in the market as environmental conscious producers. They expect that this have positive effects for their business. The technical constraints placed on final products depend strongly on the products that need to be packed; these can range from a few easy constraints to very demanding constraints. Hence, it is advisable to perform the development program in a stepwise fashion, expanding the potential market with every step taken.

Based on the technical constraints that end-users place on the final products, sets of requirements were established.

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1 Introduction

The opportunities of bran-based disposable articles and packages were evaluated by interviewing potential end-users. Samples of the current bran-based products (disposable dishes and bowls) and computer images of potential final products were used to explain the concept.

In this report, the designs of foreseeable final products are presented. Furthermore, the results of the market study are given and interpreted. The market is analysed in size, potential earning capacity and attractiveness. Based on the demands that the end-users place on the final products, sets of requirements are established. Finally conclusions are drawn for the following steps in the development program.

2 Design

In order to be able to explain and discuss the final products made from coated bran, various computer images of potential final products were generated. These images were used in the interviews with potential end-users. The images of final products were clustered into four groups:

- Disposable dishes for catering purposes
- Trays for fruits and vegetables
- Trays for meat, fish, poultry and cheese products
- Packages for prepared bread buns

Disposable dishes

Since the size and dimensions of the disposable dishes are fixed, the major remaining design parameters are colour, nature of coating and possible prints.

The simplest design would be a dish that is completely coated with a white, smooth laminate. However, such a dish would resemble ordinary disposable dishes to a large extent, and thereby consumers would no longer be able to recognise the dishes as biodegradable. An alternative would be to use a full white coating on the top of the dish and a transparent white coating on the back of the dish. A further option would be to have a full white coating on the top of the dish and no coating on the back of the dish. This dish would have the technical drawback that it cannot be placed and used on wet tables.

Another alternative is to print the IBAW logo (see figure 5) on the dishes. Many consumers recognise this logo and understand that the material is compostable.

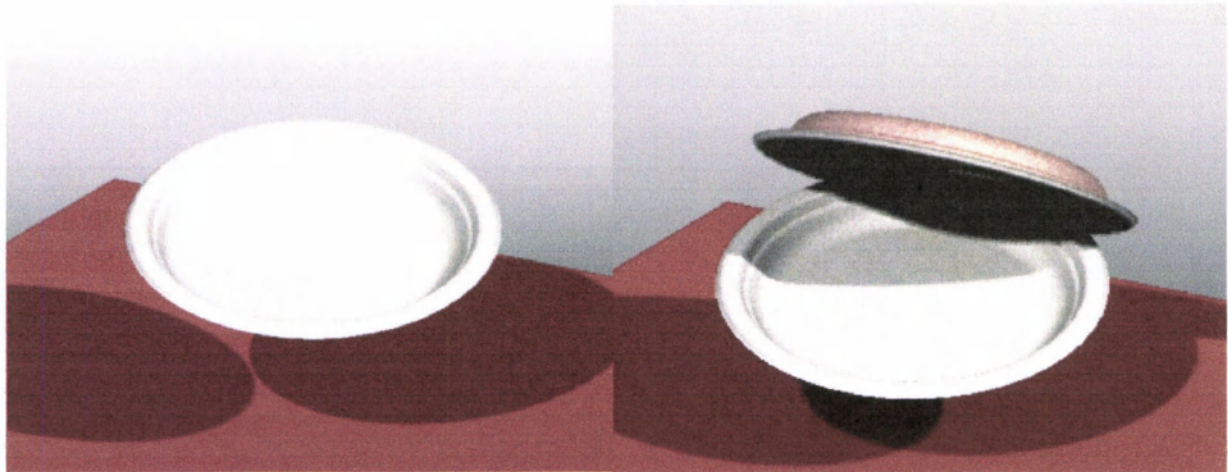


Figure 1: Designs of disposable dishes made from coated bran, either completely white (left) or with a full white top and a transparent white coating on the back (right).

Trays for fruits and vegetables

Conventional trays for fruits and vegetables come in many colours and sizes. Some of them are single trays, these can be used as they are or with flow wrap. Other trays have a sealing layer at the inside and can be used to make top-seal packages. The same design parameters can be used for the bran-based trays. Figure 2 shows two designs of mushroom trays in precisely the punnet size of the currently used polystyrene trays.

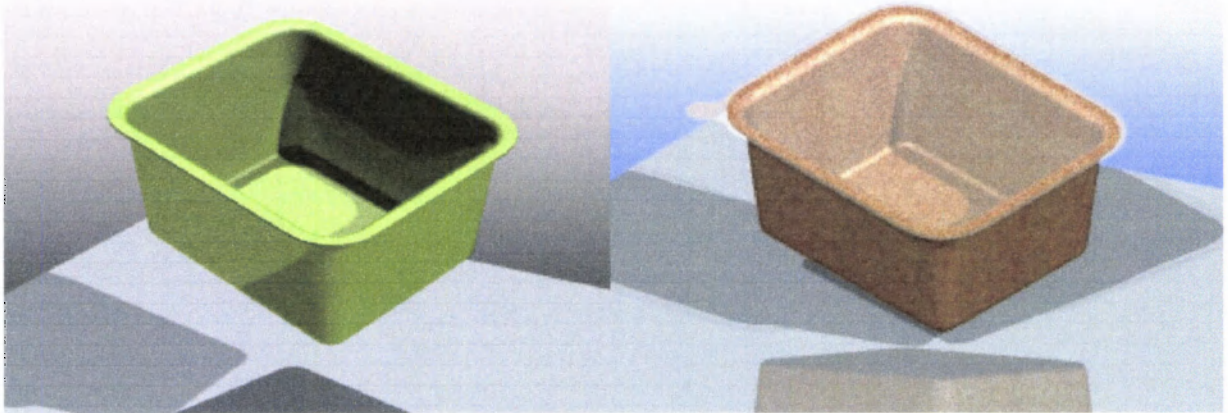


Figure 2: Designs of mushroom trays. Left: a green tray; Right: a tray with a transparent coating and a top-seal.

Trays for meat, fish, poultry and cheese products

The appearance of meat trays is very delicate. The trays should look hygienic. Traditionally the trays should look white, smooth and shining. However, increasingly, other colours are now also being used (black, yellow, green, blue and pink). Bran does not have the right appearance; hence, a non-transparent coating is necessary for the inside. Potentially, a slightly transparent coating could be used on the outside to enhance consumer recognition, or alternatively, the IBAW logo could be printed on the trays. Meat trays are used as single trays with stretch wrap around it, or as top-seal trays.

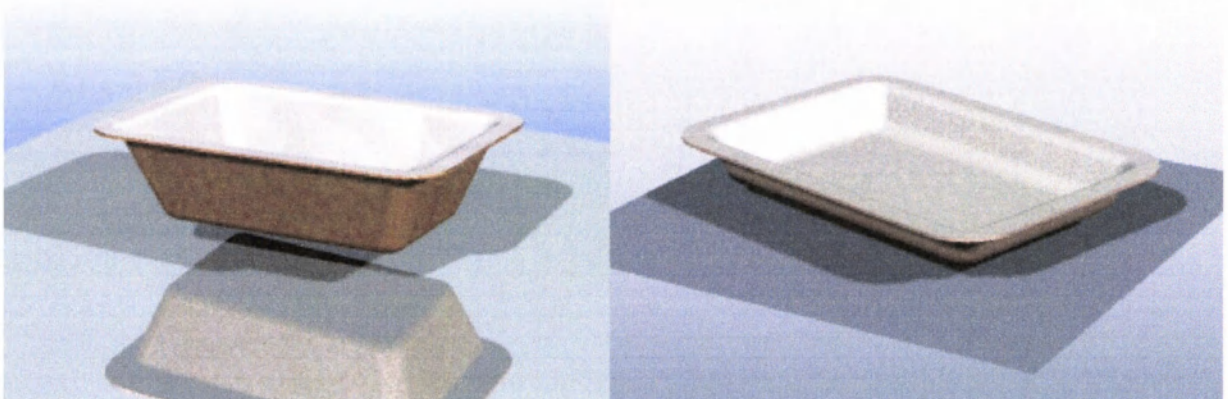


Figure 3: Designs of a top-seal meat tray with a full white interior (left) and of a conventional meat tray with a transparent white interior (right).

Packages for prepared bread buns

Prepared bread buns are currently sold on a black *underlayment* with a flow wrap. The *underlayment* could potentially be made from bran. Alternatively, top-seal trays or trays with transparent hoods could be developed. Since it is assumed that bran has a good colour to sell prepared bread buns, no coloured coatings are initially recommended. However, according to market parties, black would be a better colour.

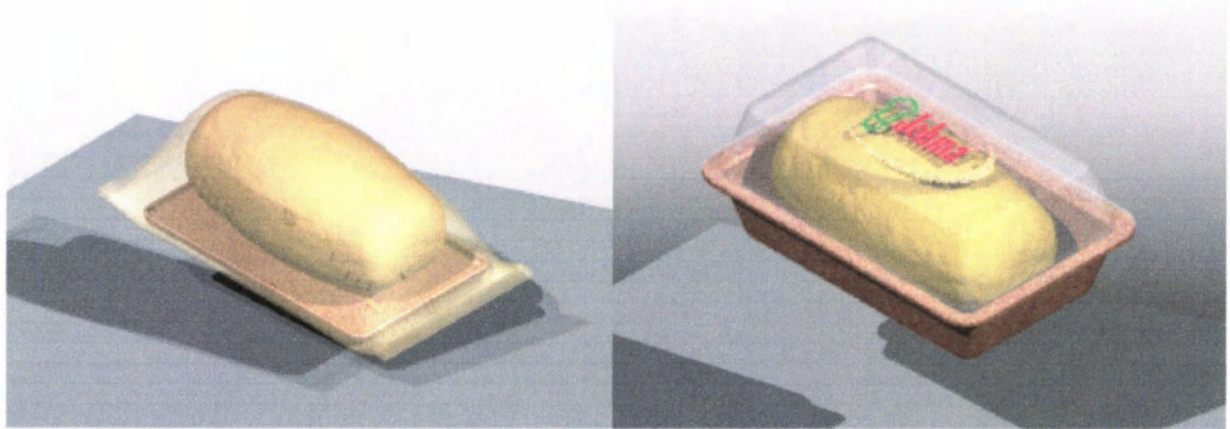


Figure 4: Designs of packages for prepared bread buns. An underlayment with flow wrap (left) and a tray with transparent tophood (right).



Figure 5: IBAW logo for compostable materials. This logo is predominantly being used in Germany.

3 Market research

Interviews with potential end-users were conducted to study the market for bran-based articles. Most of those interviewed were enthusiastic about what bran-based articles could mean for their business. They foresee good opportunities when relevant constraints are fulfilled. In this chapter, the interviews are first grouped and discussed. Subsequently, the results are interpreted and conclusions are drawn.

3.1 Disposable dishes and bowls

The opportunities for disposable dishes and bowls were discussed with four relevant companies; see table 1.

Table 1: Interviewed end-users of disposable dishes and bowls.

Company	Type of company	Contact person	Opinion
Sodexho Nederland BV	In-company catering	Mr. Nico Heukels	Interested
Albron BV	In-company and rail catering	Ms. Suzanne Bolander	Partially interested
McDonalds Nederland BV	Hamburger restaurant	Mr. Ruud den Hartog	Reserved
Merison BV	Purchase office for retailers	Mr. Van den Heuvel	Interested

3.1.1 Market data

Sodexho is the market leader in in-company catering world wide. They are also the market leader in The Netherlands with a market share of 30 %. Their turnover was 339 million Euros in 2000 with about 1360 restaurants. They use disposable dishes and soup bowls in about 30 % of all the company restaurants of Sodexho Holland; this amounts to about 140.000 dishes and soup bowls per working day. According to Mr. Heukels, the total usage in The Netherlands for in-company catering is estimated to be 350.000 plates and 350.000 bowls per working day. Hence, with about 210 working days per year in The Netherlands, about 74 million disposable dishes and 74 million disposable soup bowls are used in in-company catering in The Netherlands annually.

Sodexho is interested in compostable disposable cups, dishes and bowls to replace all the currently used polystyrene based disposable articles. It could help them to reduce their waste costs and could simplify their waste management system. Of course, the disposable articles have to be almost as cheap as the current ones (estimations are 1.5 Eurocent /article) Furthermore, most consumers would like to have white, fresh and hygienic looking disposable articles. The disposable articles should be heat resistant, water resistant, strong to endure knife cuttings and not porous.

Albron is the second in-company catering business in The Netherlands. They also run rail-, school and hospital-catering activities. Their turnover was 218 million Euros in 2000 with about 1100 restaurants. Albron would like to use compostable disposable articles for their organic catering market segment. This segment of in-company catering is currently small. Albron is aiming to reach a 5 % organic level, but this will remain a decision for their host companies.

Albron is interested in compostable disposable articles that have similar optical properties as the white polystyrene disposable articles. Furthermore, they should have the same price. Albron has recently signed agreements with a supplier of conventional disposable articles for a long-term contract at low prices. Albron is interested, but should be approached with the first coated prototypes.

McDonalds Nederland BV is the largest fast food chain in The Netherlands with 212 restaurants, a turnover of 339 million Euros in 2000 and about 180 million patrons annually.

McDonalds is interested in compostable disposable articles as alternative to the polystyrene hamburger clamshells. However, they have participated in similar projects in the past and do not believe that there are compostable products available that satisfy their criteria. These criteria are:

- Stackable, using little space during transport
- Closeable with a lid, convenient in use
- Printable: they sell emotion, a good print is necessary
- No softening after contact with warm water or fat in one hour
- As cheap as PS-hamburger clamshells (estimate is 2 Eurocents per clam shell)

The packaging policy of McDonalds is local. This implies that the Dutch McDonalds could choose compostable disposable articles, whereas the Belgian branch would choose PS-based clam shells. However, the purchase policy is on a European level, meaning that they have a European-wide purchase contract with one supplier. This gives McDonalds the lowest purchase prices. So, their purchase policy limits the local freedom in packaging policy.

Mr. Den Hartog seriously doubts that compostable articles have a real ecological benefit over conventional articles. Most of these articles are heavier, hence, they cost more energy for production and transport, etc. In case the products do not have a clear ecological benefit, it would be hard to communicate this to the customers.

Most patrons of the McDonalds restaurants buy the emotion of a pleasant visit. The appearance and emotion of bio-packages should fit with this pleasant emotion. Mr. Den Hartog finds it difficult to visualise this with the bran-based articles at the moment. The appearance of these articles is too ecological for most customers. The marketing department would surely want to change this appearance with printwork and nice colours.

McDonalds Nederland probably uses about 180 million clamshells annually. They should be approached when the prototype products are ready and when we are more confident that we can meet their requirements.

Merison Groep BV is a major wholesaler and purchase agent for retailers. They are the purchase office of disposable articles for the largest Dutch retailer (Albert Heijn). They are interested in the bran-based dishes and bowls. According to Mr. Van den Heuvel, all disposable dishes should look white and hygienic. He was not willing to share market information with us at this time. He likes to be kept informed and will discuss the matter with his clients. When the first prototypes are ready, he should be approached.

The opportunities of disposable dishes and bowls were also discussed briefly with the non-food category manager of Makro in The Netherlands and with Terry Robins of Sainsbury's in United Kingdom. According to the Makro – representative, the sold disposable dishes and bowls are for 90 % related to children parties. Hence, the dishes need to be white, lightweight, without sharp edges and with a print of Mickey Mouse or Donald Duck.

According to Terry Robins, most barbecue-related articles are sold via Do-It-Your-Own (DYO) shops. His supermarket has a special BBQ shelf during the summer months, but its market share is small.

Biotrem (the current producer of the bran-based articles) has already one successful business contact for the disposable articles. They currently sell more than 50.000 picnic sets to Carrefour Poland. They also have other interested partners: local hospitals and prisons.

3.1.2 Market analysis

The interests vary strongly among different companies, since these companies see very different opportunities with the same disposable articles.

Sodexho Nederland BV would like to replace all their disposable plastic articles to biodegradable materials in order to rearrange their waste management system and to save waste collection money. Their market volume is about 20 million dishes and 20 million bowls annually. The maximum price they will accept is estimated at 2.5 Eurocents

per article. Hence, the potential earning capacity for this client is 500.000 Euros for dishes and 500.000 Euros for bowls.

Albron BV would like to use compostable disposable articles as a marketing tool to serve their organic restaurants. They expect that these articles will please their organic customers. Their market volume in organic restaurants is expected to be 700.000 dishes and 700.000 bowls annually. The maximum price they will accept is estimated at 2.5 Eurocents per article. Hence, the potential earning capacity for this client is 17.500 Euros for dishes and 17.500 Euros for bowls.

McDonalds Nederland BV has studied and tried several compostable disposable alternatives, but did not achieve any company benefits, financial benefits or marketing benefits. Hence, they have become sceptical and should be approached at a later stage. The potential earning capacity for this client is approximately 3.6 million Euros annually for 180 million hamburger clamshells.

For compostable disposable articles sold via the supermarkets, the market potential is currently still unclear. The experience in Poland is that more than 50.000 articles can be sold via a relatively small retailer, without advertisements for a price of 2 Euros. Extrapolations for the whole of Europe would indicate that 1 million articles could be sold easily without much marketing, with a potential earning capacity of 2 million Euros. However, the validity of these numbers is low. Since most end-users want to experiment (touch, smell and feel) with the disposable articles before they make up their minds, it is very difficult to obtain reliable market information without prototype products.

3.1.3 Set of requirements

The most important technical and marketing requirements are listed below. The technical performance of polystyrene disposable articles was used as guideline.

Technical criteria:

- **Temperature resistance.** Soups are often filled hot in disposable bowls and the temperature resistance is critical. The shape of polystyrene disposable articles remain stable up to 65°C. Hence, the limit is initially set on 65°C.
- **Resistance to knife cuttings.** The coatings need to be tough to endure knife cuttings. This endurance can best be tested subjectively.
- **Water and oil resistance.** The food products that will be served in the disposable articles will be aqueous, moist or oily. The disposables need to remain stable while in contact with water and oil for the maximum expected time of use (about 2 hours). This can best be tested with a leakage test and to record the time of failure.
- **Compostability.** The articles will be sold as compostable, and hence need to comply with European legislation.

Marketing criteria:

- **Appearance.** Most interviewed persons favoured a white, smooth and hygienic appearance for disposable dishes and bowls. This will make the product less easily recognisable as a natural and compostable material. Hence, the bottom part of the dish or bowl could be kept non-coated or could be coated with a transparent material.
- **Smooth edges.** The edges of the current prototypes are sharp. To avoid cutting, the edges need to be smoothened. This can be done via the coating and the production technology.
- **Ease of usage / weight.** Disposable dishes and bowls need to be handled as simply as their stoneware counterparts. Polystyrene articles suffer from their light weight; they move easy with knife movements and the wind. The bran-based articles are intrinsically heavier and hence their ease of usage is rated higher.
- **Comply with European legislation.** Obviously, all food contact materials need to comply with the European law, which sets limits on the migration of components from the article to the food product. Most customers will require an official certification.

3.1.4 Conclusion

Although exact market volumes for bran-based compostable disposable articles are unknown at the moment, the market could be as large as many tens of million articles annually. Much will depend on an efficient marketing strategy after the first prototypes are available. The potential earning capacity will be many millions of Euro's, depending on the sales concepts (directly to large customers for low prices or to individual consumers in grill sets for high prices).

The most difficult technical requirements to fulfil will be the temperature resistance and the knife-cutting resistance if natural coating materials are used. Probably, crystallised PLA and cellulose acetate can render the required performances.

The white colour can be obtained by mixing talcum, lime or chalk into the coating.

3.2 Trays for fruits and vegetables

The opportunities of compostable fruit and vegetable trays were discussed with eight relevant companies; see table 2.

Table 2: Interviewed end-users of compostable fruit and vegetable packages.

Company	Type of company	Contact person	Opinion
Frankort en Koning	Fruit & Vegetables	Jan Klerkx	Interested
Fruitmasters	Fruit	Aric van Arendonk	Interested
Bakker Barendrecht	Fruit & Vegetables	Gerard Harleman	Interested
Sainsbury's	Retailer	Terry Robins	Interested
Qualitypack BV	Fruit & Vegetables	Jan Houdijk	Interested
Gourmet BV	Onions etc.	Jan Broerze	Very interested
CropTop quality packers BV	Vegetables	Gerrit Jan Kornet	Interested
Innopack AS	Fruit & Vegetables	Henrik Andersen	Interested
SABA distribution AB	Fruit & Vegetables	Linnea Jönsson	Interested

3.2.1 Market data

Frankort & Koning is a medium-size fruit and vegetable wholesaler in The Netherlands. **Fruitmasters** is the second largest fruit auction and packing station in The Netherlands. Because their opinions run parallel, they are discussed simultaneously. Both companies predominantly trade in conventional produce and hardly in organic produce. In general, both companies are interested in bran-based fruit and vegetable packages and mostly see opportunities as replacement for moulded fibre trays. However, they also have several tough technical and marketing requirements.

Bran-based packages can only compete with moulded fibre trays. The other market segment comprises transparent packages, which obviously is not relevant. Since most fruit and vegetables are sold in supermarkets in transparent packages nowadays, the market will be limited to replacement of moulded fibre trays.

The market of moulded fibre trays for fruit and vegetables is still large. For instance, Frankort & Koning use 20 million moulded fibre trays for 5.9 – 6.4 Eurocents, for products such as soft fruits and tomatoes.

The trays need to be coated with a coloured coating (green, blue, white, black or off-white). The surface of the bran-based articles is smoother and hence better than that of MF-trays. Potential printability of the bran-trays would be an advantage over the MF-trays.

The performance of the bran material needs some improvement. The trays need to be elastic to cope with the rough handling during distribution. The trays should be water-resistant and absorb fruit liquids. The edges need to be smoother and bran should not flake off. For some products ventilation holes need to be made in the tray.

Furthermore the trays should run smoothly on the current packaging machines (mostly flow packers).

The most suitable products seem to be the organic products, soft fruits and tomatoes.

Bakker Barendrecht BV produces pre-packed fruit and vegetable products for Albert Heijn (largest Dutch retailer). Most products are whole fruits or vegetables, some are processed (such as salads) and a small but growing segment is organic produce. Mr. Harleman sees opportunities mostly for the organic market segment. They could start with five organic products (kiwi, avocado, tomatoes, onions, asparagus) at about 8 Eurocents per tray with a maximum of 2 million trays per year. In case the tray price is lower (max of 5 Eurocents per tray) the complete fruit and vegetable portfolio could be packed in them, raising the market to many tens of millions per year.

Important improvement points are: colour (blue or green), reduced smell, water resistance. They are willing to co-operate with us during the development.

Mr. Harleman is interested because the bio-package conveys a message to the consumers that the producer is environmentally conscious. This can boost sales. But the extra tray price should be kept as low as possibly.

Gourmet BV is a relatively small packer of onions, garlic and shallots. He likes the current product, it could help to set him apart from the other producers as an environmental conscious producer. His current use is 500.000 trays annually. It is a good end-user to start the market introduction with.

CropTop Quality packers BV is a medium size vegetable packer that is a subsidiary company of The Greenery. They are interested in improved bran-based trays for about five different vegetables, which amounts to about 5 million trays annually.

Innopak AS is a medium-size packer of fruits and vegetables in Denmark. They see opportunities in the use of bran-based trays to strengthen their market position as an innovative packing company. However, the trays need to be improved to meet all criteria: colour, wet-strength, odour, etc.

SABA Distribution AB is a Swedish packer of organic fruits and vegetables. They like the concept of natural, biodegradable packaging materials and foresee a few potential uses. They are interested to discuss the concept further when the first prototype packages are available.

Qualitypack BV is a packaging purchase organisation that buys packaging materials for The Greenery and others. The Greenery is the largest fruit and vegetable trading company in The Netherlands. Qualitypack also packs the fruit and vegetables for Sainsbury's.

Sainsbury's Supermarkets Ltd is the second largest retailer in the United Kingdom. They currently use biodegradable packaging materials for organic produce. The currently used starch-based trays are relatively expensive (approx. 10 Eurocents per tray), do not perform under wet conditions and some suppliers are less reliable. They are very interested in alternatives such as coated bran-based packages.

Important improvement points are:

- The colour needs to be black or off-white.
- The edges need to be smoother.
- The odour should be reduced and not transmitted to the products.
- The packages should remain strong under wet and moist conditions.
- Printability is highly desired.
- The packages should run smoothly on the flow packers and/or tray sealers.
- The coating could be made of any functional compostable material, as long as it is not PLA.

Sainsbury's would really like us to develop trays for moist and wet organic produce: potatoes and mushrooms. Potatoes are washed and packed wet, whereas mushrooms transpire much water vapour. Last year, they sold 1.36 million punnets (packaging units) of organic potatoes and 0.7 million punnets of organic mushrooms. Other serious options are the following list of organic produce: bell peppers, onions, apples, grapefruits, tomatoes, asparagus, sweet corn, etc.

The tray price will determine the usage range. If the tray price is high (approx. 8-10 Eurocents), the usage will be limited to organic produce. However, if the tray price is lower (approx. 5 Eurocents), the complete range of fruits

and vegetables (conventional and organic) could be packed with them. In the latter case, the market volume could be about 1 billion.

Sainsbury's is a potentially interesting client. In case all performance criteria are met, the earning capacity would be as large as 50 million Euros.

3.2.2 Market analysis

All companies contacted are enthusiastic about bran-based trays as long as the final products can meet their requirements. The companies regard bran-based trays as an environmental friendly packaging option with which they can position themselves on the market as environmental and social conscious entrepreneurs.

The level of desired technical requirements varies strongly with the product; see table 3. The least requirements are placed on trays for citrus fruit, onions and garlic. More demanding requirements are placed on trays for wet-packed products (mushrooms and potatoes) and products that suffer from dehydration (courgettes, bell peppers, tomatoes, kiwi's, etc.). The toughest requirements are placed on trays for highly perishable products (salads, scraped beetroots, etc.).

Table 3: The developmental stage of fruit and vegetable trays compared with the expected market, prices and earning capacity. Since this scheme is generic for products other than just fruits and vegetables, other products are also listed.

Developmental stage	1	2	3	4
Technical performance	Coated & coloured Complies with EU laws	Coated & coloured Complies with EU laws Water resistant Reduced WVTR ¹	Coated & coloured Complies with EU laws Water resistant Reduced WVTR ¹ Deodorised	Coated & coloured Complies with EU laws Water resistant Reduced WVTR ¹ Deodorised Reduced gas perm. ²
Products	Onions Garlic Shallots Citrus fruits Apples Pears	Potatoes Mushrooms Kiwis Tomatoes Bell peppers Asparagus Courgettes	Prepared food products Salads Pizza's Bread buns Conventional packed meat	M.A. packed food products Meat Fish Poultry Salads Cheese Nuts
Estim. market size -organic -conventional	1 million 10 million	10 million 1 billion	10 million 10-20 billion	10 million 10-20 billion
Accepted tray price -organic -conventional	max 10 €cents max. 6-9 €cents	max 10 €cents max. 6-9 €cents	max 10 €cents max. 6-9 €cents	max 10 €cents max. 10-15 €cents
Earning capacity [€] -organic -conventional	100.000 500.000	1 million 75 million	1 million 0.75 – 1.5 billion	1 million 1 - 3 billion

1: Reduced Water Vapour Transmission Rates

2: Reduced Gas Permeability

Although many fruit and vegetable companies have shown interest in bran-based packaging trays, these companies are conservative in nature. This implies that the benefits of the bran-based packages should be presented crystal clear and that market penetration is a slow process.

The maximum price paid for bran-based packaging trays is the outcome of a negotiating process with potential end-users. These end-users obviously state to us that the price should be similar to the price of the conventional trays. However, bran-based trays have the additional selling point of being compostable and natural. This additional selling point needs to be exploited in the price negotiation process. For instance, Eurea claims that they are able to sell biodegradable packages to several customers for about double the price of conventional packages. Other examples are the Amcor P-plus concept,; this is micro-perforated polypropylene film that extends the shelf life of fruits and vegetables. This P-plus product is sold for a price threefold and fourfold of standard polypropylene film. Hence, the compostability of the bran-based trays renders negotiation space that can be exploited. It is assumed that bran-based trays can be sold for prices roughly 1.3 – 1.8 times the price of conventional trays, about 6-9 Eurocents per tray.

3.2.3 Set of requirements

The most important technical and marketing requirements are listed below. The technical performance of moulded fibre trays was used as reference point.

Technical criteria:

- **Mechanical properties.** More elastic to cope with the rough handling during distribution.
- The **edges** need to be more smoothened to avoid cutting.
- The **odour** should be reduced and not transmitted to the products.
- **Wet strength.** The packages should remain strong under wet and moist conditions.
- **Absorbency.** Fruit fluids need to be absorbed.
- **Machinability.** The packages should run smoothly on the flow packers and / or tray sealers.
- **Compostability.** The articles will be sold as compostable, and hence need to comply with European legislation.

Marketing criteria:

- The **colour** needs to be black, blue, green, white or off-white.
- **Printability** is highly desired.
- **Comply with European legislation.** Obviously, all food contact materials need to comply with the European law, which sets limits on the migration of components from the article to the food product. Most customers will require an official certification.

3.2.4 Conclusions

The market for bran-based fruit and vegetables appears attractive. These environmental friendly packages allow the end-users to position themselves on the market as environmental conscious entrepreneurs, as long as their requirements are met. An important financial constraint is that the tray price should be roughly 1.3 – 1.8 times the price of the conventional trays. Important technical constraints relate to wet-strength, reduced water vapour transmission rate, improved elasticity and odour. Furthermore, the tray needs to be coloured and printable. Many of these requirements can be met.

The enthusiasm from the end-users combined with the forecast that most of their demands can be met, makes this market attractive.

3.3 *Trays for meat, cheese and prepared food products*

The opportunities of compostable packaging trays for meat, cheese and prepared food products were discussed with two meat companies, three dairy companies and two prepared food companies; see table 4.

Table 4: Interviewed end-users of compostable package trays for meat, cheese and prepared food products.

Company	Type of company	Contact person	Opinion
Porkhof BV	Conventional pork	Paul Dielen	Potentially interested
Hanskamp BV	Innovative meat	Ronald Koenders	Not interested
Campina BV	Dairy	Carla Cornelissen	Not interested
Arlafoods AS	Dairy	Henrik Petersen	Potentially interested
Leerdammer BV	Cheese	Schoot Uiterkamp	Potentially interested
Johma BV	Prepared bread buns and salads	Gert Smit	Potentially interested
Hazlewood Convenience	Prepared sandwiches and pizza's	Hennie Gijsbers	Interested

3.3.1 Market data

Porkhof BV is a small traditional pork packaging company in The Netherlands. They only package pork traditionally; in a PS tray with stretch foil. They are interested in compostable trays in case their retail partners are interested and they will be interested when the price is similar to conventional trays (3-5 eurocents/tray) and the appearance is comparable (white and smooth). In that case, the retailers will regard it as a positive aspect for their clients. Of course, the tray should also absorb the drip. Porkhof is potentially interested.

Hanskamp BV is an innovative meat packaging company in The Netherlands. They only pack meat under modified atmospheres in transparent gas barrier packages. Hanskamp is interested in compostable, transparent gas barrier trays. This rules bran out. Hanskamp does not find it realistic to use only compostable underlayments. If they want to switch to compostable packages, they would like to switch over with the complete range of packages.

Campina BV is the largest dairy company of The Netherlands. Representatives were not enthusiastic about the appearance of the bran-based material. They feel that this appearance is too natural and ecological and far off the image that Campina wants to communicate to their consumers.

Arlafoods AS is the largest dairy company of Denmark and Sweden. This company is involved in a development project for PLA-based flowpacks for cut cheese slices. They are interested in bran-based materials because of the natural appearance of the bran-based materials. For most cheese products, packages with high gas barrier properties are required. This will be challenging for bran-based trays. They would like to be kept informed of the project progress.

Leerdammer BV produces quality cheese products. The trays need to have very good gas and moisture barrier properties. This will be challenging for bran-based trays. If the development project produces potential solutions, he will be very interested.

Johma BV produces prepared bread buns for motorway gas stations. They sell about 30 million of them annually with a black PS underlayment and a PP flow wrap. They are interested in compostable packages, in case the price is not much higher, the colour is black and no odour is transmitted from the tray to the bread bun.

Hazlewood Convenience BV produces several prepared food products and catering products, prepared sandwiches for gas stations and airplanes, prepared and chilled pizza's sold via supermarkets, etc. They see direct opportunities for bran as a pizza underlayer. Currently, they use foamed polystyrene discs of 310, 270 and 230 mm in diameter for prices of 4-6 Eurocents per disc. They also use cardboard-based discs of 270 mm for 6.8 Eurocents per disc. They use 80.000 discs per week (about 4 million annually).

Important points of attention for the further development will be:

- No odour or taste transmission from the disc to the pizza
- No sharp edges, but smooth round edges
- Less mechanically brittle, no flaking-off particles

➤ Good printing qualities

They also see opportunities as sandwich underlayment, but they feel that the pizza underlayer market would be better to start with. They were less clear about the amount of sandwich underlayers used, but these must be many tens of millions per year.

They are willing to co-operate with us during the development.

3.3.2 Market analysis

Two types of bran-based packages could be used in the future for meat and meat products:

- White trays with drip absorbers to replace conventional foamed polystyrene trays
- White gas-barrier, top-seal trays with drip absorbers to replace foamed polystyrene barrier trays for packaging under modified atmospheres.

Since it is technically challenging to produce compostable gas barrier trays (development stage 4 instead of 3 in table 3) the focus should be first on bran trays for conventional (stretch wrap) packaging. These bran-based meat trays should meet already tough criteria: appearance (white, hygienic, smooth surface), drip absorbency, no odour transmission, comparable or slightly higher prices (6-9 €cents/tray), etc. Once these criteria are met, meat companies would like to use these trays in order to re-position themselves on the market as environmental-conscious entrepreneurs.

The potential market size is large. In The Netherlands, about 500 million conventional meat trays are used annually with a price of 6-9 €cents per tray depending on the tray size. Hence, the earning capacity would be 37.5 million Euros for The Netherlands.

Since most cheese products are sold in modified atmosphere packages, the more demanding gas barrier trays are required (last development stage in table 3). Hence, this market should only be considered after these difficult developments have been established. Some dairy companies are interested in bran because of the natural appearance and the related market potential.

Both interviewed convenience food companies (Johma and Hazlewood) were very interested in bran-based underlayments for prepared bread buns, sandwiches and pizza's. Especially Hazlewood was very enthusiastic about the potential use as pizza underlayers. These underlayments have to satisfy several constraints of which zero odour transmission appears most technically challenging (development stage 3 in stage 3). Given the enthusiasm of Hazlewood and their willingness to co-innovate, the pizza underlayers appear to be an interesting test case for the development program. Based on their annual usage (4 million discs) and prices (about 5 €cents) the earning capacity for this first product would be 200.000 Euros.

The development of the pizza underlayer would also be an ideal preceding step in the development of a conventional meat tray. The meat tray needs all the same technical features as the pizza underlayer and one additional demand: drip absorbency.

Meat, dairy and prepared food companies are also generally rather conservative in nature, implying that the market penetration is expected to be a slow process.

Furthermore, the maximum price these companies are willing to pay for bran-based packaging trays is the outcome of negotiating processes. Obviously, all end-users state that the price should be similar to the price of the conventional packages. But it is expected that the added value of compostability can be exploited to raise the price slightly to prices of 1.3 - 1.8 times the price of the conventional trays.

3.3.3 Set of requirements

The most important technical and marketing requirements for the pizza underlayer are listed below. Additional demands for meat trays and cheese trays are also listed.

Technical criteria:

- **Mechanical properties.** More elastic to cope with the rough handling during distribution (P, M, C).
- The **edges** need to be more smoothened to avoid cutting (P, M, C).
- The **odour** should be reduced and not transmitted to the products (P, M, C).
- **Wet strength.** The packages should remain strong under wet and moist conditions (P, M, C).
- **Machinability.** The packages should run smoothly on the shrink film packers, flow packers and/or tray sealers (P, M, C).
- **Absorbency.** Meat drip and cheese fluids need to be absorbed (M, C).
- **Gas barrier properties.** For modified atmosphere packaging of meat, poultry, fish, cheese, meals, etc.
- **Compostability.** The articles will be sold as compostable, and hence need to comply with European legislation (P, M, C).

Marketing criteria:

- The **colour** needs to be white (P, C, M) or green, pink, yellow, blue, black (M).
- Good **printing** qualities (P, C, M).
- **Comply with European legislation.** Obviously, all food contact materials need to comply with the European law, which sets limits on the migration of components from the article to the food product. Most customers will require an official certification (P, C, M).

3.3.4 Conclusion

The market of underlayments for prepared food products is attractive. Once constraints are met, this is ideal start and test market, prior to the much larger meat tray market. The entrepreneurs are interested in bran because it can help them to position themselves on the market as environmentally conscious.

Subsequently, the conventional meat tray market could be targeted. This requires additional development to handle meat drip inside the package (this drip can either be absorbed inside the bran or in a separate drip absorber). This is probably the largest tray market in Europe and very attractive from an economical point of view.

Finally, the modified atmosphere packaging tray market could be targeted. This requires additional development to incorporate gas barrier properties inside the bran-based trays. It is technically challenging to produce compostable materials with barrier properties and hence this will require a substantial development program. Once developed, it is likely that these compostable barrier trays can be sold for relatively high prices of 1.5 – 2 times the price of conventional barrier trays (estimations 10-15 Eurocents per tray).

4 Conclusion

Most market parties interviewed were enthusiastic about bran-based packaging trays. Bran-based trays that can satisfy requirements will assist these entrepreneurs to position themselves on the market as environmental-conscious producers.

Because there is a clear ascending order in the demanded constraints and the type of tray markets, the safest development route is to start with the markets with least demanding constraints and expand the market step by step when technical developments can deliver another milestone. This has been visualised in table 3 and can be summarised as:

1. Trays for onions and citrusfruits
2. Trays for wet packed products (potatoes) that are sensitive for dehydration (bell peppers)
3. Pizza underlayers
4. Conventional meat trays
5. Gas barrier trays for modified atmosphere packaging

Bran-based disposable dishes and bowls are currently already sold in Poland with success. With the correct coating, this success can be extended to the rest of Europe. The market research has given us a limited but promising view of the sales potential. Further market information will only become available when the first prototypes are available. The first contacts with potential end-users have given us the conviction that this is a promising market to penetrate for Biotrem and Via-Management.