GAIN SHARING IN HORIZONTAL LOGISTIC CO-OPERATION: A CASE STUDY IN THE FRESH FRUIT AND VEGETABLES SECTOR

GROUP - 12

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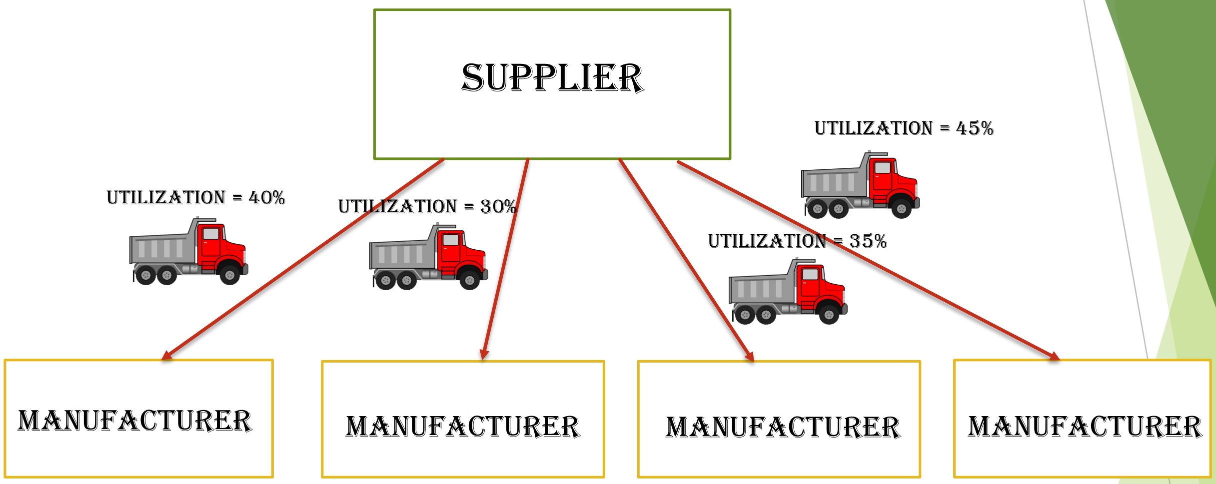
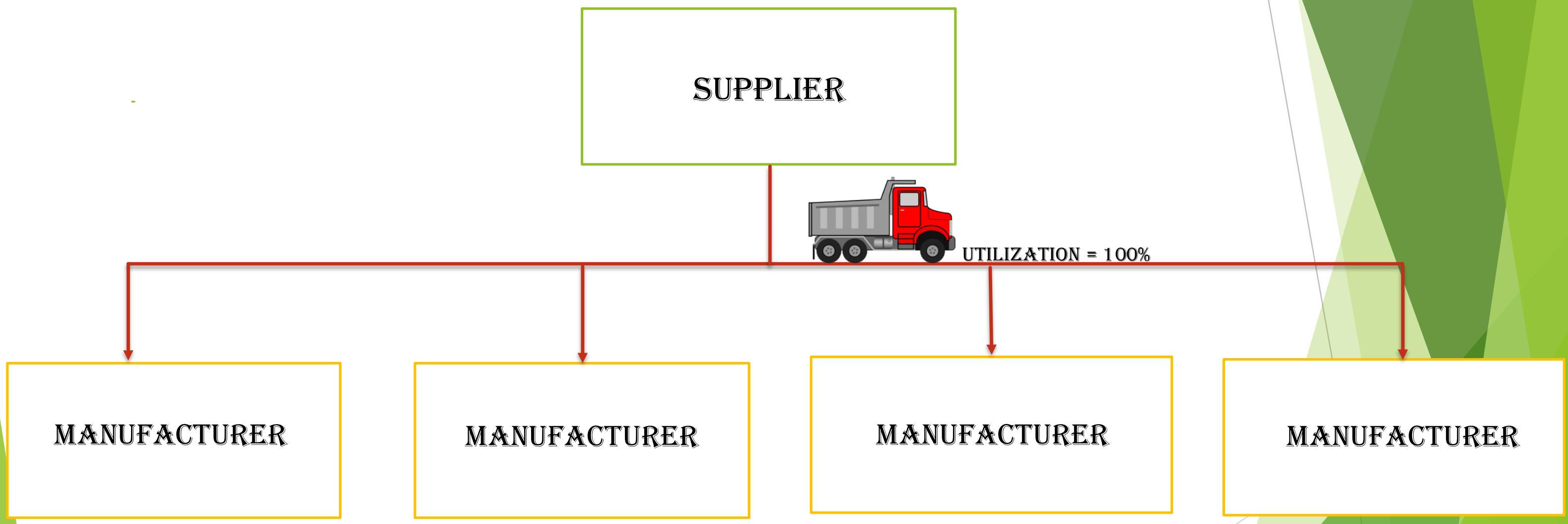
STAND ALONE SYSTEM



- In this type of system each individual orders and receives their item individually, leading to increase in the overall transportation cost and lowering of capacity utilization as well as efficiency.

HORIZONTAL COOPERATION



- Horizontal co-operation in logistics is where entities at the same level cooperate with each other, thereby gaining traction as a viable way to reduce transportation costs and increase efficiency and sustainability.

<u>MOTIVATIONS FOR HORIZONTAL COOPERATION</u>

- To reduce the total cost of transportation
- To increase system efficiency
- To increase sustainability

The main motivation for companies to collaborate is the fact that the total transportation cost of the coalition is lower than the sum of the stand-alone costs. The difference between these costs is called ***coalition gain***.

$$\textbf{Coalition Gain} = \sum TC_{\text{stand-alone}} - TC_{\text{horizontal}}$$

This coalition gain is then shared among the different partners.

FAIRNESS IN HORIZONTAL COOPERATION

- One of the main challenges in Horizontal Cooperation is the concept of fairness.

- Fair allocation of the benefits to all partners, next to finding the right partner(s) and a reliable third party that can coordinate the co-operation in such a way that all participants are satisfied, often referred to as the neutral trustee, is necessary for a proper horizontal cooperation system.

- Different definitions of the fairness criteria have resulted in a large set of ***gain sharing methods***, also known as ***profit allocation methods.***

- The rules for such methods vary from straightforward rules of thumb to more complicated concepts described in the game theory literature.

- Rather than dividing the coalition gain between the partners, the coalition can also agree to share the total cost. In this case, a ***cost allocation method*** is used.

- Although all cost allocation methods can also be used to allocate the profit, the **result for each partner is generally not the same**, and the decision to allocate the coalition gain or the coalition cost should be taken with caution.

<u>TYPES OF GAIN SHARING METHODS</u>

- **Shapley Value**
- **Nucleolus**
- **Equal Profit Method (EPM)**
- **Alternative Cost Avoided Method (ACAM)**

In addition to these methods, we also have the **Volume-based method**.

PROPERTIES OF GAIN SHARING

In the field of game theory a number of properties have been formulated that are considered important when evaluating a profit (or cost) allocation.
Some of those properties are mentioned below-

- **Pareto-efficiency:** The exact total profit should be allocated among the partners.

- **Individual Rationality:** A player should not be allocated a cost that is higher than its stand-alone cost.

- **Stability:** Individual rationality should be ensured for each sub-coalition.

- **Addivity:** The allocation can not be influenced by making larger coalitions in advance.

The profits, allocated to company i and j, are therefore equal to the profit a company would receive that represents i + j.

- **Dummy player property:** A partner that neither helps nor harms any coalition is allocated a zero-profit or a cost equal to its stand-alone cost.

PROPERTIES OF THE DIFFERENT ALLOCATION MECHANISMS

PROPERTIES	SHAPLEY	NUCLEOLUS	ACAM	EPM	VOLUME
PARETO-EFFICIENCY	✓	✓	✓	✓	✓
INDIVIDUAL RATIONALITY	✓	✓	✓	-	-
STABILITY	-	✓	-	-	-
ADDIVITY	✓	-	-	-	-
DUMMY PLAYER PROPERTY	✓	✓	-	-	-

LIST OF SYMBOLS

- N = the complete coalition with all partners
- S = a sub-coalition (S is a subset N)
- |S| = the number of partners in coalition S
- i; j = indices of different partners in a coalition
- s(i) = the stand-alone cost of partner i
- e(:) = the excess of an allocation
- c(:) = the cost of a coalition
- m_i = the marginal contribution of partner i
- w_i = the weight indicating the proportion of the gain partner i receives
- x = vector of allocated gains
- x_i = the allocated gain for partner i
- V_i = the volume of partner i

Gain Sharing Methods

From Game Theory

The Shapley Value

((Tijs and Driessen, 1986))

$$\text{xi} = \frac{1}{|N|!} \sum_{s \in N/i} |S|! * |N - S - 1|! * (c(S \cup i) - c(s))$$

Theorem

Given a coalitional game (N,c), There is unique payoff division x(i) = Φ(N,c) that divides full payoff of grand coalition and that satisfies the symmetry, Dummy Player and Additivity axioms

This captures "marginal contributions" of partner *i* averaging on all different coalitions according to which grand coalition could be built up

The Nucleolus

((Schmeidler (1969)))

$$e(x, S) = c(S) - \sum_{i \epsilon s} x(i) \longrightarrow \text{Unhappiness}$$

Theorem

Given a coalitional game (N,c), for a given set of payoff vector x(s), the number c(S)-x(S), S∈ N called excess of S with respect to x, reflects attitude of coalition S with respect to payoff vector x

Objective is to minimize maximum unhappiness (excess of proposed allocation or gain achieved by partners of coalition if they withdraw from grand coalition).

Equal profit method

((Frisk et al. (2010)

- It is based on idea of Equal profit. The total gain is shared equally relative to their stand alone cost
- It was proposed in 2010 and the method focuses to distribute relative savings as equal as possible
- Disadvantage:- Relative importance of a member in coalition is recognized just by its stand alone cost and as a result companies with higher stand alone cost get bigger absolute part of coalition gain

The alternative cost avoided Method

((Tijs and Driessen (1986)))

$$x_i = m_i + (c(N) - \sum_J m_j)\frac{s(i) - m_i}{\sum_j s(j) - m_j}$$

Separable Part

Non-Separable Part

Weight

Separable part consist of the marginal cost when that partner enters the coalition consisting of All partners

Non Separable part is divided among coalition based on individual contribution of each partner using weights defined by ACAM method which is on the basis of difference between stand-alone cost and marginal cost of each partner

Volume Based Allocation

((Frisk et al., 2010))

$$W_i = \frac{V_i}{\sum_i V_i}$$

This is a proportional allocation method where coaltion gains are divided by weight for each partner.

The weight is based on volume (for example, the number of pallets, the total weight) shipped by that partner w.r.t total coalition volume

More companies prefer this as it is straightforward and can be easily interpreted by the partners of coalition

CALCULATIONS BASED ON METHODS FOR GAIN SHARING

Sub-coalitions	A	B	C	A-B	B-C	C-A	A-B-C
Cost	6142	4844	1646	9847	5733	7441	10564
Profit				1138	757	347	2068

Volume of A = 61.12%
Volume of B = 29.54 %
Volume of C = 9.34%

SHAPLEY VALUE :

Value of coalition {} = 0

Value of coalition {A} = 6142

Value of coalition {B} = 4844

Value of coalition {C} = 1646

Value of coalition {A,B} = 9847

Value of coalition {B,C} = 5733

Value of coalition {C,A} = 7441

Value of coalition {A,B,C} = 10564

Cost allocated to A = (6142 – 0)/3 + (9847 - 4844)/6 + (7441-1646)/6 + (10564 - 5733)/3

= 5457.333

Profit allocated to A = 6142 – 5457.333 = 684.667 = 684

Cost allocated to B = (4844 – 0)/3 + (9847 - 6142)/6 + (5733-1646)/6 + (10564 - 7441)/3

= 3954.333

Profit allocated to B = 4844 – 3954.333 = 889.667 = 889

Cost allocated to C = (1646 – 0)/3 + (7441 - 6142)/6 + (5733-4844)/6 + (10564 - 9847)/3

= 1152.333

Profit allocated to C = 1646 – 1152.333 = 493.667 = 494

Alternative Cost Avoided Method :

Cost allocated to A = (10564 – 5733) + (10564 – (10564 - 5733) – (10564 – 7441) – (10564 – 9847))*(6142 – (10564 – 5733)/((6142-(10564-5733)) + (4844 – (10564 - 7441)) + (1646 - (10564 – 9847)))

= 5457.539

Profit allocated to A = 6142 – 5457.539 = 684.461 = 684

Cost allocated to B = (10564 – 7441) + (10564 – (10564 - 5733) – (10564 – 7441) – (10564 – 9847))*(4844 – (10564 – 7441)/((6142-(10564-5733)) + (4844 – (10564 - 7441)) + (1646 - (10564 – 9847)))

= 3945.482

Profit allocated to B = 4844 – 3945.482 = 898.518 = 898

Cost allocated to C = (10564 – 9847) + (10564 – (10564 - 5733) – (10564 – 7441) – (10564 – 9847))*(1646 – (10564 – 9847)/((6142-(10564-5733)) + (4844 – (10564 - 7441)) + (1646 + (10564 – 9847)))

= 1160.978

Profit allocated to C = 1646 – 1160.978 = 485.022 = 485

Volume based method

Weight parameter of A , W_a = Volume of A/Total Volume

= 0.6112

Weight parameter of B , W_b = Volume of B/Total Volume

= 0.2954

Weight parameter of C , W_c = Volume of C / Total Volume

= 0.0934

Profit allocated to A = 0.6112 * 2068

= 1264

Profit allocated to B = 0.2954 * 2068

= 611

Profit allocated to C = 0.0934 * 2068

= 193

THE NUCLEOLUS METHOD

LP 1:

Minimize Zx = w_1

Subject to

x_1 - w_1 <= 6142

x_2 - w_1 <= 4844

x_3 - w_1 <= 1646

x_1 + x_2 - w_1 <= 9847

x_2 + x_3 - w_1 <= 5733

x_1 +x_3 - w_1 <= 7441

x_1 + x_2+ w_1 = 10564

x_i >= 0 where i=1,2,3

and w_1 >= 0

Dual LP:

Maximize Zy = 6142y_1+4844y_2+1646y_3+ 9847y_4+5733y_5+7441y_6+10564y_7

Subject to

y_1 + y_4 + y_6 + y_7 <= 0

y_2 + y_4 + y_5 + y_7 <= 0

y_3 + y_5 + y_6 + y_7 <= 0

-y_1 - y_2 - y_3 - y_4 - y_5 - y_6 = 1

y_i <= 0 where i=1,2,3,5,6,7

y_7 is unsigned

LINEAR PROGRAMMING CALCULATIONS:

x1	5677.5						
x2	3705						
x3	1181.5						
w1	-464.5						
constraints							
x1	x2	x3	w1				
1	0	0	-1	6142	<=	6142	
0	1	0	-1	4169.5	<=	4844	
0	0	1	-1	1646	<=	1646	
1	1	0	-1	9847	<=	9847	
0	1	1	-1	5351	<=	5733	
1	0	1	-1	7323.5	<=	7441	
1	1	1	0	10564	=	10564	
objective function							
Min	w1	=	-464.5				

	A	B	C	D	E	F	G	H	I	J
1										
2	y1	0								
3	y2	0								
4	y3	-0.5								
5	y4	0								
6	y5	-0.5								
7	y6	0								
8	y7	-0.5								
9										
10	constraints									
11	y1	y2	y3	y4	y5	y6	y7			
12	1	0	0	1	0	1	1	-0.5	<=	0
13	0	1	0	1	1	0	1	-1	<=	0
14	0	0	1	0	1	1	1	-1.5	<=	0
15	-1	-1	-1	-1	-1	-1	0	1	=	1
16										
17	objective function									
18										
19	Max	Zy	=	-464.5						

By solving above LP we get

w_1 = -464.5

x_1 = 5677.5

x_2 = 3705

x_3 = 1181.5

y_1 = 0

y_2 = 0

y_3 = -0.5

y_4 = 0

y_5 = -0.5

y_6 = 0

y_7 = -0.5

LP 2:

Minimize Zx = w_2

Subject to

x_1 - w_2 <= 6142

x_2 - w_2 <= 4844

x_3 = 1646 – 464.5

x_1 + x_2 - w_2 <= 9847

x_2 + x_3 = 5733 – 464.5

x_1 +x_3 - w_2 <= 7441

x_1 + x_2+ x_3 = 10564

LINEAR PROGRAMMING CALCULATIONS:

x1	5295.5					
x2	4087					
x3	1181.5					
w2	-464.5					
constraints						
x1	x2	x3	w2			
1	0	0	-1	5760	<=	6142
0	1	0	-1	4551.5	<=	4844
0	0	1	0	1181.5	=	1181.5
1	1	0	-1	9847	<=	9847
0	1	1	0	5268.5	=	5268.5
1	0	1	-1	6941.5	<=	7441
1	1	1	0	10564	=	10564
objective function						
Min	w2	=	-464.5			

By solving LP2 we get

w_2 = -464.5

x_1 = 5295.5

x_2 = 4087

x_3 = 1181.5

Profit allocated to A = 6142 – 5295.5 = 846.5

Profit allocated to B = 4844 – 4087 = 757

Profit allocated to C = 1646 – 1181.5 = 464.5

EQUAL PROFIT METHOD:

Minimize Z = f_0

Subject to

$\frac{y_1}{6142}$ - $\frac{y_2}{4844}$ <= f_0

$\frac{y_2}{4844}$ - $\frac{y_1}{6142}$ <= f_0

$\frac{y_2}{4844}$ - $\frac{y_3}{1646}$ <= f_0

$\frac{y_3}{1646}$ - $\frac{y_2}{4844}$ <= f_0

$\frac{y_3}{1646}$ - $\frac{y_1}{6142}$ <= f_0

$\frac{y_1}{6142}$ - $\frac{y_3}{1646}$ <= f_0

y_1 + y_2 <= 9847

y_2 + y_3 <= 5733

y_1 + y_3 <= 7441

y_1 + y_2 + y_3 = 10564

f_0 = 0

y_1 = 5136.4858

y_2 = 4050.9829

y_3 = 1376.5313

Profit allocated to A = 6142 – 5136.4858 = 1005.512

Profit allocated to B = 4844 – 4050.9829 = 793.0171

Profit allocated to C = 1646 – 1376.5313 = 269.4687

LINEAR PROGRAMMING CALCULATIONS:

	A	B	C	D	E	F	G
1							
2	y1	5136.48575					
3	y2	4050.982901					
4	y3	1376.531349					
5	f0	0					
6							
7	Stand alone costs		y1	y2	y3		
8			6142	4844	1646		
9	constraints						
10	y1	y2	y3	f0			
11	0.000162813	-0.000206441	0	-1	0	<=	0
12	-0.000162813	0.000206441	0	-1	0	<=	0
13	0	0.000206441	-0.000607533	-1	-1.1E-16	<=	0
14	0	-0.000206441	0.000607533	-1	1.11E-16	<=	0
15	0.000162813	0	-0.000607533	-1	-1.1E-16	<=	0
16	-0.000162813	0	0.000607533	-1	1.11E-16	<=	0
17	1	1	0	0	9187.469	<=	9847
18	0	1	1	0	5427.514	<=	5733
19	1	0	1	0	6513.017	<=	7441
20	1	1	1	0	10564	=	10564
21							
22	objective function						
23							
24	Min	f0	=	0			
25							

A DIFFERENT ALLOCATION METHOD , A DIFFERENT INCENTIVE

- Every gain sharing method take as an input a limited number of parameters and partner characteristics

For Example

Shapley Value – based on cost
Volume based method – takes shipping amount
ACAM – based on cost
EPM – divides gains based on relative differences of costs or profits

THE INCENTIVES OF DIFFERENT GAIN SHARING METHODS

Allocation Method	Partner Characteristics	Incentive
Shapley Value	Stand-alone cost Cost of all sub-coalitions	Efficiency
Nucleolus	Stand-alone cost Cost of sub-coalitions with ||N|-1| partners	Stability
Equal Profit Method	Stand-alone cost	Stand-alone inefficiency
Alternative Cost Avoided Method	Stand-alone cost Cost of sub-coalitions with ||N|-1| partners	Efficiency
Volume based Allocation	Volume	Ship-large volumes

Q) What method do you suggest for gain sharing ?

THE NUCLEOLUS METHOD:

- Solution in center of core is guaranteed
- Long term stability
- No partner feels abandoned

Q) What are the Limitations of the method used by the traders for gain sharing?

- Traders shipping huge volume has larger amount of profit
- May cause destabilization in coalition

Working of the Fresh Produce Traders

- Due to its high perishability, fresh food requires an effective supply chain in order to maintain a high level of customer service.
- In 2012, three traders at a fruit and vegetable auction in Belgium started a cooperative shuttle service between the auction and the traders' common transportation platform. This service was supervised by a neutral third party. A specialist in logistics services(LSP) was hired to provide this shuttle service.
- The Observed Effects of this Platforms are:
  - The shuttle service provided traders with the assurance that their purchases, even those made at the last minute, could be transported properly. A reliable truck at the auction, provided the necessary temperature controlled transportation.
  - Better prices from the LSP might be obtained by combining the orders of the three dealers and thereby increasing the transported volume.

- A yielding pace list that took into account the amount of the overall dispatched order to calculate the transportation cost was agreed (i.e., the number of pallets). The regressive nature of this instrument was designed to encourage traders to place larger orders. The traders are compelled to prevent small order shipments by purchasing more goods at the auction or, if possible, delaying their delivery to the next day because the entire cost of the shuttle truck is computed based on the consolidated volume.
- The project for cooperation is supported by the auction authorities in two ways.
  - The shuttle service is given priority by being allocated a specific quay.
  - By keeping track of the consolidation gains, the auction also serves as an impartial party (i.e., the profit obtained by switching from individual transport to the shuttle service). These profits are periodically distributed among the dealers according to the volume method, or in proportion to the number of traded pallets.

- We carefully examine the manner in which the traders agreement divides the consolidation gains. We assess the characteristics and outcomes of the gain sharing methods in comparison to the existing mode of operation. We discover that various gain-sharing systems produce largely dissimilar outcomes and produce various incentives for coalition members. These factors lead us to the conclusion that picking a suitable gain-sharing mechanism is crucial.

STABILITY OF THE COALITION

- All manufacturers can develop joint pricing as long as they have an agreement on profit segmentation.
- An establishment of a coalition needs the following condition to hold true: All dealer's profits with the coalition are more than those without coalition or sub-coalition i.e. the grand coalition is the most powerful and cooperates towards the collective good of each stakeholder.
- If any dealer suffers losses, the coalition will be considered unstable and will ultimately result in the dissolution of the coalition.

OBSERVATION

We can explain the stability of a coalition by a simple induction as follows:

- Suppose there are n dealers R1, R2, R3….Rn who sell homogeneous products bought from a supplier. These dealers sell their products at prices P1, P2, P3…Pn and get a profit X1, X2, X3….Xn respectively. If they develop a coalition and make P as their unified price, they will get profits as Y1, Y2, Y3….Yn.
- Hence if X1< Y1, X2< Y2, X3< Y3……Xn<Yn, i.e. the dealer's profits in a grand coalition is more than those without a coalition, then the coalition is considered to the stable.

The same principle holds true for sub-coalitions i.e. if the profit obtained by a group of dealers over a unified price via a sub-coalition is less as compared to the profits obtained via a grand coalition, then the grand coalition remains stable and acts towards the collective good of all stakeholders.

INFERENCES

- The total cost of a (sub)-the coalition is always smaller than the summed
- stand-alone costs of the partners involved for a stable grand coalition.
- A random fluctuation in the market may make the cooperation of some partners generate higher profit for a short time period but short-term instability does not necessarily endanger the long-term stability of the total coalition and is rather rare and temporar

Aggregated total cost of the (sub)-coalitions for the shuttle truck case study

Sub-coalitions		A	B	C	A–B	B–C	A–C	A–B–C
Original	cost	€6142	€4844	€1646	€9847	€5733	€7441	€10564
	profit				€1138	€757	€347	€2068
Flexible	cost	€6096	€4680	€1475	€9548	€5400	€7038	€10110
	profit				€1229	€756	€534	€2142

FURTHER INFERENCES (BACKWARD INDUCTION METHOD)

- If the dealer's coalition is stable then, the profit allocation among all entities in the entire supply chain achieves optimality
- If one or more dealers want more profits when the dealers' coalition is stable, they can use two methods: unilateral price increase or unified price increase.
- A unilateral price increase leads to the collapse of the coalition, so each dealer's profit will return to its profit without a coalition.
- Raising the unified price is also not a good idea because the unified price calculated by using backward induction is the optimal solution of the sequential game and positive growth of it will reduce all dealers' profits.
- If the suppliers want more profits when the dealers' coalition is stable, they can use two methods: increase the wholesale price or destroy the coalition.
- Increasing the wholesale price is not possible because the wholesale price is calculated by using backward induction and changing it will lead to a loss to the supplier.
- Also by a basic principle of a coalition, if the coalition is broken then all their profits ae less than the profits of the coalition.

- In summary, the dealers or suppliers have no way to increase their profits anymore when their coalition is stable.

FLEXIBILITY IN A COALITION

- The achievement of economies of scale by transporting more volume in each trip and reducing the number of redundant trips is one of the main benefits of horizontal logistic collaboration. The coalition's success is heavily reliant on how flexible each partner is with its delivery terms.
- The partners' willingness to be flexible in delivery conditions is a key factor affecting the coalition’s benefit. Permitting deliveries to be made at a later time rather than requiring a certain delivery date, and allowing the delivery of a single order's pallets or boxes in several vehicles as opposed to having them all arrive in one truck increases the coalition's optimization options and, as a result, increase the consolidation gain.

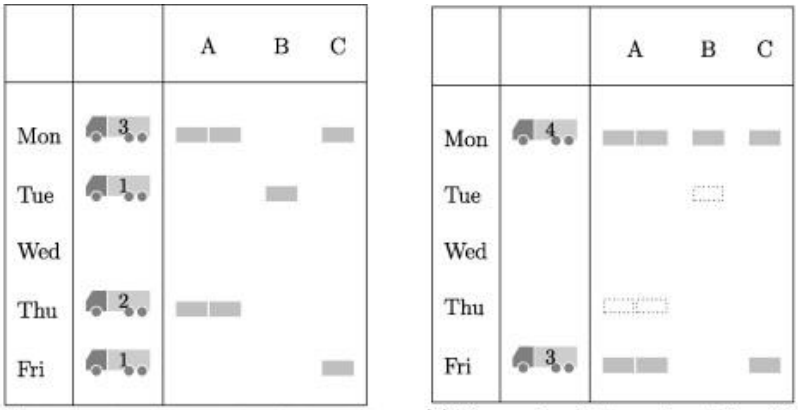
- Hence the logistics planning is divided into two parameters:

❖ Rigid Planning (all orders are shipped on the day they are placed)

❖ Flexible Planning (assumes that small order sizes can be stored at the auction for one day and combined in the next day’s truck if this yields a smaller total cost)

BENEFITS OF FLEXIBLE PLANNING

In a hypothetical example, businesses A, B, and C all deliver to the same area. On Monday and Thursday, Company A provides two pallets; on Tuesday, Company B delivers a pallet; and on Monday and Friday, Company C delivers two pallets. Five shipments are necessary if each company operates independently. However, if they work together, the number of shipments may be decreased from five to four. When companies A and B agree to shift their shipments by one day, the shipments may be coordinated and reduced to two, which helps to lower the cost of transportation and, ultimately, lowers the coalition cost, improving coalition wins across the board.



(a) The number of trips when A, B and C collaborate but are not flexible

(b) The number of trips when A, B and C collaborate, A and B allow their orders to be moved one day

OBSERVATIONS

One-week sample of shipped volumes per partner and for the grand coalition

(a) Rigid planning

	A	B	C	Grand coalition (A+B+C)	
	volume	volume	volume	volume	coalition cost
day 1	3×33	10		$3 \times 33 + 10$	€1212.7
day 2		5	4	9	€219
day 3	13	22		33 + 2	€410
day 4					
day 5	11	10	10	31	€320.54
aggregated	**123**	**47**	**14**	**184**	**€2159.24**

(b) Flexible planning

	A	B	C	Grand coalition (A+B+C)	
	volume	volume	volume	volume	coalition cost
day 1	3×33	10		$3 \times 33 + 10$	€1212.7
day 2					
day 3	13	22 + 5	4	33 + 11	€557.37
day 4					
day 5	11	10	10	31	€320.54
aggregated	**123**	**47**	**14**	**184**	**€2090.61**

This clearly represents that the total cost of the coalition decreases as a whole although, the coalition gain might decrease. This is due to the fact that the stand-alone cost of the partners also decreases when flexibility is enforced. Nevertheless, because of the lower total coalition cost, the flexible approach will still be beneficial for the coalition.

INFERENCES

- An understanding of the profit allocation data helps us realize the fact that though the total cost of the coalition is less and greater profits are obtained, the profit per individual entity might be less due to holding charges or an increase in the stand-alone charges which ultimately decreases the profits for an individual entity.
- Hence, the flexibility of the partners with respect to their delivery terms has to be encouraged while at the same time as a coalition consists of individual companies acting out of self-interest, the allocation of the total cost can play an important role in the promotion of flexibility, and therefore a factor that cannot be underestimated when planning the distribution of the orders of the coalition for the collective good of all the stakeholders.
- This refers to the hidden costs that are involved in the coalition and need to be addressed for the stability and smooth functioning of the coalition.

CONCLUDING REMARKS

- The advantages of horizontal collaboration strongly rely on the flexibility each partner permits in his delivery circumstances via the development of better and more effective distribution strategies over the long term or short basis which in return helps us to identify the coalition gain which is divided among the shareholders.
- A reduction of 16% was observed over the horizontal collaboration where a short-term association provided the maximum efficiency of each cycle (Shapley Value being the exception)
- The partners' engagement in sustainability and flexibility must be taken into account when allocating joint savings in order to ensure equity. When distributing the benefits of horizontal collaboration, it is important to take each partner's sustainability and flexibility into account.
- Without putting into doubt the partners' flexibility or the effectiveness of the transport, a volume-based allocation encourages the expansion of the partners. On the other side, the Shapley value and ACAM use marginal costs to drive efficiency. The parties may choose the nucleolus in order to attain stability since it guarantees a resolution in the core. However, there is no clear connection to partner traits or operational aspects. As a result, the findings could be challenging to interpret.