Improved competitiveness through optimization of cold chain communication

Guðrún Ólafsdóttir
Implementation Coach CHILL-ON

Pre-conference Workshop - EFFoST
Budapest November 10th 2009
Real time temperature monitoring, geographic location and traceability system

Supply Chain Management & Decision Support System

Improved quality, safety, transparency and traceability for consumers

Fish Supply Chain Hand over points
- From vessel
- Fish Market
- Processor
- Trucking company
- Shipping Company
- Stevedoring at foreign port
- Trucking to 2nd processor
- Secondary Processor / Depot
- Trucking to Market
- Sales point at Market
- Trucking to buyer
- Buyers depot / cold store
- Trucking
- Retailer / Fishmonger / Restaurant
- Consumer

Optimized chilling
- T-sensors, GPS - ICT

Optical TTIs for packaging
- QMRA / SLP models

Rapid detection of bacteria / qPCR

CHILL-ON Technologies
Content

• CHILL-ON project
• CHILL-ON technologies
• Vision of CHILL-ON
• Implementation and validation in field trials
  – Monitoring of temperature - transparency
• Industrial requirements
  • Competitiveness
  • Compliance with regulations – industrial standards
  • Added value
CHILL-ON Consortium
25 partners from 12 countries

Duration: 4 years (July 2006 - June 2010 => ext. Dec 2010)
Total budget: 15,6 Mio. €
EC contribution: 10,1 Mio. €
Coordinator: ttz Bremerhaven
Intergrated project, FP6, Food Quality and Safety
Novel technologies to improve the safety, transparency and quality assurance of the cold chain

www.chill-on.com

intermediary between the anticipated and already achieved results of Chill-On and the practical needs of industry.
**Implementation - Communication**

**Challenges**

- **Different countries**
  - Cultural barriers
  - Language barriers

- **Different scientific disciplines**
  - Lack of understanding
  - Isolation

- **Industrial partners**
  - Competition - IPR
  - Motivation
  - Commitment

**Food industry**

**R&D Technology providers**

**Authorities**

- Preparation for field trials
- Implementation and validation of technologies
- Integration, communication,
- Complementary motives and mutual benefits of partners
Validation of CHILL-ON technologies in field trials

CHILL-ON technologies

- a holistic concept
- stand alone technologies

Status

- Prototypes - still in the testing phase
- Ready for implementation
- Commercial products

Supply chains:

- Poultry
  - Germany
  - Italy
  - Brazil
- Fish
  - Cod IS->FR
  - salmon, CSS NO->FR
  - Hake - Chile
  - Tilapia - China
CHILL-ON technologies conceptual holistic approach

- Improved chilling methods
- Novel packaging concepts
- Safety and quality information

CHILL-ON

www.chill-on.com

T-sensor
RF-TTI
Color-TTI

DAM / MMU
SMU

Real time temperature data

Location data-Traceability

Real time temperature data

PCR - microbial analysis

Over limit
Under limit

Hazard potential

No risk
Shelflife prediction

TRACECHILL server

Tracking & Tracing / GiS
Decision Support System
Quantitative Microbial Risk Assessment
Shelflife Prediction
Supply Chain Management

UNIVERSITY OF ICELAND
Vision of CHILL-ON

www.chill-on.com

Quality, Safety & Traceability of Food Supply

ISO

Commercial Standards

Food Legislation

Chill-On Technologies

Traceability

Step Analysis and Action Points (SAAP)

HACCP

SOP

TOR

Monitoring

Responsible

Control

Verification

Target Criteria

Consumer

Food Chain Supply System

Optimization of chilling

T-sensors - Real time temperature monitoring

Rapid detection of bacteria (PCR)

Time Temperature Indicators

Smart labels

RF-TTI, OnVu

WLAN

GSM

TRACECHILL Server

Tracking and tracing

Supply Chain Management Decision Support System

UNIVERSITY OF ICELAND

EU
Implementing technologies in field trials risk based approach

- Adapt the 7 steps of HACCP methodology
- Analyse risks in the process of implementing technologies
- Evaluate all obstacles / Risk Assessment / Action points

➢ SAAP – based on preventive measures
Establishment of Standard Operation Procedures (SOP) and TOR - Field trials scenarios

Preventive measures

Partner Responsibility Document
CHILL-ON reference documents

- Assessment of the chains
  - Flow charts, process description,
  - Temperature mapping
- SOPs for technologies/Application sheets
- Allocation of technologies in each link
- Risk assessment - Contingency plans

Step Analysis and Action Points
SAAP

TOR – Field Trial Scenarios
Experimental design
Validation goals
Assessment of supply chains

- processes
  - Air transport v.s ship
  - Packaging
    - MAP/air / cooling mats
  - Optimized chilling
    - slurry ice v.s. CBC (Contact Blast and Cooling)

- requirements of the industry / authorities
  - Temperature criteria
  - Type of bacteria and limits
Mapping trials: cod fillets / loins transported by ship/truck IS-UK-FR

- Landing / weighing / market IS
- Transport to factory
- Storage in factory
- Processing and packaging
- Storage before shipment
- Transport to shipper IS
- Storage at shipper IS
- Shipping to Immingham UK
- Storage in Immingham UK
- Shipping to BsM FR
- Arrival at BsM FR

Temperature abuse - handover storage -> transport

Optimum chilling

Immingham UK storage -> transp.

Transport by ship
Effect of temperature abuse on shelf life of cod loins

Shelflife of products under various conditions verified by sensory analysis.
— Decision Support System based on output from:

- Quantitative Microbial Risk Assessment Specific Foodborne Pathogens (SFP)
- Shelf life prediction - Specific Spoilage Organisms (SSO) *i.e. in cod*
  - *P. phosphoreum*
  - *Pseudomonas spp*
  - *H₂S*-producers

— **QMRA/SLP models take into account growth rate of bacteria at different temperatures**
Molecular diagnostic tools

PCR test kits (Polymerase Chain Reaction) for
✓ food pathogens (i.e. Salmonella, Listeria monocytogenes, Campylobacter, E. coli, S. aureus)
✓ spoilage organisms (P. phosphoreum, Pseudomonas ssp, H₂S-producers)
✓ hygienic markers (Enterobacteriaceae)

Status:
✓ Validation of methods in ring trials between laboratories/ external laboratories
✓ Shelf life studies to verify their correlation to conventional methods
✓ link traceability with analytical procedures based on DNA analysis

Advantage:
- Analysis time ~ 3-4 hours - conventional methods 3-5 days
- Quantification possible

No. of Bacteria
Molecular diagnostic tools
- stand alone technologies

- PCR test kits
  - Spoilage bacteria
  - Pathogenic bacteria

- Magnetite and silica-magnetite nanoparticles, which can be added during DNA extraction to purify nucleic acids from food material (Univ. Kent)
• Freshpoint technology relies on the properties of organic materials that change color according accumulated temperature history of the product.

• These materials form the basis of a pigment which is used to formulate their intelligent ink.

• The TTI becomes dark when activated (by UV light) and then progressively lighter over time and depending on the temperature history.
OnVu™ – for poultry products in retail

www.chill-on.com
CHILL-ON provides tools to:

- monitor HACCP - safety
  - temperature (T-sensors (active)/ color TTIs, rf-TTIs)
  - microbial contamination /spoilage (PCR-test kits / QMRA models)
- promote food supply of better quality (optimised chilling & SLP models)
- improve traceability (ICT-solutions),

- enhance consumer trust
- supply chain efficiency
- lower the cost of recalls,
- minimize perishable waste,
- enhance sustainability of products,

**Temperature influences shelflife**
- Real - Time Alerts
- Quality v.s. logistics
  - FEFO - First Expired First Out
  - FIFO First in First out
  - Cost – benefit
Food industry - requirements

www.chill-on.com

– Food producers
  • Tools to ensure food safety and traceability
  • Quality / Competitiveness

– Public safety
  • traceability can protect public health and enhance consumer trust.

• Audits / Compliance with regulations & industrial standards
  – BRC (British Retail Consortium)
  – IFS (International Food Standard)
  – ISO 9001 / ISO 22000

  – GMP Good Manufacturing Practices / Codex
  – HACCP – Hazard analysis critical control points system
  – Harmonized auditing and evaluation system

• European directives and regulations

• National legislations

Poultry and Fish supply chains

UNIVERSITY OF ICELAND
Current situation

www.chill-on.com

- information flow - logistics
  - Traceable units / barcodes
  - Data / lab results /
  - Dispatch papers - invoices etc.

- Paper based system in small companies
- Electronic systems in large enterprises
• Functionality testing of HW & SW
• Application sheets for training
• Target criteria
  – Compatibility
  – Signal strength
  – Temperature recording
  – Data transfer

=> Alerts
• Validation
  – Microbial testing
  – Temp & Data loggers
Temperature is interoperable in the chain

if access is given to the temperature profile, the whole chain becomes transparent!

Consumers 😊

Food industry / SME´s/Retail    - Alliances
Surveys: Implementation of traceability & temperature monitoring systems

Studies done in China and EEA, Vietnam and Chile

**Barriers**

- Cost of implementation too high
- Lack of unified standards
- Lack of technical staff
- Lack of governmental support (China)

**Benefits**

- Improve supply chain management
- Differentiate from others

---

Adoption of traceability system in Chinese fishery process enterprises: Difficulties, incentives and performance

Feng Wang ¹, Zetian Fu ¹, Weisong Mu ¹, Liliana M. Moga ² and Xiaoshuan Zhang ²

¹China Agricultural University Beijing 100083, P.R. China. ²Dumbrava de Jos University of Galati, 47 Domneasca Street, 800008 - Galati, Romania. *e-mail: zhsuan@cau.edu.cn
Thank you

Guðrún Ólafsdóttir,
CHILL-ON Implementation Coach
Laboratory of Applied Supply Chain Systems
School of Engineering and Natural Sciences
University of Iceland 
www.hi.is
e-mail:go@hi.is

www.chill-on.com