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FACULTY OF BIOSCIENCE ENGINEERING

Measuring microbial food safety output and comparing self-checking systems of food business operators in Belgium

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Objective of research ?

Belgian risk management decision in 2003 to :

- introduce 'self-checking system' based on PRPs, HACCP, traceability, notification, legal quality aspects along the agri-food chain
- each food business operator must implement a 'self-checking system'
- certification is possible by commercial third parties or by governmental food safety authority
- certificate ➔ minus on yearly taxes
- **Research question : does the introduction of a self-checking system improve the safety ?**

Food Safety Management 2012 – Campden BRI

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FOOD 2 KNOW UGent

Faculty of Bioscience Engineering

Introduction

Food Safety Requirements:
EU Legislation, Belgium legislation, CODEX, PRP/GMP,HACCP, BRC, ISO22000, ...

Development and implementation of a Food Safety Management System in a specific SME/industrial company in the agri-food chain

Safe food products ?

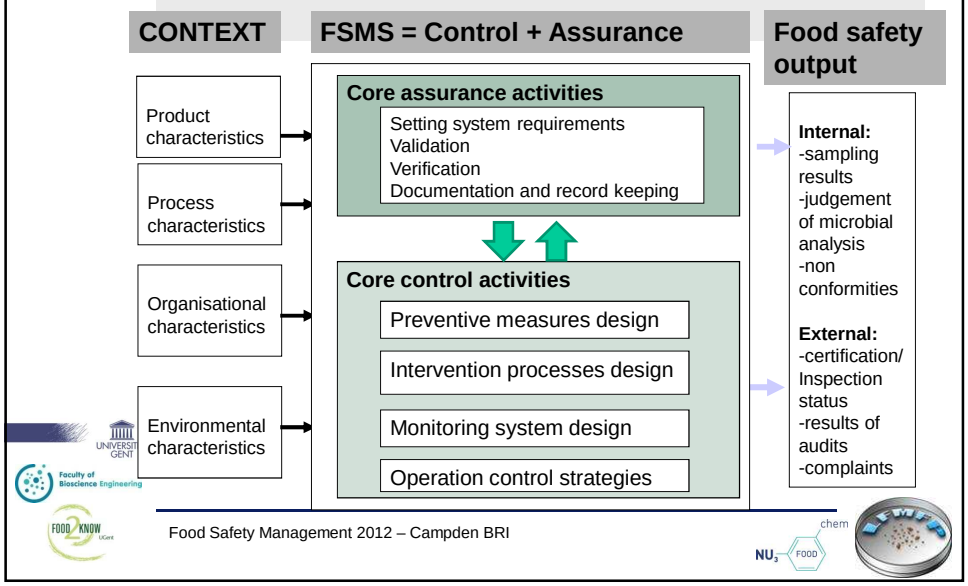
Introduction

EU Research project PathogenCombat (www.pathogencombat.com)

Diagnostic instrument (FSMS-DI) for food processing companies to measure:

- the performance of current FSMS (core control activities and core assurance activities)
- the performance of food safety output
- in relation to the context of a company
- standing apart from auditing/inspection of implemented commercial QA standard/legislation!

Introduction



Introduction

- FSMS-DI – content (58 indicators)

Part I: Introductory section for Food Safety Management System (FSMS)

A.	Introduction questions	(1 -11)
B.	Selection of Representative Production Unit (RPU) for self-assessment	(12-20)

Part II: assessment of contextual factors

A.	Assessment of product characteristics	(A1-3)
B.	Assessment of process characteristics	(B4-6)
C.	Assessment of organisation characteristics	(C7-13)
D.	Assessment of chain environment characteristics	(D14-17)

PART III: assessment of core safety control activities

E.	Assessment of preventive measures design	(E18-23)
F.	Assessment of intervention processes design	(F24-27)
G.	Assessment monitoring system design	(G28-34)
H.	Assessment of operation of preventive measures, intervention process and monitoring systems	(H35-41)

PART IV: assessment of core assurance activities

I.	Assessment of setting system requirements activities (I42-43)	
J.	Assessment validation activities	(J44-46)
K	Assessment of verification activities	(K47-48)
L	Assessment of documentation and record-keeping to support food assurance	(L49-50)

PART V: assessment of food safety performance

M.	EXTERNAL Food Safety Performance	(M51-54)
N.	INTERNAL Food Safety Performance	(N55-57)

Introduction

- FSMS-DI – indicators translated into grids

1. In which situation would you place the risk of your raw materials in your RPU (representative production unit)?

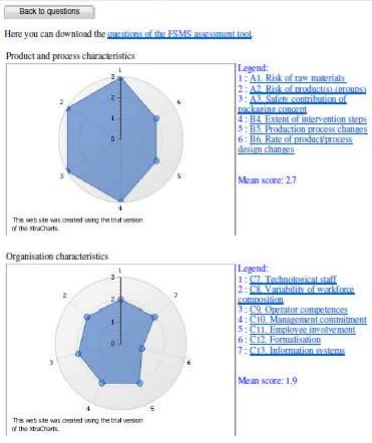
Situation 1	Situation 2	Situation 3
- Basic/major raw materials are not associated with high initial microbial levels and pathogens. - Storage at (uncontrolled) room temperature conditions	- Minor raw materials/ingredients associated with high initial microbial levels and pathogens, which potentially can affect safety of final product. - Storage at lower than room temperature but no specific, strict control requirements	- Basic/major raw materials associated with high initial microbial levels and pathogens, which potentially can affect safety of final product. - High requirements on storage conditions and its control

Supporting information to differentiate situation 2 and 3
- When your raw materials are associated with high initial microbial levels and or pathogens, and when they should be stored below room temperature, then it is level 2 or 3.
- Crucial for level 3 is that high requirements on storage are crucial for prevention of undesired growth of micro-organism (including pathogens).

Previous Next

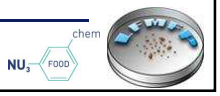
Introduction

- Indicators are organised in spiderwebs
- Results can be applied as internal audit
- Short/mid/long term improvements of FSMS



Introduction

- FSMS-DI:
  - Tool available for PROCESSING FOOD INDUSTRY
  - On line www.pathogencombat.com – on paper
  - Dutch, French, English, Spanish, Greeck
  - Data companies in database of WU
  - Profiling countries – sectors – interventions - …
  - Applied in Belgium study (june 2010 – october 2010)
  - Cooperation FAVV – UGent – WU



Belgian study

- Quantitative study in Belgian food/feed processing companies
- Different sectors - different size
- With/without certified self checking systems : can we see a difference in level of food safety and level of implemented FSMS ?
- 200 companies invited ➔ 82 respondents
- 50% certified for self checking
- 90% certified for commercial system (BRC, IFS, GMP+, etc)
- Only 3 companies without any certificate …

Belgian study

BIAS in our study …

- ➔ Difficult to get companies involved
- ➔ Involved companies ➔ assumed to have higher level in FSMS due to (multiple) certification
- ➔ Involvement of non certified companies ?

Questions:

- ➔ Can we identify clusters/profiles in FSMS performance in food processing companies in Belgium ?
- ➔ Do we see a difference in level of performance of food safety output (low – moderate – good) ?
- ➔ Do we see a difference in level of performance of actual implemented FSMS (basic – generic – tailored/scientific underpinned) ?

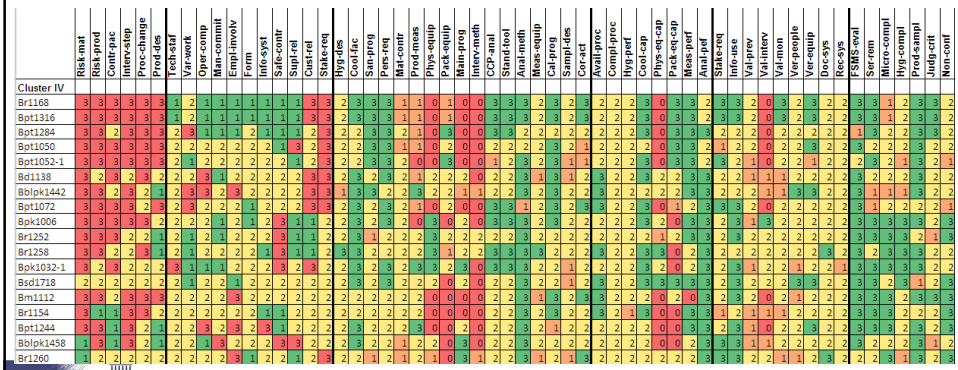
Characterisation of respondents

n = 41 n = 41

Production sector	Micro and small (1-9 & 10-49)		Medium (50-249)		Large (> 249)		Total
Self checking system	Not certified	Certified	Not certified	Certified	Not certified	Certified	
Meat products	10	2	2	3		2	19
Red meat slaughterhouses/cutting		3		5			8
Poultry slaughterhouses/cutting	2		4	2	2	1	11
Ready-to-eat meals	2	2	1	2			7
Dairy			3	2		1	6
Fish processing	4	1	1		1		7
Vegetables, fruits, potatoes trade/processing	2	1	2	3		2	10
Industrial bakery		1	2			1	4
Brewery		1		1		1	3
Feed		2		1			3
Others	2		1	1			4
Total	**22**	**13**	**16**	**20**	**3**	**8**	**82**

n = 35 n = 36 n = 11

Results - database



Cluster IV	Risk-mat	Risk-prod	Contr-pac	Interv-step	Proc-change	Prod-des	Tech-staf	Var-work	Oper-comp	Man-commit	Empl-involv	Form	Info-syst	Safe-contr	Supl-rel	Cust-rel	Stake-req	Hyg-des	Cool-fac	San-prog	Pers-req	Mat-contr	Prod-meas	Phys-equip	Pack-equip	Main-prog	Interv-meth	CCP-anal	Stand-tool	Anal-meth	Meas-equip	Cal-prog	Sampl-des	Cor-act	Avail-proc	Compl-proc	Hyg-perf	Cool-cap	Phys-eq-cap	Pack-eq-cap	Meas-perf	Anal-pef	Stake-req	Info-use	Val-prev	Val-interv	Val-mon	Ver-people	Ver-equip	Doc-sys	Rec-sys	FSMS-eval	Ser-rem	Micro-compl	Hyg-compl	Prod-sampl	Judg-crit	Non-conf
Br1168	3	3	3	3	3	3	1	2	1	1	1	1	1	1	1	3	3	2	3	3	3	1	1	0	1	0	0	3	3	3	2	3	2	3	2	2	3	0	3	3	2	3	3	2	0	3	2	3	2	2	3	3	1	2	3	3	2
Bpt1316	3	3	3	3	3	3	1	2	1	1	1	1	1	1	1	3	3	2	3	3	3	1	1	0	1	0	0	3	3	3	2	3	2	3	2	2	2	3	0	3	3	2	3	3	2	0	3	2	3	2	2	3	3	1	2	3	3	2
Bpt1284	3	3	2	3	3	3	2	3	1	1	1	2	1	1	1	2	3	2	2	3	3	2	1	0	3	0	0	3	3	2	2	2	2	2	2	2	2	3	0	3	3	3	2	2	2	0	2	2	2	2	2	1	3	2	2	3	3	2
Bpt1050	3	3	3	3	3	3	2	2	2	2	2	2	2	1	3	2	3	2	2	3	3	1	1	0	2	0	0	2	2	2	2	3	2	1	2	2	2	2	0	3	3	2	1	2	2	0	2	2	3	2	2	3	2	2	3	2	2	2
Bpt1052-1	3	3	3	3	3	3	2	1	2	2	2	2	2	2	1	2	3	2	2	3	3	2	0	0	3	0	0	1	2	3	2	3	1	1	2	2	2	3	0	3	3	2	3	2	1	0	2	2	1	2	2	2	3	2	1	3	2	1
Bd1138	3	2	3	2	3	2	2	2	3	1	2	2	2	2	2	3	3	2	3	2	3	2	1	2	2	2	0	2	2	3	1	3	1	2	3	2	2	3	2	2	3	3	2	2	1	1	1	2	2	2	2	3	2	2	3	2	2
Bblpk1442	3	3	2	3	2	1	2	3	3	2	3	2	2	2	2	3	3	1	3	3	2	2	3	2	2	1	1	2	2	3	2	3	2	2	3	2	2	2	2	2	3	3	2	2	2	1	1	1	3	3	2	2	3	1	1	1	3	2
Bpt1072	3	3	3	3	2	3	2	3	2	2	2	1	2	2	2	3	3	2	3	2	3	2	1	0	2	0	0	3	3	1	2	3	2	3	3	2	2	3	0	1	2	3	3	3	2	0	2	2	2	2	2	3	1	2	2	2	2	1
Bpk1006	3	3	3	3	3	2	2	2	2	1	2	1	2	3	1	1	2	2	3	2	3	2	0	3	0	2	0	3	3	3	2	3	2	2	2	2	2	3	2	0	3	3	2	3	1	3	2	2	2	2	2	3	3	3	3	3	2	3
Br1252	3	3	3	2	2	1	2	1	2	1	2	2	2	3	1	1	2	2	3	1	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	1	2	3	3	2	3	2	2	2	2	2	2	2	2	3	3	3	3	2	1	3
Br1258	3	3	2	2	3	1	2	1	2	2	2	2	1	3	1	1	2	3	3	2	2	2	2	3	1	2	2	3	3	3	3	2	2	2	3	2	2	3	3	0	2	3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	2	2
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Bsd1718	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2	2	2	2	3	2	3	2	2	2	0	2	0	2	2	3	2	2	1	2	3	2	2	3	3	3	3	3	2	3	2	2	2	3	3	2	2	3	3	2	3	3	1	2
Bm1112	3	3	2	3	3	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	2	2	3	1	3	2	3	3	2	2	2	0	2	0	3	2	3	2	0	2	1	2	2	2	3	3	3	2	3	3
Br1154	3	1	1	3	3	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	0	0	0	0	0	2	2	3	2	3	2	2	3	2	1	3	0	0	3	3	1	2	1	1	1	2	2	2	2	3	3	3	2	2	3
Bpt1244	3	3	1	3	2	1	2	2	3	2	3	2	3	1	2	2	2	2	3	2	2	2	3	0	0	2	0	2	2	3	2	1	2	2	2	2	2	2	0	0	3	3	2	3	1	0	2	2	3	2	2	3	3	3	2	3	2	3
Bblpk1458	1	3	1	3	2	1	2	2	1	3	2	2	2	3	3	2	2	2	3	2	2	1	2	2	0	3	0	2	2	3	2	2	2	2	2	2	2	2	0	0	2	3	3	3	1	1	2	2	2	2	2	3	2	2	2	3	1	2
Br1260	1	2	2	2	2	2	2	2	2	2	3	1	2	2	1	2	3	2	2	1	2	1	2	2	1	0	3	1	2	2	3	1	2	1	3	2	2	2	2	2	2	3	3	3	2	2	1	1	2	3	2	2	2	3	1	3	2	3

Etc….

Results - Food safety output ?

- Overall : moderate (overall score 2) to good (overall score 3) performance of FS output for all Belgian food/feed processing companies

n	Overall score for food safety output
15 (18%)	Good
57 (70%)	Moderate-good
9 (11%)	Moderate
1 (±1%)	Moderate-low

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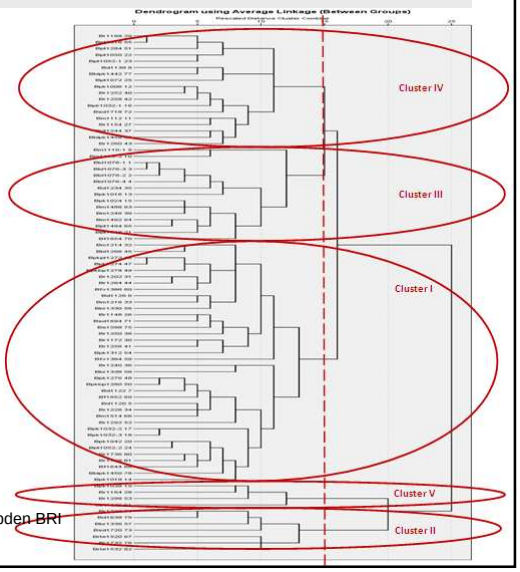
Results - Clusters ?

- Individual database
- Hierarchical cluster analysis
- Dendograms
- 5 clusters could be defined



Results - identification of clusters

73% of all companies and 76% certified SC

Cluster	Number of companies	% certified for self checking	Sector
Cluster I	38	60	Animal products
Cluster II	7	71	Non animal products (FVP, candies, brewery, feed, bakery)
Cluster III	15	20	Animal products
Cluster IV	18	44	Mixture of companies but no intervention possible in process
Cluster V	4	50	Mixture

Overall performance

Results – Cluster I versus III

Cluster I: 97 % commercial 60 % self checking

Cluster III: 90 % commercial 20 % self checking

- Cluster I and Cluster III : all animal products

Results – Cluster I versus III

- Cluster III less advanced FSMS compared to cluster I

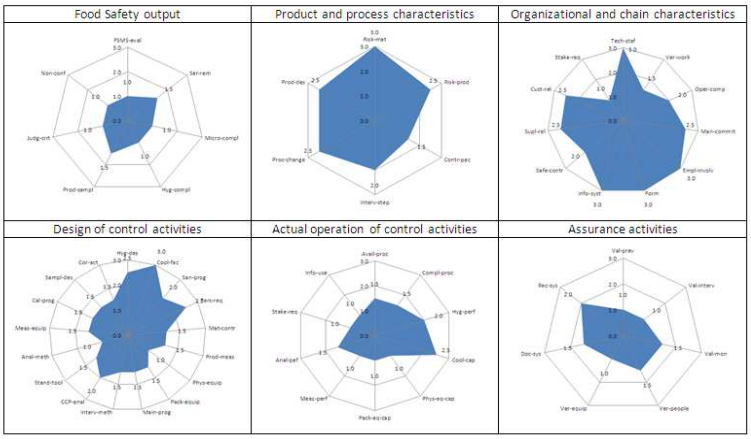
Belgian results in the European context

- Survey also conducted in Spain, Greece, the Netherlands
- Outside Europe e.g. Japan

- Differences with Belgium ?
  - Lower food safety output ➔ internal evaluation of food safety output (e.g. product sampling, judgement criteria, non conformities) ➔ more severe internal judgement by Belgian companies
  - Core assurance activities (validation and verification) ➔ elaborated at higher level in Belgian companies
  - Belgian companies high level of performance of FSMS (more advanced, tailored and scientific underpinned)
  - Awareness of importance of food safety and FSMS ?
  - Drive of legislation / self checking systems ?

Belgian results in the European context

- Example of lowest cluster in European study (no Belgian companies…)



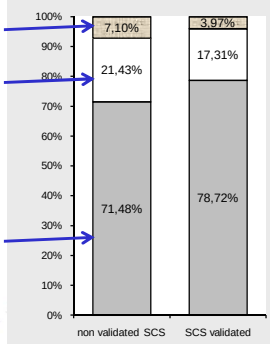
Improvement of FSMS by introduction self checking system ?

- Evolution of official inspection results conducted by government (Belgian FASFC)

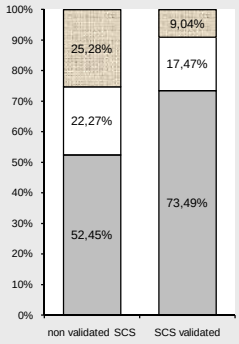
No acceptable inspection results

Acceptable inspection results with remarks

Acceptable inspection results



Transformation sector



Distribution sector

Conclusions

- Overall Belgian food processing companies demonstrated good performance of food safety output and rather advanced level of food safety management systems
- Validation and verification activities in a FSMS are less advanced worked out
- Impact of introduction of self checking systems was more difficult to see in transformation sector due the the high presence of voluntary standards and certification

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Conclusions

- To be continued…
- Current running FP7 project 'Veg-i-Trade'

  - Extended to other actors in the chain (e.g. primary production, trade sector)
  - Context ➔ aspect of globalisation will be included
  - Focus also on mycotoxins and pesticide residues next to microbial hazards
  - Veg-i-Trade
    - www.veg-i-trade.org

Impact of Climate Change and Globalisation on Safety of Fresh Produce

Governing a Supply Chain of Uncompromised Food Sovereignty

Acknowledgements

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