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Sustainpack

**Innovation and Sustainable Development in the Fibre Based
Packaging Value Chain**

Outline Specification of Demonstrators
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Prepared by Pira International

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1.0 INTRODUCTION

The demonstrator projects are a tool for animating and communicating the successes and overall potential of the Sustainpack research to a wide audience. Since “seeing is believing,” the demonstrators will show visually and physically the achievements of the project, in order to engage and enthuse potential users about the results. A key aim is to encourage materials producers, converters and packaging users to continue to build upon the platform of technology breakthroughs established by Sustainpack and, through further development work, bring these breakthroughs on to the next level of commercialisation. This process should be facilitated by considering the seven key elements outlined below, which define how an ideal demonstrator might be constructed and managed to, “prove the technical viability of a new technology together with its possible economic advantages under realistic conditions.” Typically, the projects identified and selected through the technology mapping process should:

- Include technologies (methodologies, practices, etc.) representing a high degree of **novelty**, either novel technology or novel application or - even better – both.
- Not include any research activities: all of the necessary **knowledge** must be available for the proposers to implement the demonstration.
- Be executed on a **scale** of operations representing reality.
- Include both technology producers (i.e. the inventor) and technology **users** (i.e. industry partners from the consortium, etc.).
- Be **pre-competitive**. Therefore, the projects should aim at demonstrating a novel technology or a novel application and cannot include marketing activities (i.e. technologies/products already on the market for the same application cannot be demonstrated).
- Have a clear **European dimension** and significance (include two, or preferably more, partners from different Member States).
- Include **targeted dissemination** to potential users and to other groupings that can influence the future success of the technology in the market place (this "Extended Audience" could include for example platforms of users, authorities, opinion leaders, interested organisations, etc.).

In an open discussion with the sub-project 1 partners in February 2006, a total of 7 “integrated demonstrator projects” were agreed, each of which will present the outputs of a minimum of three, sub-project outputs. The demonstrator projects and agreed project managers can be seen in Figure 1.1.1 below, along with the anticipated involvement from each of the sub-projects. Full details for each of these demonstrator projects can be found in sections 2.0 to 8.0 in this document.

2.0 DEMONSTRATORS

2.1 DEMONSTRATOR 1

A corrugated box offering equivalent performance with lighter weight material, incorporating fibre-based cushioning, barrier coatings and an RH indicator/logger

This will be achieved by using the results of SP2 to develop a stronger corrugated box, which can be combined with fibre based cushioning materials of SP5 and incorporated water vapour (WV) of SP4 and relative humidity (RH) indicator/logger of SP6.

This demonstrator project will be managed by **STFI-P**, the specification for this demonstrator project can be seen in Figure 3.1.

2.2 DEMONSTRATOR 2

A carton offering equivalent performance with lighter weight material, incorporating barrier coatings and a 2D barcode

This will be achieved by using the results of SP2 to develop stronger carton board, which can be coated to provide improved water vapour and/or oxygen barrier than normal boards available for constructing cartons. A 2D bar code will be printed (either directly to the board or onto a label) which will carry additional information about the product and packaging. This information will be accessed by a mobile device and when downloaded it will be relayed to the consumer visually or audibly and possibly in different languages, via the mobile device.

This demonstrator project will be managed by **VTT**, the specification for this demonstrator project can be seen in Figure 3.2.

2.3 DEMONSTRATOR 3

A carton offering equivalent performance with lighter weight material, incorporating a laminated barrier film and a 2D barcode

This will be achieved by using the results of SP2 to develop stronger carton board, which can be laminated to provide improved water vapour and/or oxygen barrier than normal boards available for constructing cartons. A 2D bar code will be printed (either directly to the board or onto a label) which will carry additional information about the product and packaging. This information will be accessed by a mobile device and when downloaded it will be relayed to the consumer visually or audibly and possibly in different languages, via the mobile device.

This demonstrator project will be managed by **VTT**, the specification for this demonstrator project can be seen in Figure 3.3.

2.4 DEMONSTRATOR 4

A barrier coated tray for chilled ready meals, sealed with a bio-based nanocomposite film lid and incorporating a temperature logger

This will be achieved by using materials developed in SP5 to construct trays for perishable food products. These trays may be coated to provide improved oxygen and water barrier, seal ability etc (SP4 development). On top of the tray a lidding film

(a composite of renewable polymers and nanoparticles) developed in SP3 is applied. A temperature logger developed in SP6 will be incorporated onto the package in order to show how this technology can be used to monitor and improve perishable food supply chain performance.

This demonstrator project will be managed by **A&F**, the specification for this demonstrator project can be seen in Figure 3.4.

2.5 DEMONSTRATOR 5

A flexible packaging film for frozen food, incorporating barrier coatings and a temperature logger

This will be achieved by using films developed in SP3 to construct bags for frozen food products. These bags may be coated to provide improved oxygen barrier, enhanced printability, etc. A temperature logger will be incorporated, either directly onto the package or on to the secondary packaging, in order to show how this technology can be used to monitor and improve frozen food supply chain performance.

This demonstrator project will be managed by **ITENE**, the specification for this demonstrator project can be seen in Figure 3.5.

2.6 DEMONSTRATOR 6

A flexible packaging film for snack products, incorporating barrier coatings and an RH indicator

This will be achieved by using films developed in SP3 to construct bags for snack food products. These bags/packets may be coated to provide improved oxygen and water vapour barrier, enhanced printability, etc. A relative humidity indicator will be incorporated directly onto the package, to show how this technology can be used to assure pack content quality.

This demonstrator project will be managed by **Pira**, the specification for this demonstrator project can be seen in Figure 3.6.

2.7 DEMONSTRATOR 7

A carton board or micro-flute box for luxury goods incorporating a biodegradable polymer window, moving image and anti-counterfeiting technology

This will be achieved by using micro flute board developed in SP2 to construct a box for luxury products. This box may be printed with a decoration and a moving image to attract the consumer and upgrading the image of a luxury product. Anti-counterfeiting technology may be applied in order to protect the original product to be copied.

This demonstrator project will be managed by **DTI and STUBA**, the specification for this demonstrator project can be seen in Figure 3.7.

3.0 Demonstrator specifications

Figure 3.1

Demonstrator 1 Specification: A corrugated box offering equivalent performance with lighter weight material, incorporating fibre-based cushioning, barrier coatings and an RH indicator/ logger

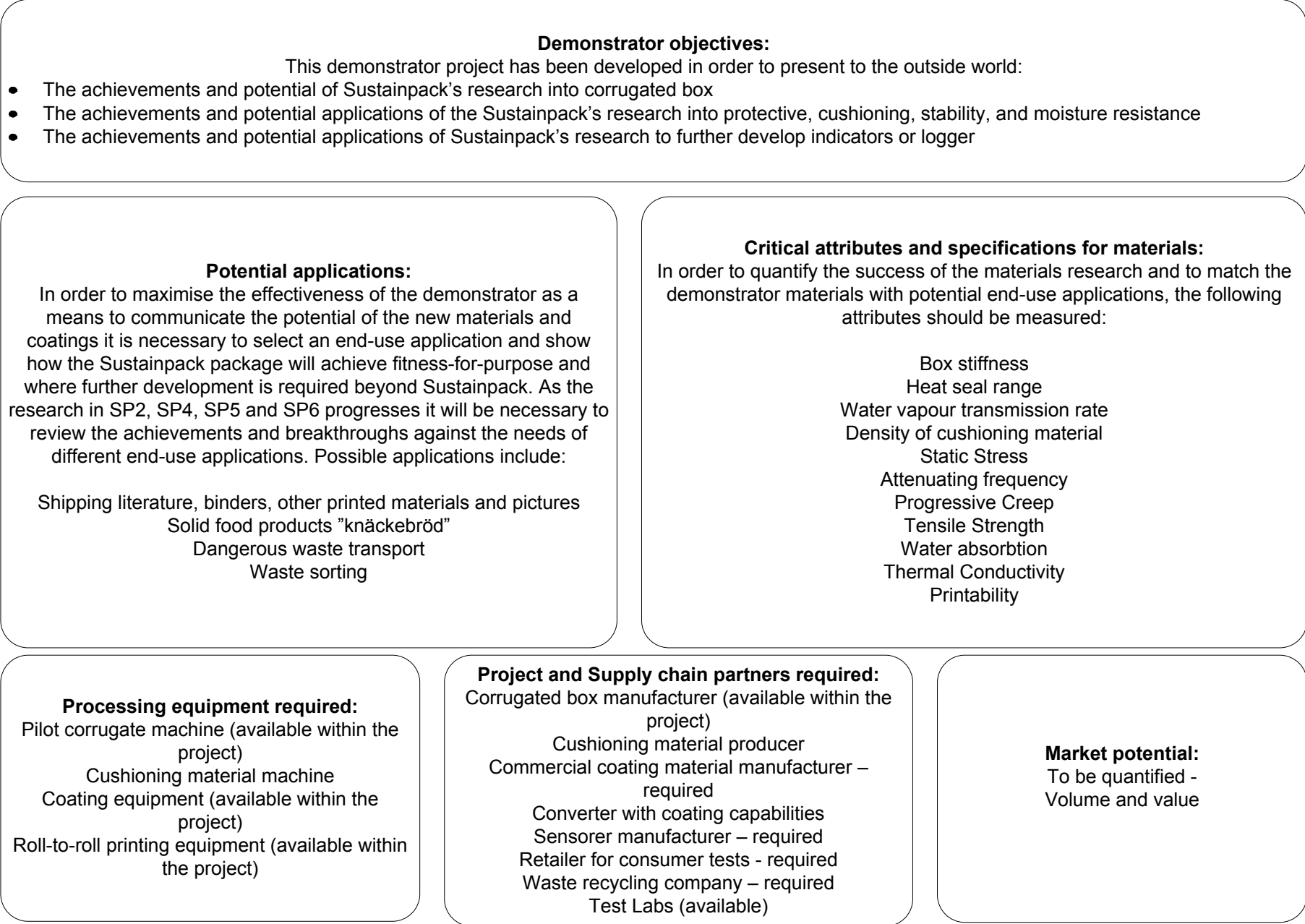


Figure 3.2

Demonstrator 2 Specification: A carton offering equivalent performance with lighter weight material, incorporating barrier coatings and a 2D barcode

Demonstrator objectives:

This demonstrator project has been developed in order to present to the outside world:

- The achievements and potential of Sustainpack’s research into lean and effective liquid paper board (and carton board)
- The achievements and potential applications of the Sustainpack’s research into protective and barrier coatings
- The achievements and potential applications of Sustainpack’s research to further develop 2D bar code technology (linked to mobile phones)

Potential applications:

In order to maximise the effectiveness of the demonstrator as a means to communicate the potential of the new materials and coatings it is necessary to select an end-use application and show how the Sustainpack package will achieve fitness-for-purpose and where further development is required beyond Sustainpack. As the research in SP2 and SP4 progresses it will be necessary to review the achievements and breakthroughs against the needs of different end-use applications. Possible applications include:
Non-food products (e.g. washing detergents)
Solid food products (e.g. biscuits)
Beverages or Liquid foods (milk, juice soup)

The 2D barcode will be readable by a mobile device camera. Its purpose will be as a means to relay product information to special needs groups. The product information will be delivered as an audible or visual message via the mobile device.

Critical attributes and specifications for materials:

In order to quantify the success of the materials research and to match the demonstrator materials with potential end-use applications, the following attributes should be measured:

- Water vapour transmission rate
- Oxygen permeability
- Heat seal range
- Tensile strength
- Elongation
- Board stiffness
- Crease stiffness
- Water resistance
- Surface energy
- Co-efficient of friction
- Grease resistance

Processing equipment required:

- Pilot board machine (available in the consortium)
- Coating equipment (curtain coating, spot coating, etc) (available in the consortium)
- Roll-to-roll print process (available in the consortium)

Project and Supply chain partners required:

- Liquid paper board producer (Stora Enso available in the consortium)
- Commercial coating manufacturer – required to produce sufficient quantities of coating unless this can be produced within the consortium
 - Converter with coating capabilities
- Printer – numerous available in the consortium
- Retailer for consumer testing (JS Sainbury available in the consortium)
- Test labs for verifying physical properties, etc (numerous available in the consortium)

Market potential:

To be quantified -
Volume and value

Figure 3.3

Demonstrator 3 Specification: A carton offering equivalent performance with lighter weight material, incorporating a laminated barrier film and a 2D barcode

Demonstrator objectives:

This demonstrator project has been developed in order to present to the outside world:

- The achievements and potential of Sustainpack's research into lean and effective paper board (and carton board)
- The achievements and potential applications of the Sustainpack's research into protective and barrier laminations
- The achievements and potential applications of Sustainpack's research to further develop in 2D code technology

Potential applications:

In order to maximise the effectiveness of the demonstrator as a means to communicate the potential of the new materials and laminates, it is necessary to select an end-use application and show how the Sustainpack package will achieve fitness-for-purpose and where further development is required beyond Sustainpack. As the research in SP2 and SP3 progresses it will be necessary to review the achievements and breakthroughs against the needs of different end-use applications.

Possible applications include:

- Non-food products (e.g. washing detergents)
- Solid food products (e.g. biscuits)
- Beverages or Liquid foods (milk, juice soup)

The 2D barcode will be readable by a mobile device camera. Its purpose will be as a means to relay product information to special needs groups.

The product information will be delivered as an audible or visual message via the mobile device.

Critical attributes and specifications for materials:

In order to quantify the success of the materials research and to match the demonstrator materials with potential end-use applications, the following attributes should be measured:

- Water vapour transmission rate
- Oxygen permeability
- Heat seal range
- Tensile strength
- Elongation
- Board stiffness
- Crease stiffness
- Water resistance
- Surface energy
- Co-efficient of friction
- Grease resistance

Processing equipment required:

- Pilot board machine (available in the consortium)
- Lamination equipment
- Roll-to-roll print process (available in the consortium)

Project and Supply chain partners required:

- Paper board producer (Stora Enso available in the consortium)
- Commercial laminate film manufacturer
- Converter with laminating capabilities
- Printer – numerous available in the consortium
- Retailer for consumer testing (JS Sainbury available in the consortium)
- Test labs for verifying physical properties, etc (numerous available in the consortium)

Market potential:

- To be quantified -
- Volume and value

Figure 3.4

Demonstrator 4 Specification: A barrier coated tray for chilled ready meals, sealed with a bio-based nanocomposite film lid and incorporating a temperature logger

Demonstrator objectives:

This demonstrator project has been developed in order to present to the outside world:

- The achievements and potential applications of Sustainpack’s research into fibre-based 3D composites
- The achievements and potential applications of Sustainpack’s research into protective and barrier coatings
- The achievements and potential applications of Sustainpack’s research into renewable polymeric matrix with nanoparticles
- The achievements and potential applications of Sustainpack’s research to develop interactive temperature loggers

Potential applications:

The degree to which barrier properties are achieved will dictate what end-use applications the packaging may be used for. High barrier will provide for a wider market (e.g. food with a longer shelf life)

The temperature logger/indicator will provide a mechanism for monitoring the performance of the chilled food chain. This will be targeted at supply chain stakeholders rather than consumers.

Critical attributes and specifications for materials:

In order to quantify the success of the materials research performance targets should be set the following attributes:

- Tensile strength – Machine Direction (MD)
- Tensile strength – Traverse Direction (TD)
- Elongation (stiffness) – Machine Direction (MD)
- Elongation (stiffness) – Traverse Direction (TD)
- Puncture resistance – (N)
- Tear resistance (mN)
- Transparency (lidding film)
- Formability (3D material)
- Oxygen and Water vapour transmission rate
- Heat seal range
- Temperature range and accuracy

Processing equipment required:

- Sheet casting equipment
- Thermoforming equipment
- Pilot coating equipment (curtain coating, spray coating, etc) (available in the consortium)
- Pilot film extrusion (preferred to casting)
- Possibly full scale film extrusion
- Roll-to-roll printing for temperature logger (available in the consortium)
- MAP tray sealer (for modified air) (available in the consortium)

Project and Supply chain partners required:

- Possibly film/sheet manufacturer
- Possibly tray manufacturer
- Commercial coating manufacturer – required to produce sufficient quantities of coating unless this can be produced within the consortium
- Possibly printer for printable electronics
- Test labs for verifying physical properties, etc (numerous available in the consortium)

Market potential:

- To be quantified -
- Volume and value

Figure 3.5

Demonstrator 5 Specification: A flexible packaging film for frozen food, incorporating barrier coatings and a temperature logger

Demonstrator objectives:

This demonstrator project has been developed in order to present to the outside world:

- The achievements and potential of Sustainpack's research into fibre-based composite films
- The achievements and potential applications of the Sustainpack's research into protective and barrier coatings
- The achievements and potential applications of Sustainpack's research to develop interactive temperature loggers

Potential applications:

The degree to which grease resistance is achieved will dictate what end-use applications the film may be used for. High grease resistance will provide for a wider market (e.g. including high fat content French fries, etc)

The temperature logger/indicator will provide a mechanism for monitoring the performance of the frozen food chain. This will be targeted at supply chain stakeholders rather than consumers.

Critical attributes and specifications for materials:

In order to quantify the success of the materials research performance targets should be set the following attributes:

- Water vapour transmission rate
- Heat seal range
- Tensile strength – Machine Direction (MD)
- Tensile strength – Traverse Direction (TD)
- Elongation – Machine Direction (MD)
- Elongation – Traverse Direction (TD)
- Puncture resistance – 20N
- Tear resistance (mN)
- Dart impact (g)
- Surface energy (printability)
- Co-efficient of friction
- Grease resistance

Processing equipment required:

- Pilot film extrusion (preferred to casting) (available at STUBA)
- Possibly full scale film extrusion
- Pilot coating equipment (curtain coating, spot coating, etc) (available in the consortium)
- Possibly conversion and filling line equipment

Project and Supply chain partners required:

- Possibly film manufacturer
- Commercial coating manufacturer – required to produce sufficient quantities of coating unless this can be produced within the consortium
- Possibly converter
- Possibly filler
- Test labs for verifying physical properties, etc (numerous available in the consortium)

Market potential:

- To be quantified -
- Volume and value

Figure 3.6

Demonstrator 6 Specification: A flexible packaging film for snack products, incorporating barrier coatings and an RH indicator

Demonstrator objectives:

This demonstrator project has been developed in order to present to the outside world:

- The achievements and potential of Sustainpack's research into fibre-based composite films
- The achievements and potential applications of Sustainpack's research into protective and barrier coatings
- The achievements and potential applications of Sustainpack's research to develop and successfully apply RH indicators to consumer packaging

Potential applications:

The rate of O₂ and H₂O transmission, and resulting level/cost of spoilage will dictate what applications the film may be used for.

Similarly, the degree of grease resistance achieved will also dictate what end-use applications the film may be used for. High grease resistance will provide for a wider market (e.g. including high fat content snacks and crisps).

The RH indicator will provide a mechanism for monitoring the condition of the pack contents. This will be targeted mainly at consumers rather than supply chain stakeholders.

Critical attributes and specifications for materials:

In order to quantify the success of the materials performance, targets should be set the following attributes:

- Water vapour transmission rate
- Oxygen transmission rate
- Heat seal range
- Tensile strength – Machine Direction (MD)
- Tensile strength – Traverse Direction (TD)
- Elongation – Machine Direction (MD)
- Elongation – Traverse Direction (TD)
- Puncture resistance (N), Tear resistance (mN), Dart impact (g)
- Surface energy (printability)
- Co-efficient of friction
- Grease resistance

Processing equipment required:

- Pilot film extrusion (preferred to casting)
(available in the consortium)
- Possibly full scale film extrusion?
- Pilot coating equipment (curtain coating)
(available in the consortium)
- Possibly conversion and filling line equipment

Project and Supply chain partners required:

- Possibly commercial scale film manufacturer
- Commercial coating manufacturer – required to produce sufficient quantities of coating unless this can be produced within the consortium
- Possibly converter
- Possibly filler
- Test labs for verifying physical properties, etc
(numerous available in the consortium)

Market potential:

- To be quantified -
- Volume and value

Figure 3.7

Demonstrator 7 Specification: A carton board or micro-flute box for luxury goods incorporating a biodegradable polymer window, moving image and anti-counterfeiting technology

Demonstrator objectives:

This demonstrator project has been developed in order to present to the outside world:

- The achievements and potential of Sustainpack's research in stronger boards in order to produce luxury boxes
- The achievements and potential of Sustainpack's research in producing biodegradable sheets
- The achievements and potential of Sustainpack's research in printing moving images on packaging
- The achievements and potential of Sustainpack's research in anti-counterfeiting

Potential applications:

The concept is designed to pack luxury or high-end products in order to give the products a better position on the market and to add other features to the market. The idea is to merge high quality with new feature as a moving image. For this kind of products anti-counterfeiting is an important issue.

Critical attributes and specifications:

The moving image shall have a size of more than 3x3 cm and be able to play sequences of more than 100 different frames in min. 10 frames/sec.
The anti-counterfeiting system shall have an intelligent security system.
Window requirements (clarity etc?)

Processing equipment required:

The board and box pilot line
The polymer film extrusion line (available at STU)
Printing for moving images can be done at ACREO
Anti-counterfeiting (ACREO or KaU?)

Project and Supply-chain partners required:

Paper manufacturer
Box converter
Biodegradable polymer manufacturer

Market potential:

To be quantified in volume and value

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