

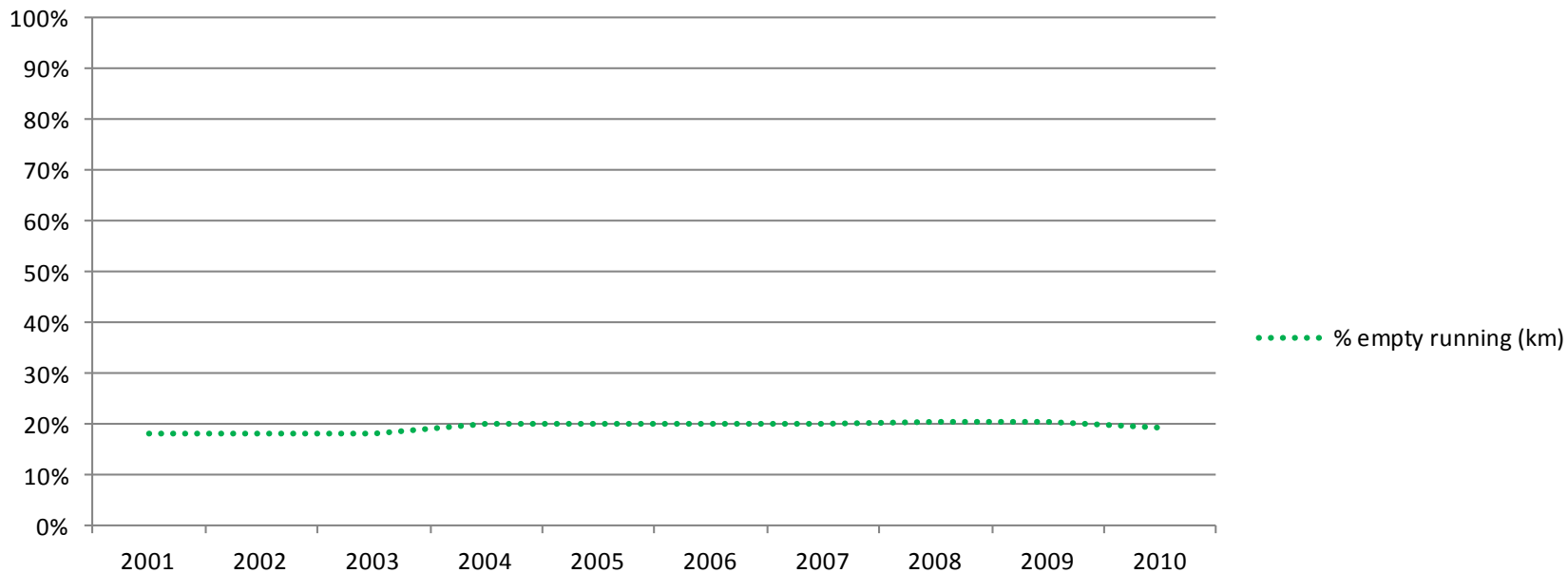
CO3 case study: Retail Collaboration in France



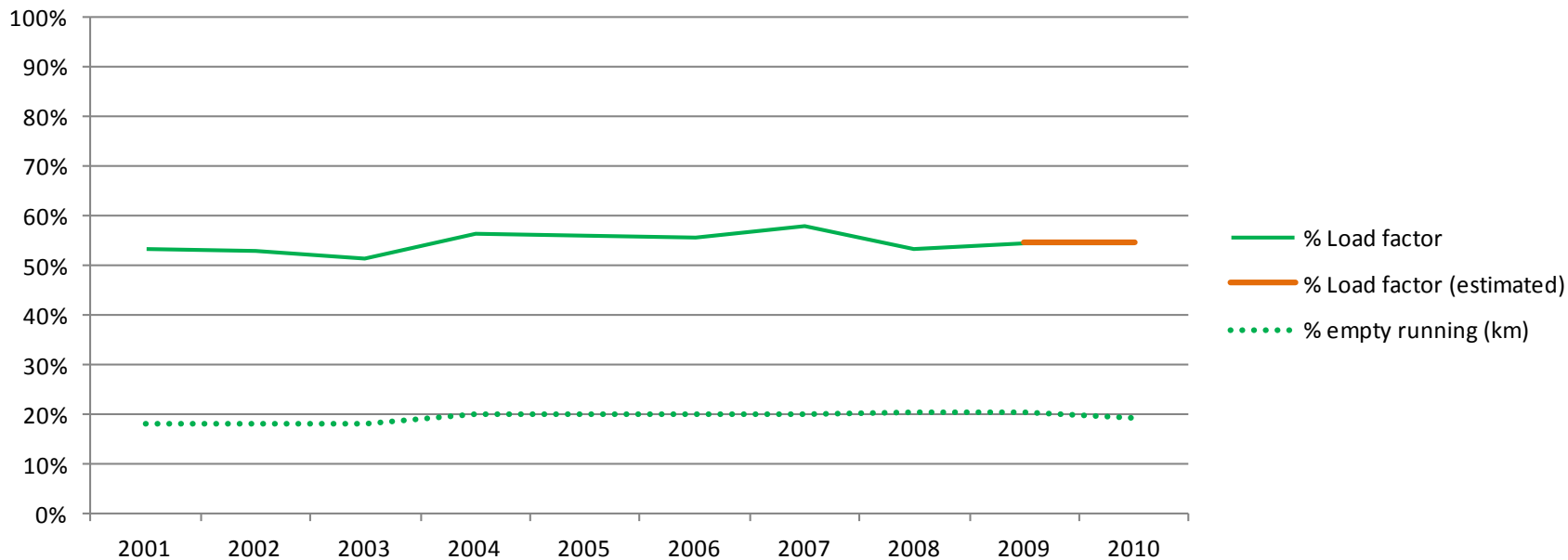
November 2012

Alain Guinouet, Mars
Marjolein Jordans, ArgusI
Frans Cruijssen, ArgusI

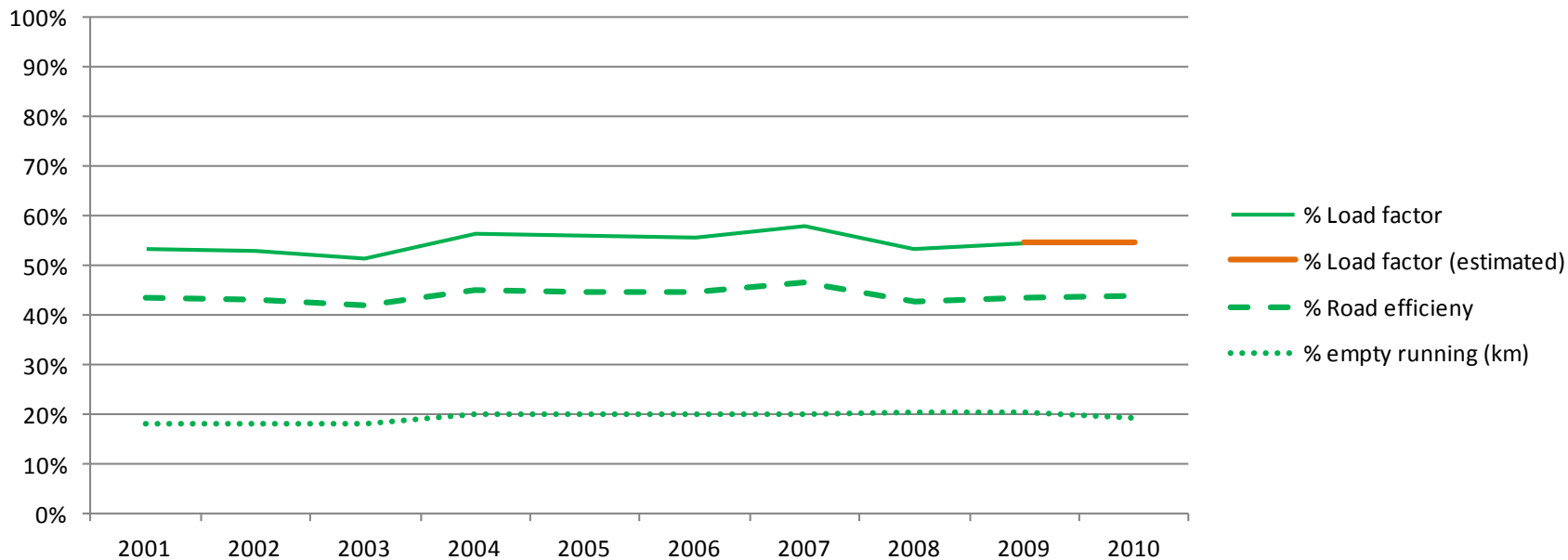
% Empty running (km)



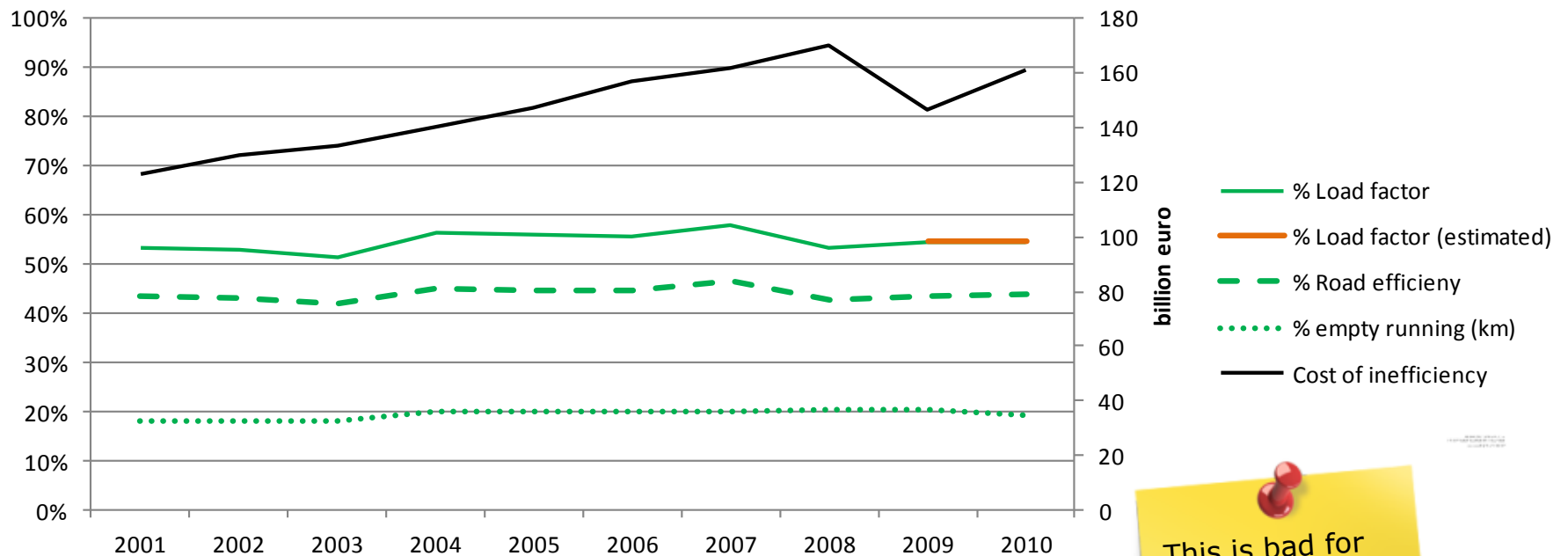
% Load factor



% Road efficiency

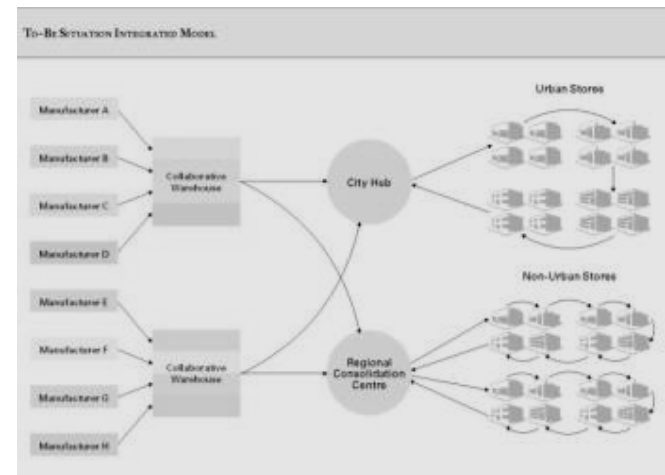
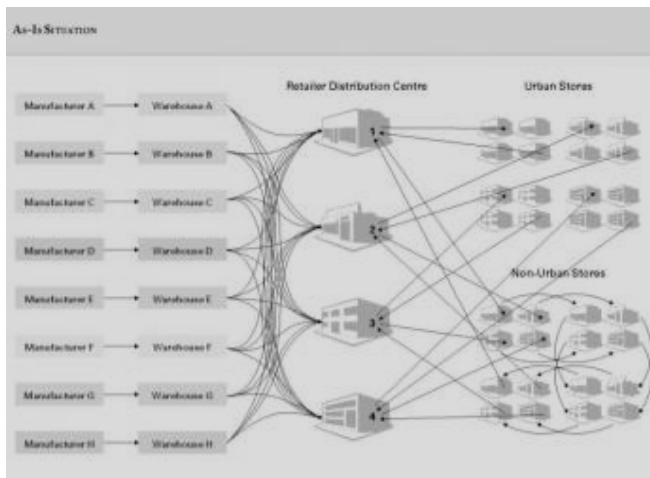


Overview of efficiency of EU road transport



This is bad for both profitability and environment

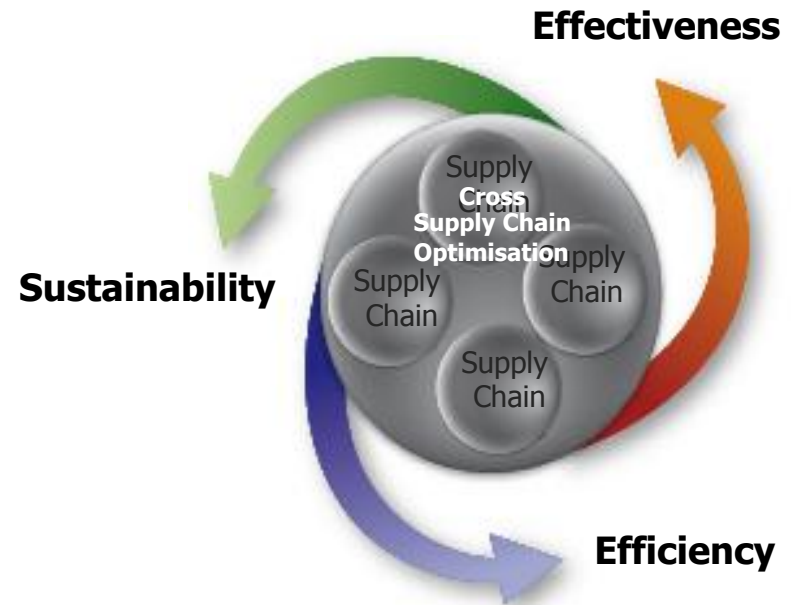
- Global Commerce Initiative & Capgemini
- Joint work of 24 major FMCG companies
- New sustainable supply chain architecture: collaborative warehousing and distribution
- Time to act is now!



Supply chain development

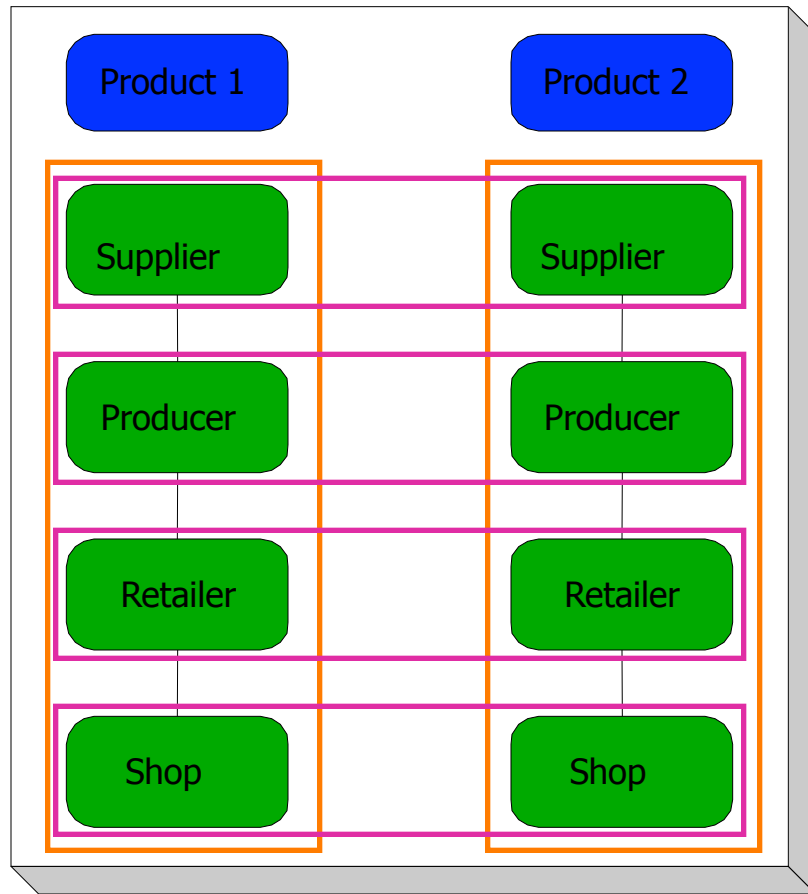
Proposition:

'Beside technology improvement, only cross company collaboration can simultaneously improve efficiency, effectiveness and sustainability'



Horizontal collaboration

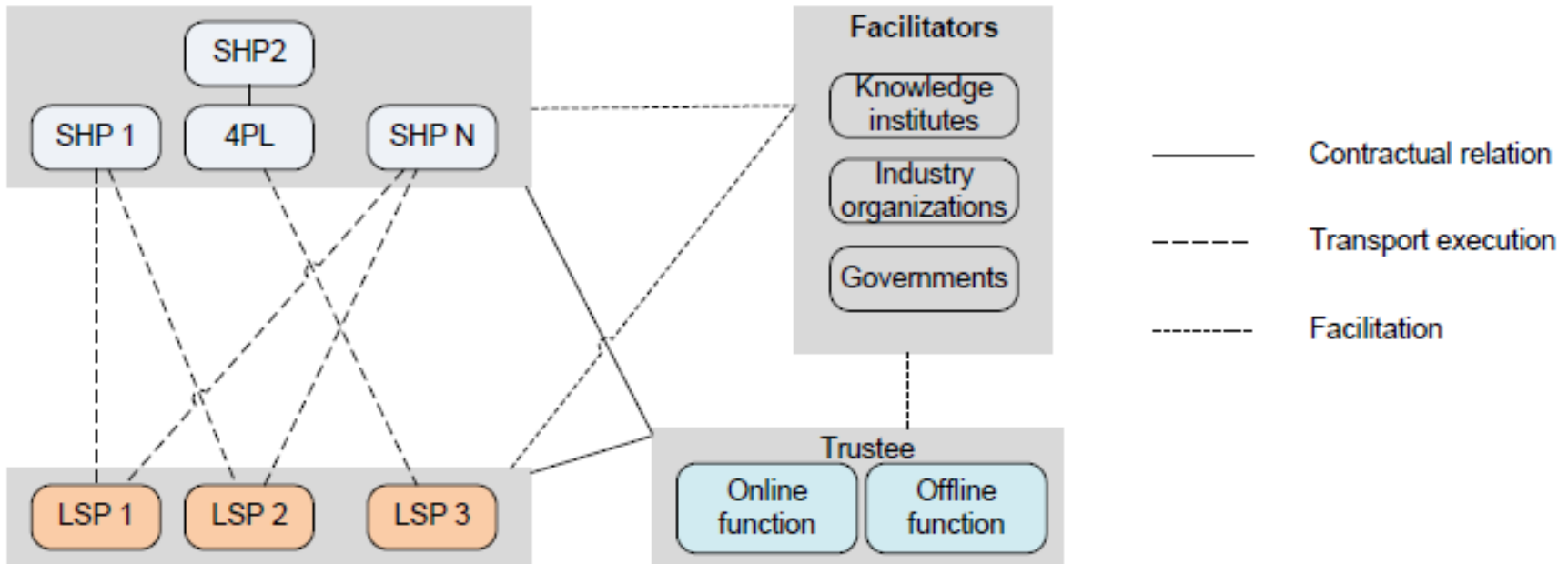
- Traditionally: vertical collaboration (SCM)
- Alternative: horizontal collaboration



- Keywords:
- Inventory control
 - Synchronization
 - Bursting time
 - Pushing and pulling
 - Transparency
 - Legalization
 - Overriding policies
 - Bullwhip effect
 - Chain dominance
 - Product design
 - Integration
 - Power
 - ...

$$\varphi_i(v) = \sum_{S \subseteq N} \frac{|S|! (n - |S| - 1)!}{n!} (v(SU\{i\}) - v(S))$$

How to organize this? Roles and responsibilities



- Mars works according to five key cultural principles
- These principles are in line with the challenges posed in the previous slides:
 - **Quality** - Satisfy high customer requirements
 - **Responsibility** - Minimize environmental footprint
 - **Mutuality** - Give-take mentality in collaboration
 - **Efficiency** - Optimize load factors
 - **Freedom** - Partners are free to join
- Mars and partners have started a collaboration that can serve as a roll model for other prospective collaborators

- French retailers demand full truckload (FTL) deliveries from suppliers to their warehouses throughout France BUT strongly focus on fixed assets reduction.
- Vendor Managed Inventory (VMI) makes the suppliers responsible for the inventory replenishment at the warehouses.
- A group of four suppliers led by Mars collaborate to fulfil the FTL delivery requirement and to keep logistics cost & performances under control.



	Company	Products	Head office	Group
	Mars PF France	Pet Foods: Whiskas, Pedigree, Sheba	Orléans	Mars Inc
	United Biscuits	Biscuits: Delacre, BN	Nanterre	
	Saupiquet	Fish products	Courbevoie	Bolton Group
	Wrigley	Candy & gum: Freedent, 5	Biesheim	Mars Inc

MARS
petcare & food
france



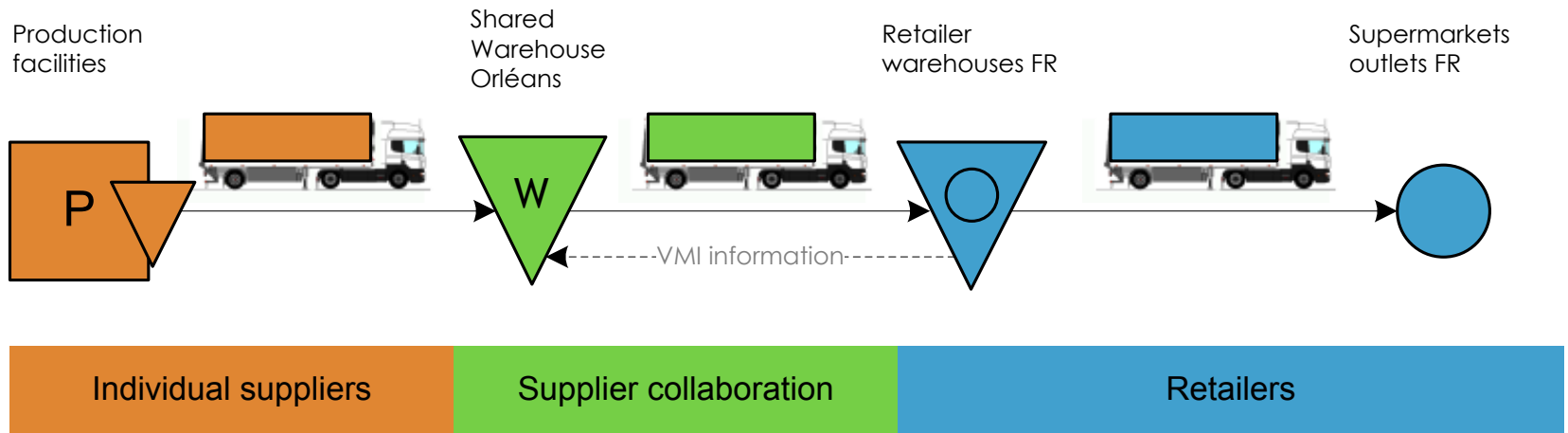




WRIGLEY



The Supermarket Supply Chain



All four producers have factories across Europe. From the factories products are transported to the shared warehouse in Orléans (operated by a logistic service provider - LSP).

From this joint warehouse **collaborative deliveries** are made to retailer warehouses in France. From there, the individual retailers supply their supermarkets.

The collaboration consists of a number of phases:

Phase 1: A joint LSP is hired by first two companies



Phase 2: A shared warehouse is opened in Orléans in 2009

Phase 3: First joint shipments are executed in November 2009

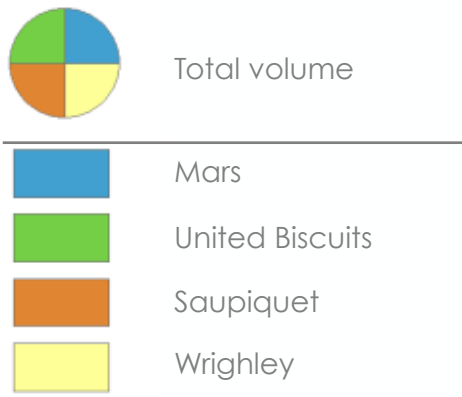
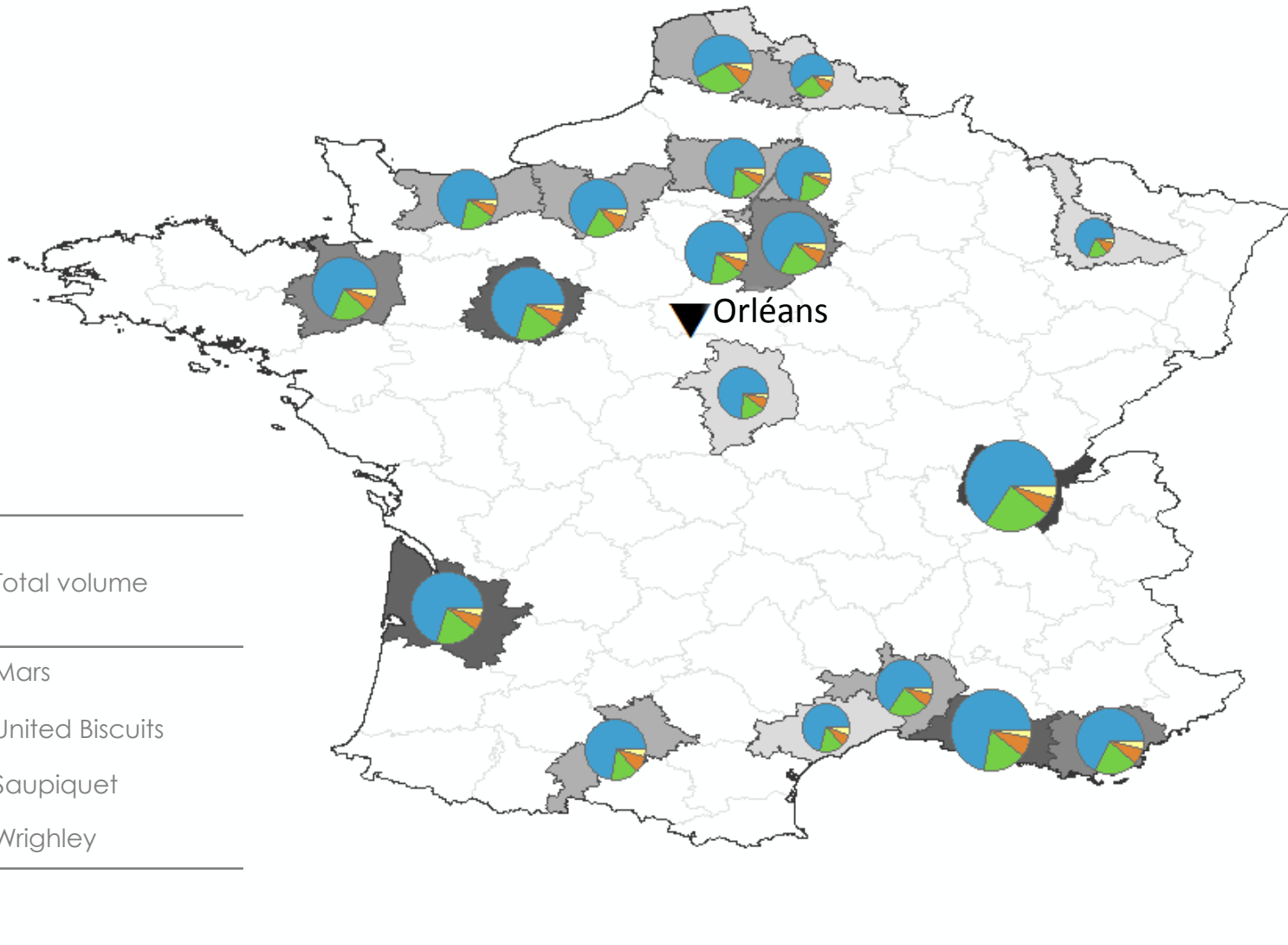
Phase 4: Two additional companies enter the collaboration

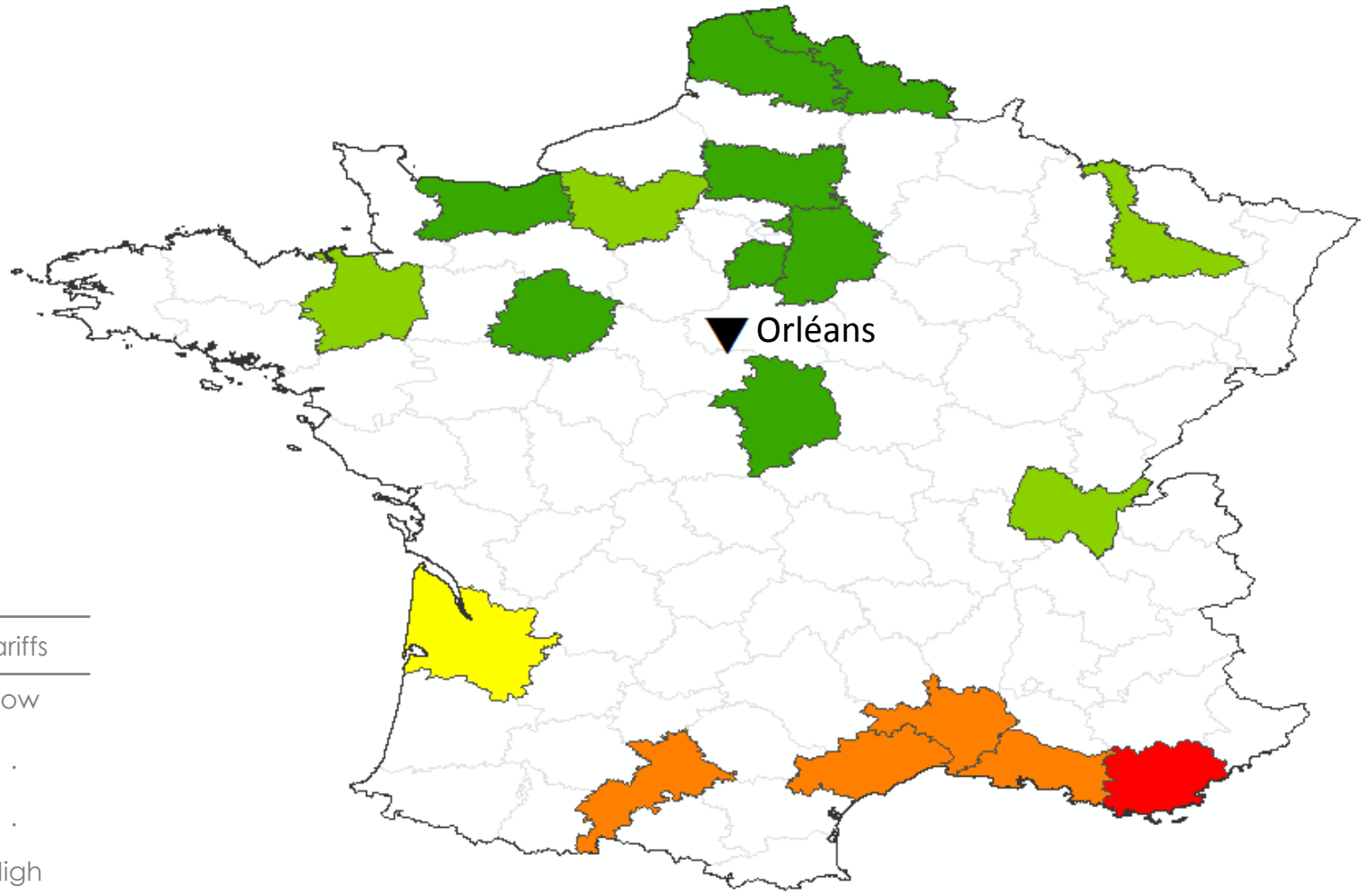
Phase 5: Currently: Deliveries are combined to form full truck loads on a daily basis

Phase 6: Planned: Increase scope by adding new retail clients

Phase 7: Planned: Increase scope by adding new joint warehouses and additional suppliers

Deliveries from Orléans to retail DCs





Strong consortium

Consortium consists of strongly committed companies that want the collaboration to flourish and last.

Trustees

The role of the trustee is divided in online and offline tasks:

- (1) Main online tasks: Synchronization of Orders & Shipments, communication with transport companies.
- (2) Main offline tasks: Gain sharing and fair cost allocation.

Legal

Formal contract between the individual producers and the LSP, and trustee respectively. Between the producers there is a letter of intent (gentlemen's agreement).

Exit clause

Should one of the companies wish to leave the collaboration, it can only do so after a minimum 6-month notice.

Transport execution

FTLs with products of the four companies are shipped to the retailer DCs by the jointly hired LSP.

Tariff

The LSP works on the basis of an LTL tariff table with rates per pallet – FTL means: 33 pallets.

Synergy

Synergy is calculated by means of the tariff table: the sum of the transport costs with and without collaboration are compared (see next slide).

Collaboration between all companies typically results into the FTL price; whereas no collaboration results into the sum of LTL costs.

Tariff table

		Number of pallets											
		1	2	3	4	5	...	10	15	20	25	30	33
Destination	A	€ 70	€ 135	€ 195	€ 250	€ 295	...	€ 500	€ 710	€ 890	€ 1,060	€ 1,190	€ 1,240
	B	€ 84	€ 162	€ 234	€ 300	€ 354	...	€ 600	€ 852	€ 1,086	€ 1,272	€ 1,428	€ 1,488
	C	€ 49	€ 95	€ 137	€ 175	€ 207	...	€ 350	€ 497	€ 623	€ 742	€ 833	€ 868



Subcoalition # Pallets Costs

M(ars) 15 € 710



S(aupiquet) 10 € 500



M, S 25 € 1,060

Synergy / Efficiency gains:
 € 710 + € 500
 - € 1,060 = € 150

But, how to allocate these efficiency gains in a fair and stable way...?

Gain sharing basis

Gain sharing is done for every departing truck for the collaboration, i.e. more than 1200 trucks per year.

Financial settlement

Periodically, the gain sharing is settled by the trustee via the LSP's invoices.

Gain sharing rule

Efficiency gains are shared based on the principle of equal profit margins. The consortium has picked this gain sharing rule, as each company will have a similar saving percentage. This method quite closely resembles the "Shapley value" in this case (see next slides).

When designing or selecting a gain sharing rule, two aspects are highly important: **Stability** and **Fairness**.

Stability can be objectively determined:




- All possible subcoalitions should be better off in the consortium collaboration than they would be in a smaller group (see next slide)

Fairness is more subjective. However, game theory provides some well-defined fairness properties:

- Efficiency: The complete savings of collaboration are distributed
- Monotonicity: If player A adds more value to every coalition than player B, player A will get a higher payoff
- Dummy: A player that adds no value to any coalition, will receive no payoff
- Symmetry: Two players that add exactly the same value to every other coalition, will get the same payoff
- Individual fairness: No player will suffer from collaboration (for each player, cost level after collaboration is not higher than before collaboration)

The "Shapley value" is the only rule that has all these properties.

Let's get back to our example:

	Subcoalition	# Pallets	Costs
	M	15	€ 710
	S	10	€ 500
	M, S	25	€ 1,060

Hence, in any stable gain sharing rule for this situation:

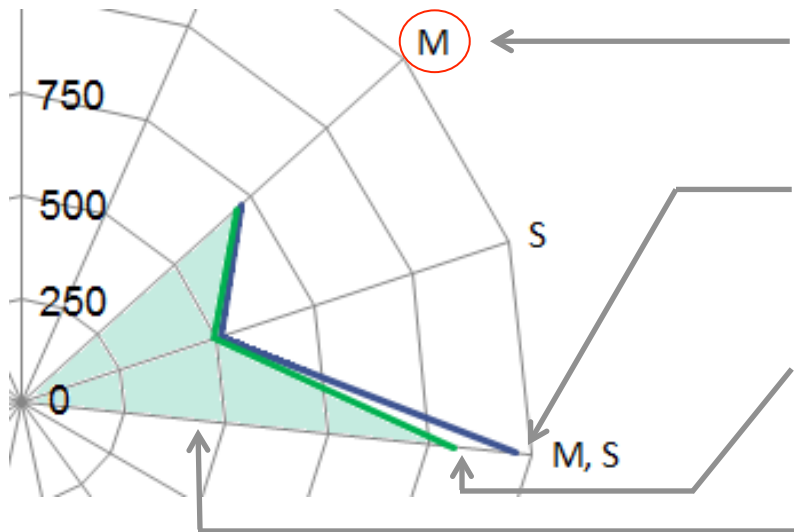
- Company M never pays more than € 710;
- Company S never pays more than € 500;
- Company M and S together not more than € 1,060.

Otherwise, they would just split off from the consortium and start their own (smaller) collaboration, as this will save money.

Collaboration and stability can be illustrated by means of a spider graph.

Stability based on gain sharing rule (2)

Subcoalition	Costs (when collaborating)	Costs (without collaboration)
M	€ 710	€ 710
S	€ 500	€ 500
M,S	€ 1,060	€ 1,210



M ← Subcoalition (collaborating companies)

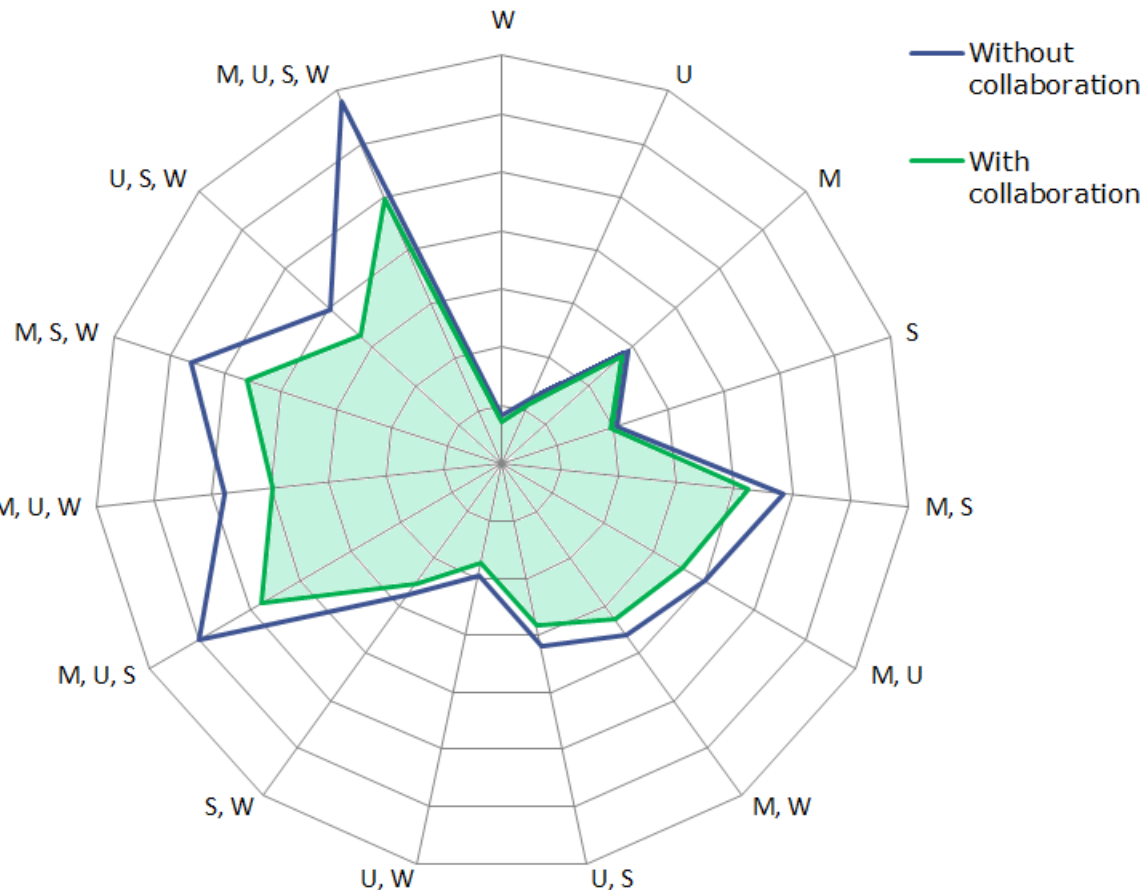
Blue line: Total costs if the subcoalition depicted at the endpoint is not collaborating

Green line: Total costs if the subcoalition depicted at the endpoint is collaborating

Shaded area: Tolerance area (called the 'core') for gain sharing rules that can be called stable

Stability based on gain sharing rule (3)

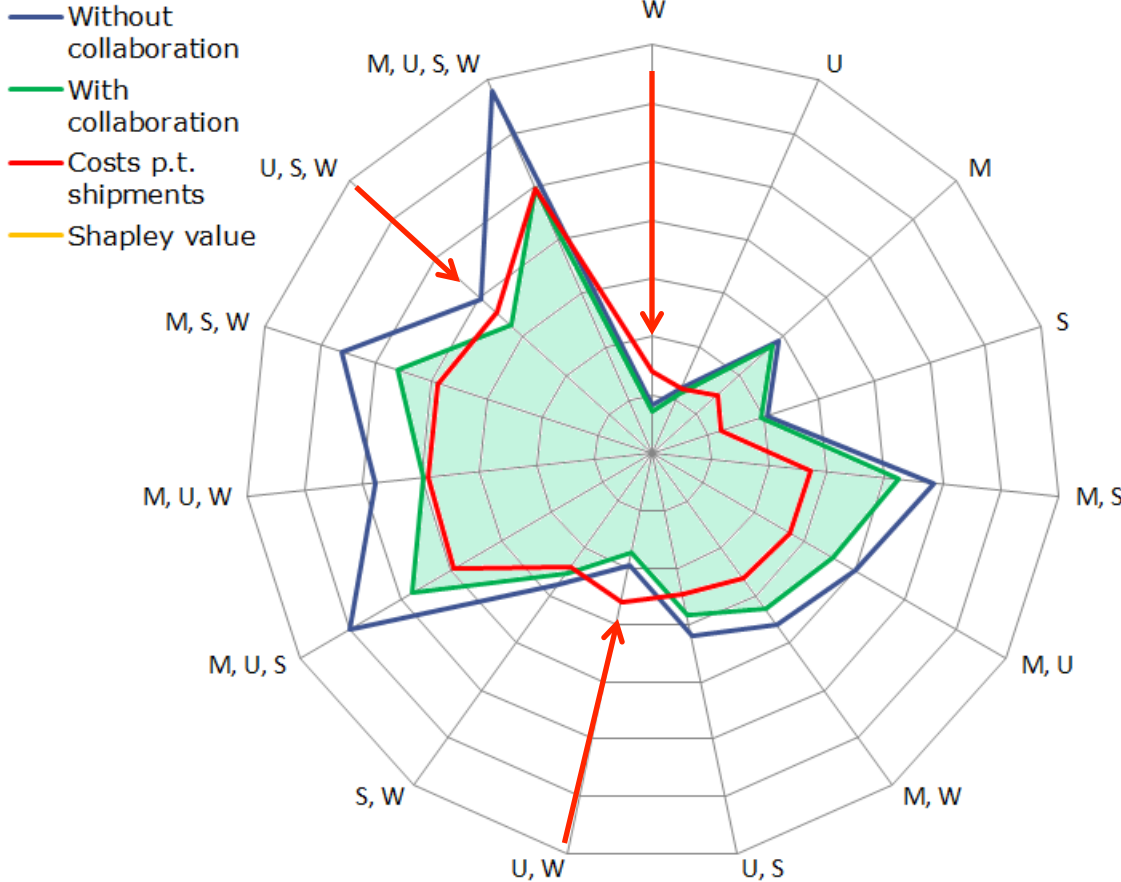
Suppose that companies W(rigley) and U(nited Biscuits) enter the consortium:



The same principle holds: to have a stable collaboration, every subcoalition must have a cost level after gain sharing that is lower than before collaboration.

This graph helps to evaluate a gain sharing rule on **stability**: whenever a rule can be depicted completely within the shaded area, it is stable; otherwise not.

Gain sharing rule: costs p.t. shipments



The red line depicts a gain sharing rule. It indicates what part of the total cost **under collaboration** is allocated to the companies in the subcoalition depicted at the endpoint.

Clearly, this gain sharing rule is not stable, as the red line does not lie within the shaded area. The graph shows that gain sharing deserves some good thought, as the simple rule of thumb of cost division based on individual cost per shipment (rule w.r.t. red line), results in an **unstable situation**.

Company W, subcoalitions U, W and U, S, W are not satisfied with the gain sharings and would split off when applying this rule.

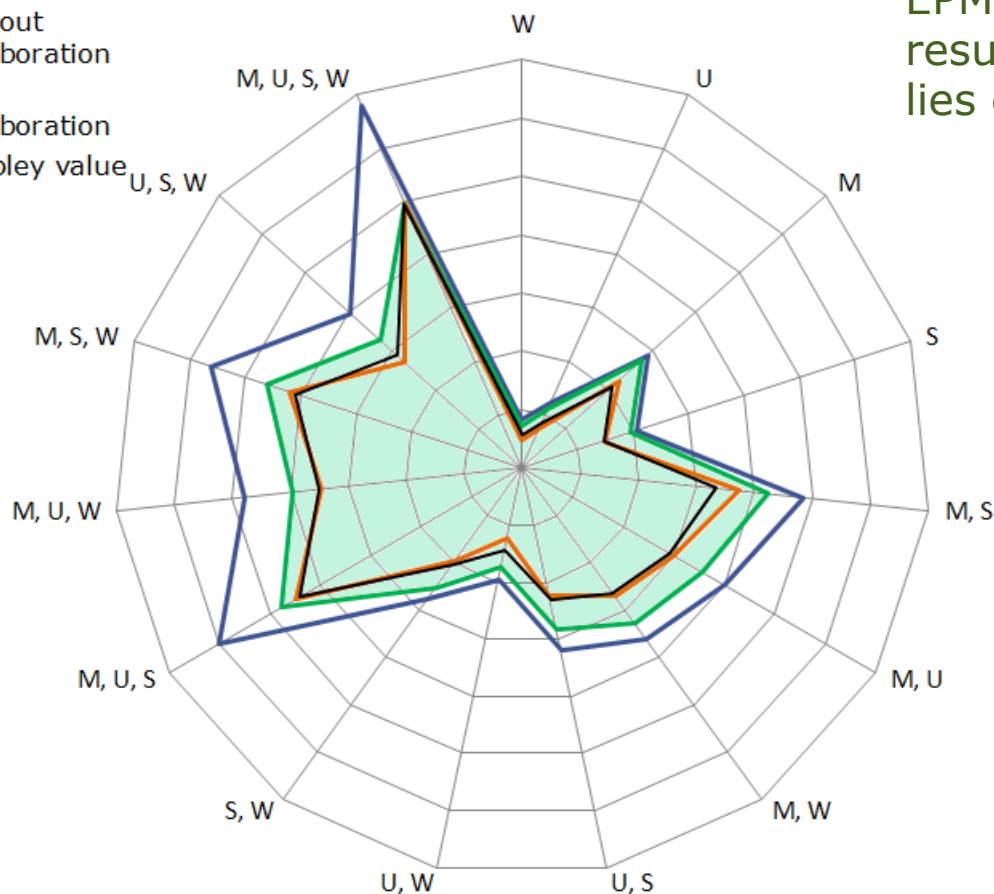
Gain sharing rules: EPM and Shapley value

Mars and partners currently apply the EPM gain sharing rule (black line). It results in a **stable situation**, as it lies entirely within the shaded area.

The Shapley value (orange line), the advertised rule by the CO3 consortium, gives only a slightly different stable solution.

Therefore, there is no reason to switch gain sharing rules at the moment.

However, the Shapley value would give more reliable stability when new partners enter the consortium, and is more objectively **fair**.





Collaboration
Concepts for
Co-modality

Thank you

The project is financed by the
European Commission



$$\varphi_i(v) = \sum_{S \subseteq N} \frac{|S|! (n - |S| - 1)}{n!} (v(SU\{i\}) - v(S))$$