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Market analysis
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Preliminary view

WP8 – Task 8.3 –D56

Montreux

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Bio-Sense

Market analysis

Goal

- Estimate European market opportunities for GoodFood technologies in the selected analysis/market segments
  - Demand (type, size)
  - Understand demand drivers and critical issues
  - Identify perceived and real barriers of entry
  - Estimate economic impact

Problems encountered

- Extreme complexity of the fields covered by the project (segments, type of risks, safety, quality)
- GF developments not immediate > longer term view on economic motives and systemic changes in society influencing opportunities
- Project assessment in view of broader scope of applicability
  - Focus on the qualitative aspects, i.e. understanding the dynamics on which GF technology concepts can be supported

Safety in the food supply chain
Key drivers of change (1)

Global

- World Trade liberalisation (price pressure, EU safety standards)
- Organic, integrated and sustainable food production (fair trade)

Regulatory drivers

In Europe: "Liability of the end-product seller"

- Traceability of all products, ingredients and raw materials
- HACCP principles further upstream integrated into agriculture
- More restrictions on food contaminants and permitted levels
- Litigation trend slowly penetrates in Europe

"Society is increasingly risk averse, shifting responsibility upstream"

Safety in the food supply chain
Key drivers of change (2)

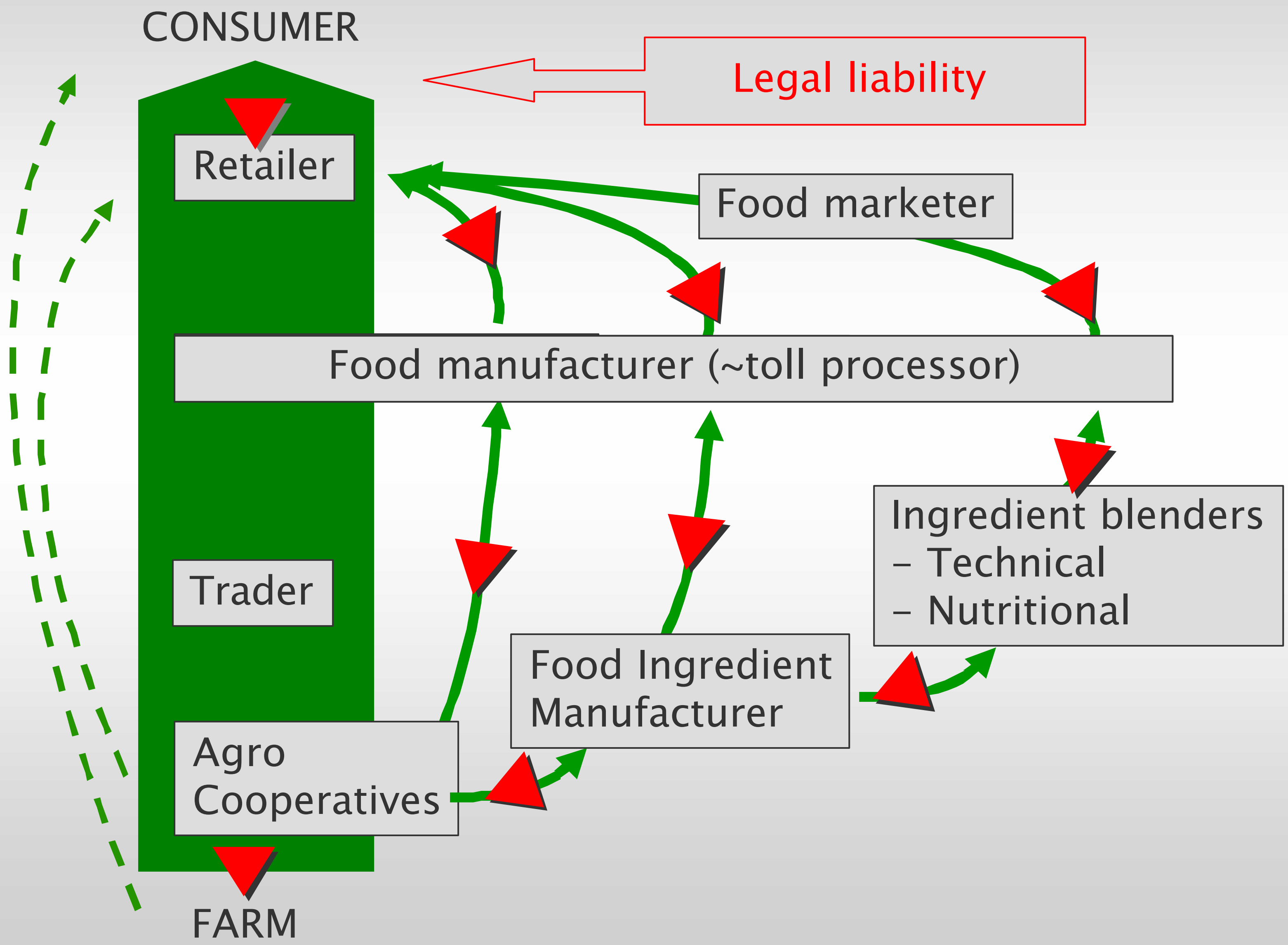
Consumer

- Faster and more individual lifestyles > convenient processed foods
- Growing awareness and food safety concerns > traceable, natural, sustainable and healthy food production (slow food, fair trade)
- Reduced spending on food (e.g. UK<10 %)

Food industry

- Increasing retail power > pressure on margins, cost, efficiency
- Fragmentation and complexity of the supply chain (assembly line, outsourcing, off-shoring):
  - Brand marketers (move downstream)
  - Producers (move upstream)
- More import from outside EU

Complexity of the food supply chain



Food safety/quality analysis
The recent evolution: how and why

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From QA (end-product analysis)

- prevent contaminated end-product from being consumed
  - Representative sampling (low defect rates, uneven distribution)
  - Products with low defect rates (microbiological) require too high sampling frequencies to be economically viable
  - Minimally detectable contaminant levels in end-products

To HACCP (in process control)

- prevent contamination from entering the production chain
  - Legal liability pushes food safety control up the supply chain
  - HACCP principle in agriculture: food safety control at the harvesting stage
  - Analytical techniques not yet adapted to high sampling rates

Diagnostics market
Key dynamics

Food Safety (GF WP1-WP2-WP3-WP4)

- Regulation is the primary determinator
- Competitive improvements come into play only when regulations are set
  - The regulator is in the driving seat to foster change by facilitating progress in analytical methodology (GoodFood focus)
  - Cost driven competition
  - Official acceptance of tests is the key marketing tool
  - Mostly post mortem > cost is important, time not

Food Quality (GF WP5-WP6-WP7)

- Independent competitive dynamic based on customer requirement and marketing mechanisms (e.g. organic)
  - Value driven competition (differentiation, loyalty, added value, cost)
  - Market acceptance, customer partnership and proprietary technology are key marketing elements

Global diagnostics market
Food Microbiology (pathogens + spoilage)

- Estimated market is 558 million tests
- Total market for microbiological analysis is worth 1.45 billion €
- Service laboratories account for over 90% of all the analyses
- 70% of the analysis is for Samonella and Listeria
- Weighted average cost of test (ACT): 2.6 €
- Use of rapid test kits has reached 37% of the analyses
- In-house testing is usually done where rapid test kits are feasible
- Expected annual growth to 2008: volume 5-6%, value 9-10%

Global diagnostics market
Chemical contaminants

- Estimated market is 55 million tests, worth 300 million €
- Mostly cheap antibiotic tests
- Average cost of test (ACT): 50-60€ (1.5€ in antibiotics)
- Expected annual growth to 2008: volume 6%, value10-12%
- Pesticides are the largest sector (40%) followed by mycotoxins (35%)
- Penetration of novel methods reached 25% in 2004
- Less than 5% of the analysis is performed in-house

Goodfood target markets

	SAFETY				QUALITY		
	Antibiotics	Pesticides	Mycotoxins	Pathogens	Quality parameters	Logistics	Aml
DAIRY	v		v	v			
FRUIT		v	v			v	
WINE		v	v		v		v
FISH				v	v		

- Each sector is very relevant but with very different dynamics and issues

Antibiotics

- Main markets concerned: dairy, meat, fish, honey
- Currently mostly analysed by rapid test kits (multi-residue)
- 90% of all reported contaminations are β-lactams
- Estimated diagnostics market: 55 million € (~25 million tests)
- Regulatory concern about cumulative doses in humans and growing risk for antibiotic resistant strains
- Antibiotic (as growth enhancer) use in feed totally prohibited
- Contamination of food chain now only through deliberate disease treatment of animals

Antibiotics
Dairy

- Milk supply chain is most advanced example of integrated safety analysis:
  - Official sampling at each loading (post mortem analysis)
  - Analysis in truck before delivery (speed is essential)

Key demand driver

- Reduce time cost at unloading – interest for instant test, preferably already at loading (farm compatible) to avoid contamination in truck
- Farmer interest to check milk quality after AB treatment (per animal)

Economic impact

- 0.15% AB positive milk (195 kt) represents a lost value of 60 mio € for the farmer; little value is lost by food industry (process or dilute)
- Farmer is main interested party to improve/optimise detection

Issue for GF approach

- Already very cheap detection methods (1.5-4 €) > difficult to replace – higher price acceptable if cost (risk) saving for farmer
- Other targets for AB detection in liquid to be considered (honey?)

Pathogens

- Microbiology represents > 90% of the industrila diagnostics (3.2 billion €) and is thus by far the most important sector for diagnostics
- Salmonella and Listeria represent 70% of all analysis
- Relevant to all food markets, be it fresh produce or processed food or drinks either in the end-product or the process environment
- Mostly traditional methods (plate-count, mainly service) but growing presence of rapid tests (37%) for specific pathogens
- Barriers to entry:
  - image of plate counts has become an industry tradition
  - Low product/high time cost vs. high product/low time cost

Pathogens
Dairy

Major problem

- End-product sampling: high frequency (low defect rates, uneven distribution) and reliability from complex matrices (extraction, incubation step)
- No instant measurement tools to control in process (only HACCP)
- Time cost for end-product analysis becomes critical (reduce from 24-36 to 4-8 hours)

Key demand driver

- low cost, high throughput method needed (speed becoming more important because of shorter delivery and storage deadlines)

Economic relevance

- important: off-code product must be reworked or disposed of
- But estimated failure rate in industry is very low: probably $<0.1\%$
- Continuous production methods make estimations difficult
- However, solution is relevant to all liquid food products

Pesticides

- EU strong limitation of traditional and new pesticides is leading to less pesticide use: integrated agriculture > organic agriculture (steady increase in the world, except USA)
- Persistence of pesticide residues in soil and water will require careful analysis for several more years but will eventually fade
- More emphasis on detection in imported end-products
- Detection may shift closer to primary production
- Main markets: all vegetable crops and derived ingredients
- Typically multi-residue analysis > new methods should be compatible with a matrix/array-type approach
- Main problem is extraction: single method for a broad range
- Current analysis very expensive (200 - 500€) and time consuming

Pesticides
Fruit

- Main market concerned is fruit preparation and juice producers (concentrate!), because often used in baby food (even lower MRL's)
- Storage of juice/concentrate in large tanks > dilution effect reduces risk

Key demand driver

- Regulatory compliance
- Costly and complex analysis (difficult to do in-house)
- Fruit processors are becoming more concerned with contaminant levels of raw materials and would like to detect pesticides in raw materials before processing (select suppliers based on this)

Economic relevance

- Very small: final juice products are often blends of various batches and any contaminants are 'easily' blended away. Fruit preparations can be blended for this purpose.

Pesticides
Wine

- With wine and grape producers often being one entity, pesticide use is well known and can be easily controlled
- Integrated agriculture now reduces the risk further, hence there is little concern for too high pesticide levels in the industry. Moreover, as for fruit juice, wine-making allows for any dilution if necessary
- The number of analysis is limited and outsourced to lowest cost lab

Key demand driver

- Regulatory compliance – no specific demand for other solutions

Economic relevance

- Very small

Mycotoxins

- Magnitude and impact only recognised relatively recently
- Main markets: dried fruits, nuts, cereals and snacks
- Heat and extraction stability are key concerns for processed food industry
- Very low toxic dose and potential occurrence of very high levels in a tiny contaminated pocket > risk is not diluted easily in a food/ingredient
- Recent regulatory measures in EU imposes lower limits
- 40% of all notified contaminations are for mycotoxins and virtually all is in EU imported products, thus EU primary producers are not concerned
- Analysis is specific for a type of mycotoxin (linked to raw materials)
- Diagnostics demand is rapidly growing (35% of total chemical contam.)
- Analysis is very expensive (150-200€)
- Main problem is very low level (<20ng/l for aflatoxin M1)

good food

Mycotoxins
Fruit

- Main market concerned is imported dried fruit, nuts and cereals which is outside the GF scope
- Apple juice and compote are directly concerned EU products (patulin) but little evidence of regular occurrence of contamination

Key demand driver

- regulatory compliance
- No demand for rapid in-house testing
- Reduce cost of expensive mycotoxin analysis (150-200€)

Economic relevance

- None: off-code juice product is diluted by blending

GF to consider

- To cover the major demand, GF should ideally consider technology suitable for liquid extracts (water, solvent?) from dry products (consider emphasis on extraction and pre-concentration?)

Mycotoxins
Wine

- Mycotoxins occur regularly in wine (and more in S.European wines) but their presence remains limited and diluted. Imported products are also within

Economic relevance

- OTA in wine is of limited importance: no reported excess levels (dilution)

Mycotoxin producing fungi

- Infections with mycotoxin producing fungi in the vinyard are usually very local and non-systemic. There is a demand for mould growth detecting systems in vineyard but not for mycotoxin producing fungi in particular.
- Internal competition with AmI virtual sensor approach to detect mould-growing conditions.
- Manual rapid detection system would be useful for tropical fruit and cereal cultures where systemic infections occur more regularly (climate)

Quality parameters
Fish

Problems

- No real quantitative parameters of freshness available
- Safety entirely relies on cold-chain maintenance with many transfers posing risk for cold-chain interruption

Key demand drivers

- Recording of cold chain maintenance – early detection of failure (retailer)
- Rapid detection of freshness allowing more frequent sampling before processing (processed fish industry)
- Consumers (retailer) demand traceability of origin and freshness indicator

Economic relevance

- moderate as off-code product still useful for fish meal and fish feed (0.2-0.3% of the volume)
- Added value creation by competitive differentiation

Quality parameters
Wine market

- Economically important sector for Europe (68% of 150 billion € world market value)
- Under strong competitive pressure both on its home and export markets from New World wine producers
- Price/quality rules the market > branding more important and traditional classifications in Europe less relevant for the market
- Struggling because:
  - very fragmented industry (Italy>France>Spain) > high cost
  - large variability in grape quality and fermentation > inconsistent end-product quality
- Profitability is too low
- GF technology offers posible opportunities especially in better vineyard management, grape quality and fermentation control

Quality parameters
Wine

Problem

- There is a lack of understanding about the relationship between grape variety/quality and wine quality attributes
- A wide range of parameters are assumed to be possible but need to be established in correllation with end-product quality
- Similarly more fermentation parameters than actually controlled are important for an optimal fermentation

Key demand driver

- Achieve higher quality wine and profitability by better selection of grape variety/quality and better control of the fermentation process

Economic relevance

- Generate added value by shifting from basic/popular wines to premium wines (increase by 50-200% sales value ex-cellar). For an average EU winery this may represent additional income of 30.000 € in the medium term (excl. additional analytical costs).

Ambient Intelligence
Wine

Problem

- Natural variation within vineyards results in inconsistent grape quality and thus irregular fermentation and wine quality

- With the right and more detailed information, micro-management of the vineyard and the cellar is possible raising overall grape quality, having coherent fermentation patterns, reducing costs from redundant spraying and irrigation

Key demand driver

- Achieve higher quality wine and profitability by precision vineyard management and on-line control of the fermentation process

Economic relevance

- In the medium term, losses in the order of 22-35.000 €/average vineyard could be avoided with an AmI system. If only 10% of the vineyards achieves this, it would represent an a economic surplus of 1 billion €.

Wine is a good target market for technological innovation

- Wine is a value added product where the producer still earns a reasonable part of the value chain. This is not the case in many other agriculture segments. Given investment and return opportunities are reasonable, new technologies should find it easier to be adopted.
- Wine is a product with an image based on quality, including major elements of origin and craftsmanship. which technology can help to improve and to make it more consistent.
- The wine industry, being very traditional in Europe, has still a lot to benefit from technological and scientific progress both in the field as well as in the cellar. One could say that in Europe art has dominated the industry whereas in the new world a competitive advantage was built on science and technology.
- The modernisation of the image of the wine industry and trade due to the new world producers has also provided a platform for a more ‘high tech’ approach in the marketing. This is reflected in more trendy labels which imply to consumers a ‘modern product’ made according to modern principles, attracting a new and younger public.

Concluding remarks

- Many sectors have interest in rapid and on the spot (in-house) analysis for key safety parameters
- Analytical cost reduction is often of the only driver and thus in many cases the most substantial barrier for new technology to enter. This is particularly the case for
- Where other drivers play an important role the economic justification for introducing new technologies seems better:
  - Antibiotics/dairy: testing at the farm
  - Pathogens/dairy: speed and high throughput
- The economic justification for introducing new technologies is most clearly defined for the quality elements which contribute to value creation, but depend also more on successful marketing these benefits
- Mycotoxin analysis in liquids is rather far from the markets of concern
- GF focus on liquid foods

“GF target sectors are to a large extent suitable to demonstrate feasibility of new technologies”