

# ERPsim

## Manufacturing Sustainability Student Friendly Challenge

### **Please Note**

This event might be recorded and made available on the ERPsim website. Please be aware that questions you ask or discussions you participate in will be recorded as a part of the presentation.

By attending this online event you are giving your permission to being recorded. Participant names / photos / video (if connected to event via webcam) may be shared. If you do not wish to be recorded, please disconnect from the event at this time.

This presentation contain references to products of SAP SE, Dietmar-Hopp-Allee 16, 69190 Walldorf, Germany. The names of these products are registered and/or unregistered trademarks of SAP SE. SAP SE is neither the author nor the publisher of this presentation and is not responsible for its content.

ERPsim Manufacturing Sustainability Student Challenge 2025  
Hybrid | Feb 14, 2025

ERPsimLab  
HEC MONTRÉAL



Serious games to learn enterprise  
systems and business analytics

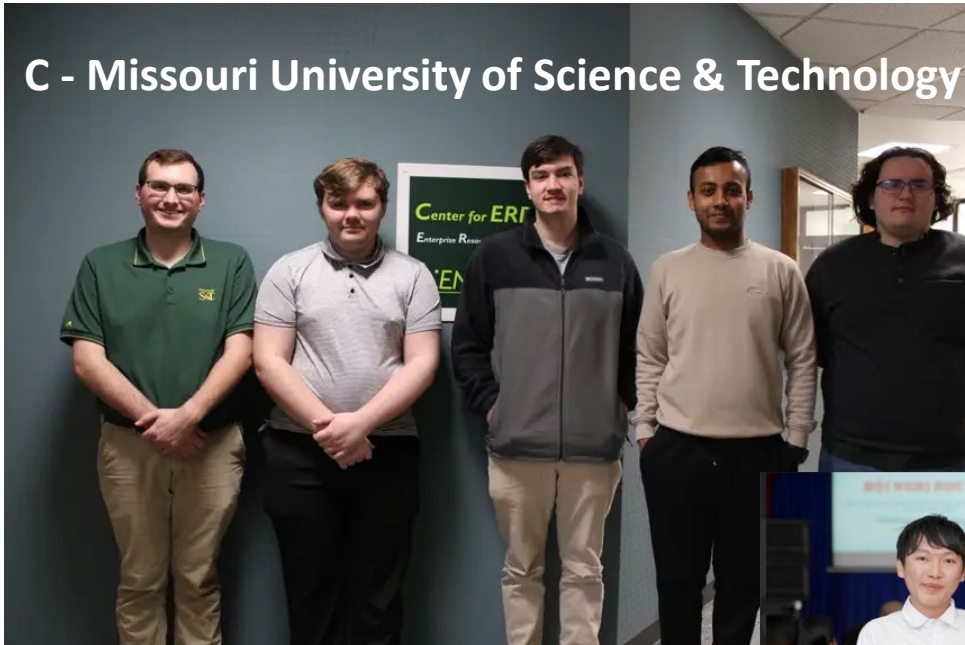
בְּרוּךְ הַבֹּא  
välkommen 欢迎 velkommen  
chào mừng ようこそ hoşgeldiniz merhba  
خوش آمدید benvenuto willkommen 환영  
witamy selamat datang  
أهلاً بك Welcome bienvenu  
fáilte welkom bine ati venit bienvenido  
добро пожаловать स्वागत vitéjte  
bem-vindo tervetuloa خوش آمدی  
wamukelekile wëllkomm καλώς ήρθες

# Teams

- A - Centria UAS
- B - Tecnológico de Monterrey
- C - Missouri University of Science & Technology
- D - Université Laval
- E - Durham College
- F - Oulu Business School
- G - UEH-ISB
- H - SIIT, Thammasat University
- I - Nha Trang university
- J - Montana Technological University
- K - Seneca Polytechnic
- L - Leeds Beckett University
- M - Azerbaijan Technical University
- N - Duy Tan University
- O - West Chester University
- P - Universidad Peruana de Ciencias Aplicadas
- Q - International Management Institute, New Delhi
- R - Niagara College
- S - Universidade Presbiteriana Mackenzie
- T - Central Michigan University
- U - Georgia College & State University
- V - International University of Rabat

# Teams

C - Missouri University of Science & Technology




H - SIIT, Thammasat University



I - Nha Trang University



# Job Aid (Manufacturing Sustainability Preset 2/3)



**Manufacturing Sustainability Game (Preset 2)**

powered by ERPsim

User: **\$\_1 to \$\_9**  
Initial password: **ERPSIM**

Adapted for Fiori and for SAP GUI with Fiori Visual Theme Activated  
© ERPsim Lab, HEC Montréal  
Last Update: July 31, 2023

**CHANGE PRODUCT DESIGN**  
Validated BOM Change (ZCSO2)

Select the material to change by clicking

- 1
- 2 Change quantities and

! If received error messages, click on  to modify the entries

**FORECAST SALES**  
Create Planned Indep. Req. (MD61)

Select *Product group* and enter the following information

- 1  Product group: **\$\$-P**
- 2
- 3 Enter your forecast quantities in the 2nd date column
- 4

**CALCULATE REQUIREMENTS**  
MRP Run (MD01)

- 1 Press Enter or click
- 2 Ignore orange warnings  
Press two more times on Enter
- 3 In the pop-up window, click

**SELECT VENDOR**  
Procurement Sourcing (ZME12)

1 Click on *Assign Source of Supply*

2 For each *Material*, assign a vendor

3

**ORDER MATERIALS**  
Create Purchase Orders (MES9N)

1

! Purchase orders are created

! If no open requisitions:  
*No suitable requisitions found*

**RELEASE PRODUCTION**  
Convert Planned Orders (CO41)

1

! If no planned order: *Planned order could not be selected*

2 Select orders

3

! If conversion fails, click on **X** to see log

**PLAN STOCK TRANSFER**  
Stock Transfer (ZMB1B)

- 1 In *Planning Mode*, select a *Push or Pull* transfer strategy
- 2 In *Scheduling*, enter your delivery frequency
- 3
- 4 Enter the amount of each product you wish to send/maintain in each region
- 5

**MAINTAIN PRICES**  
Change Price List (VW32)

- 1 Open the *Prices* folder and double click on *Price list*
- 2 In *Distribution channel*, enter 10, 12 or 14
- 3
- 4 Modify your prices
- 5

**PLAN MARKETING BUDGET**  
Marketing Expense Planning (ZADS)

- 1 Enter your daily amount of marketing expenditure for each product per area
- 2

**STANDARD INVESTMENTS**  
Financial Postings (ZFB50)

- 1 Select the type of *standard investment* you wish to make
- 2 Enter the *Posting Amount*
- 3 Click on
- 4 Click on

**SUSTAINABLE INVESTMENTS**  
Financial Postings (ZFB50)

- 1 Select the type of *sustainable investment* you wish to make
- 2 Click on
- 3 Click on

**PRODUCTION COST**  
Product Cost Planning (ZCK11)

Shows variable and fixed costs for each finished product

Recalculates costs based on production capacity and productivity level

Shows daily amounts of fixed costs (overhead, depreciation and S, G & A)

**STOCK LEVELS**  
Inventory Report (ZMB52)

Shows stock levels for both finished products and raw materials

Shows quantities of raw materials reserved for production

**PROCUREMENT TRACKING**  
Purchase Order Tracking (ZME2N)

Shows the details/status of each purchase order

Shows expected goods delivery Date

**SALES AND MARKET DATA**  
Summary Sales Report (ZVZ)

Shows aggregate daily sales by product

**Detailed Sales Report (ZVA05)**  
Shows sales related info such as sales revenue by region

**Price Market Report (ZMARKET)**  
Shows aggregate market sales data of past 5 days

**FINANCIAL STATEMENTS**  
Financial Statements (F01)

- 1 In *Company Code*, enter your *<company code>*\*
- 2 GUI step  
Select *ALV Tree Control*
- 3 GUI step   
Fiori step   
Fiori step

**MANAGE IT REPORTS**  
Report Management (ZITM)

Shows report availability and allows report(s) purchase

**CASH FLOW**  
Liquidity Planning (ZFF7B)

Displays an estimate of your cashflow for the coming weeks

**PRODUCTION SCHEDULE**  
Production Report (ZCO01S)


Shows released production orders

For each order, the time released, started and finished (or to start and finish if incomplete)

If Target Qty > Conf. Qty production is still pending

\*To find your company code, refer to transaction ZORG (Organizational Structure)

■ Planning 
 ■ Procurement 
 ■ Production 
 ■ Sales 
 ■ Reports 
 ■ Accounting 
 ■ Logistics 
 1/2



**Manufacturing Sustainability Game (Preset 2)**

powered by ERPsim

User: **\$\_1 to \$\_9**  
Initial password: **ERPSIM**

Adapted for Fiori and for SAP GUI with Fiori Visual Theme Activated  
© ERPsim Lab, HEC Montréal  
Last Update: July 31, 2023

**Bill of Materials**

Nut	Strawberry	Original	Raisin	Blueberry	Mixed
\$\$-F01 500g \$\$-F11 1kg	\$\$-F03 500g \$\$-F13 1kg	\$\$-F05 500g \$\$-F15 1kg	\$\$-F04 500g \$\$-F14 1kg	\$\$-F02 500g \$\$-F12 1kg	\$\$-F06 500g \$\$-F16 1kg
20% wheat* 30% oat* 20% nut* 1 box / 1 bag*	20% wheat* 30% oat* 20% strawberry* 1 box / 1 bag*	20% wheat* 30% oat* 1 box / 1 bag*	20% wheat* 30% oat* 20% raisins* 1 box / 1 bag*	20% wheat* 30% oat* 20% blueberry* 1 box / 1 bag*	20% wheat* 30% oat* 30% fruits & nuts** 1 box / 1 bag*
*minimum	*minimum	*minimum	*minimum	*minimum	*minimum **requires all fruits/nut

**STORAGE CAPACITY AND COSTS**

Product Type	Current Space	Daily Cost per additional 50 000 units*	Daily Carbon cost per additional 50 000 units*
Finished products	250 000 boxes	€500	2 500 (kg of CO <sub>2</sub> e)/day
Raw materials	250 000 kg	€1 000	5 000 (kg of CO <sub>2</sub> e)/day
Packaging (bags and boxes)	750 000 units	€100	1 500 (kg of CO <sub>2</sub> e)/day

*\*Billed automatically*

**FIXED COSTS (€ paid each 5 days)\***

Labor	20 000
Manufacturing overhead	15 000
S, G & A	40 000
Depreciation (Building)	1 250
Depreciation (Equipment)	50 000

*\*Billed automatically*

**DAILY OVERHEAD CARBON**

Purchased Energy (kg of CO <sub>2</sub> e)	500
Other Overhead (kg of CO <sub>2</sub> e)	400

**PRODUCTION CONSTRAINTS**

Capacity (units/day)	24 000
Additional Capacity Cost (€ per 1 000 units)	1 000 000**
Additional Capacity Carbon Emission (kg per 1 000 units)	1 000
Production Carbon Emission	0.30 kg per box
Setup Carbon Emission	50 kg per hour
Minimum/Maximum Lot Size	16 000/48 000

*\*\*Investing in additional capacity will increase equipment depreciation costs*

**SETUP TIME REDUCTION**

Setup Time (hrs)	Cost (€)	Carbon (kg)
8	-	-
7	50 000	100
6	125 000	250
5	250 000	500
4	500 000	1 000
3	1 250 000	2 500

**SUPPLIERS**

Vendor	V01	V11	V02	V12
Lead time (days)	2-3	1-4	2-3	1-4
Delivery Cost (euros)	-	€ 1 000	-	€ 2 000
Delivery Carbon (kg of CO <sub>2</sub> e)	10 000	10 000	6 000	15 000

**CUSTOMERS**

<b>DC 10: Hypermarkets</b> Payment Time: 20 days Approximate Market Size €90 000 per team per week
<b>DC 12: Grocery Chains</b> Payment Time: 10-20 days Approximate Market Size €360 000 per team per week
<b>DC 14: Independent Grocers</b> Payment Time: 1-20 days Approximate Market Size €135 000 per team per week

**TRANSPORTATION AND CARBON FEES**

Movement type	Cost (€)	Carbon (kg)
Main Warehouse to Regions	500	750
Regions to Customers	-	200
Main WH to Customers (per unit)	0.05	0.25

**FIXED CARBON TAX**

Price (€/kg of CO <sub>2</sub> e)	0.20
-----------------------------------	------

**SUSTAINABLE INVESTMENTS**

Type	Cost (€)	Carbon (kg of CO <sub>2</sub> e)	Reduction (%)	Max. Reduction (%)
Freight Fleet Improvement	10 000	2 000	15	45
Sustainable Manufacturing	10 000	2 000	15	45

■ Planning 
 ■ Procurement 
 ■ Production 
 ■ Sales 
 ■ Reports 
 ■ Accounting 
 ■ Logistics 
 2/2

# Challenge Rules

- Teams will play 6 Rounds of the ERPsim **Manufacturing Sustainability** (Preset 2+) scenario.
- Teams are **only allowed** to perform **transactions** described on the **Job Aid**.
- Teams must **finish with a debt less than the initial one** (8 Million EUR).
- Investing in **capacity increase** and **setup time reduction** is **irreversible**.
- **Coaches** can login but not allowed to input transactions.
- **Coaches** can join their team's breakout rooms but will be asked to come back to the main session when the simulation is running.
- Teams have **access** to the **OData** service.
- Teams must **behave ethically** and responsibly.
- Teams will be ranked based on their **company valuation**.

# Round 1&2

# Rounds Evolution

## Round 1&2

- Carbon tax at 0.20€/kg CO<sub>2</sub>e
- Initial inventory
- Initial planned orders
- Sales from main or regional warehouses
- Standard & sustainable investments allowed
- ZITM unavailable (all reports available)
- Suppliers V11 and V12 now available

## Round 3&4

- Carbon tax at 0.30€/kg CO<sub>2</sub>e\*
- Random disruption 1

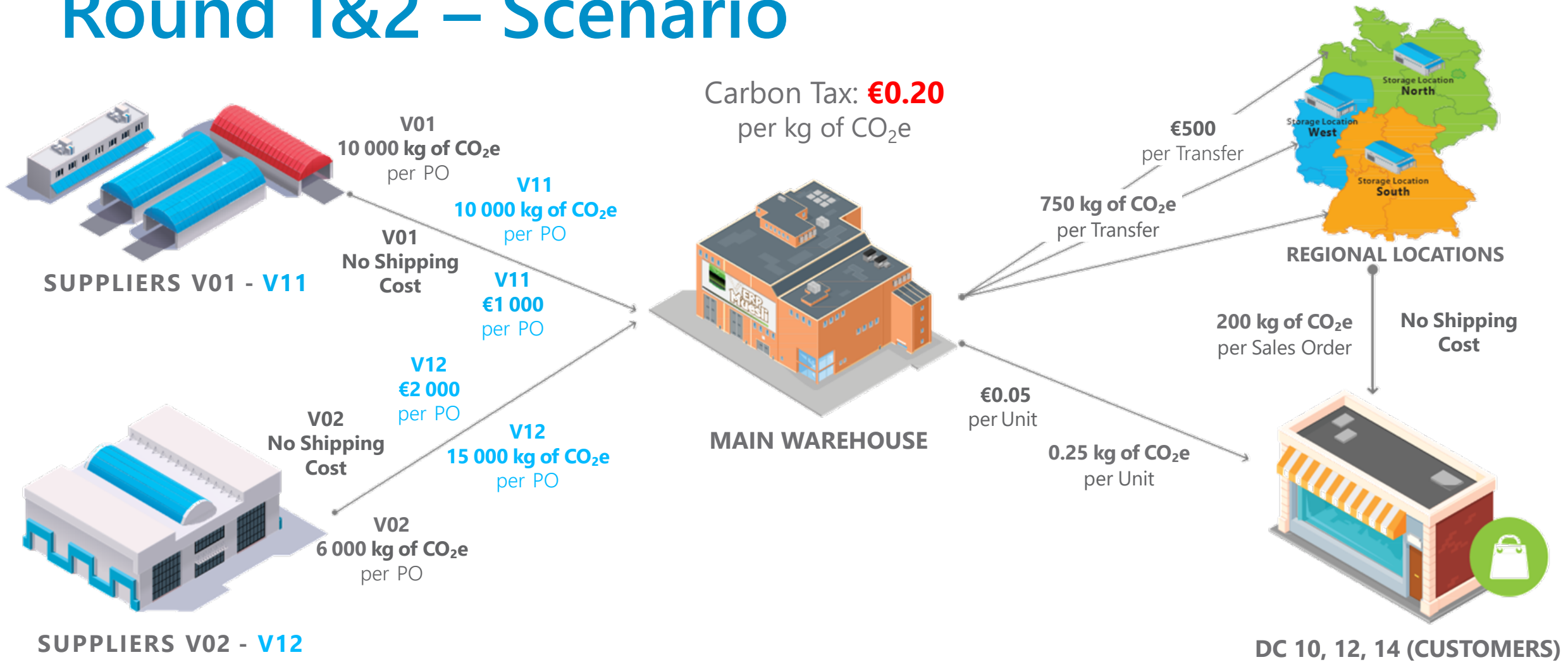
## Round 5&6

- Carbon tax at 0.40€/kg CO<sub>2</sub>e\*
- Random disruption 2

\* Values might be different, depending on the Random Disruptions



# Round 1&2 – Scenario



# Round 1 - Results

## Financial Statements - R1

Team	Credit ratings	Interest Rate (%)	Rank	Company valuation	Cumulative Net Income	Total sales	Gross Margin (%)	Net Margin (%)	ROE (%)	ROA (%)	D/E (%)	Mktg/S (%)	Round Net Income	Round Productivity	Round Sales per Team	CO2e (kg)	CO2e per Unit Sold (kg/unit)	CO2e per Sales (kg/€)
B	A+	7.750	1	174,654,236.26	1,196,822.73	3,193,219.30	74.003	37.480	5.392	3.901	38.213	0.000	1,196,822.73	95.000	3,193,219.30	525,511.05	1.18	0.16
K	AA+	6.500	2	164,299,146.42	1,416,846.52	2,775,438.50	74.150	51.049	6.320	4.908	28.766	0.359	1,416,846.52	91.667	2,775,438.50	371,871.48	0.74	0.13
N	BBB	9.000	3	161,462,116.92	548,339.60	3,422,749.84	73.427	16.020	2.545	1.585	60.520	0.114	548,339.60	87.069	3,422,749.84	478,141.10	0.94	0.14
C	AA-	7.250	4	158,375,319.82	1,315,185.29	3,027,000.45	74.510	43.448	5.894	4.244	38.856	6.355	1,315,185.29	87.500	3,027,000.45	438,081.79	0.89	0.14
T	BBB	9.000	5	153,601,750.46	1,150,685.63	3,407,270.72	71.836	33.771	5.195	3.299	57.457	0.000	1,150,685.63	89.167	3,407,270.72	421,813.40	0.74	0.12
H	A+	7.750	6	153,179,083.91	949,878.53	2,995,891.50	71.976	31.706	4.327	3.204	35.047	0.310	949,878.53	81.875	2,995,891.50	536,506.25	1.02	0.18
E	AA-	7.250	7	152,193,248.71	523,895.04	2,952,913.54	72.752	17.742	2.434	1.738	40.085	0.161	523,895.04	93.173	2,952,913.54	452,627.45	0.93	0.15
J	A	8.000	8	110,030,496.67	128,638.30	2,574,299.17	69.585	4.997	0.609	0.427	42.752	0.000	128,638.30	74.000	2,574,299.17	462,777.66	0.93	0.18
O	A+	7.750	9	108,753,939.40	964,048.99	2,543,011.49	64.709	37.910	4.389	3.164	38.706	0.009	964,048.99	79.008	2,543,011.49	475,797.66	0.84	0.19
D	AA-	7.250	10	105,276,907.38	730,304.34	2,202,754.00	71.193	33.154	3.361	2.479	35.587	0.006	730,304.34	66.875	2,202,754.00	357,073.56	0.89	0.16
U	A+	7.750	11	100,193,935.66	733,565.62	2,482,549.07	63.012	29.549	3.375	2.406	40.290	0.000	733,565.62	85.625	2,482,549.07	595,920.25	1.07	0.24
A	BB+	9.750	12	95,744,339.20	638,737.22	2,727,200.23	67.151	23.421	2.952	1.984	48.762	0.253	638,737.22	77.499	2,727,200.23	794,921.60	1.46	0.29
V	AA	7.000	13	57,424,825.09	526,394.23	1,699,790.88	64.081	30.968	2.445	1.780	37.412	0.000	526,394.23	42.917	1,699,790.88	303,961.00	0.80	0.18
F	CCC	12.000	14	43,801,188.24	574,683.50	2,070,479.60	68.764	27.756	2.664	1.507	76.705	0.222	574,683.50	81.666	2,070,479.60	566,272.86	1.43	0.27
I	BBB+	8.750	15	39,690,273.88	421,709.16	1,705,749.00	72.409	24.723	1.969	1.404	40.180	0.000	421,709.16	35.000	1,705,749.00	1,049,412.75	4.25	0.62
G	A-	8.250	16	12,271,984.00	(360,556.83)	1,063,119.11	69.997	(33.915)	(1.747)	(1.302)	34.190	0.945	(360,556.83)	31.667	1,063,119.11	232,804.00	1.27	0.22
M	A+	7.750	17	(1,077,386.55)	(10,549.41)	855,709.50	64.330	(1.233)	(0.050)	(0.036)	38.114	0.000	(10,549.41)	0.000	855,709.50	163,396.25	0.85	0.19
L	A	8.000	18	(3,025,265.67)	(543,585.99)	943,895.00	61.485	(57.590)	(2.657)	(1.977)	34.411	0.000	(543,585.99)	39.167	943,895.00	183,553.59	1.04	0.19
P	A+	7.750	19	(3,038,926.98)	(29,756.16)	827,613.53	64.315	(3.595)	(0.142)	(0.103)	38.149	0.000	(29,756.16)	0.000	827,613.53	161,848.75	0.87	0.20
R	BBB+	8.750	20	(49,523,741.18)	(526,189.75)	78,623.25	58.624	(669.255)	(2.570)	(1.848)	39.074	0.076	(526,189.75)	10.000	78,623.25	141,223.50	13.69	1.80
Q	B	11.000	21	(53,186,278.40)	(6,838,578.48)	671,719.50	70.369	(1,018.071)	(48.290)	(26.817)	80.071	0.000	(6,838,578.48)	34.971	671,719.50	205,097.91	1.65	0.31
S	A	8.000	22	(156,644,123.00)	(1,566,441.23)	1,413,219.01	64.049	(110.842)	(8.060)	(5.672)	42.108	135.014	(1,566,441.23)	35.000	1,413,219.01	299,417.00	0.94	0.21

# Round 2 - Results

## Financial Statements - R2

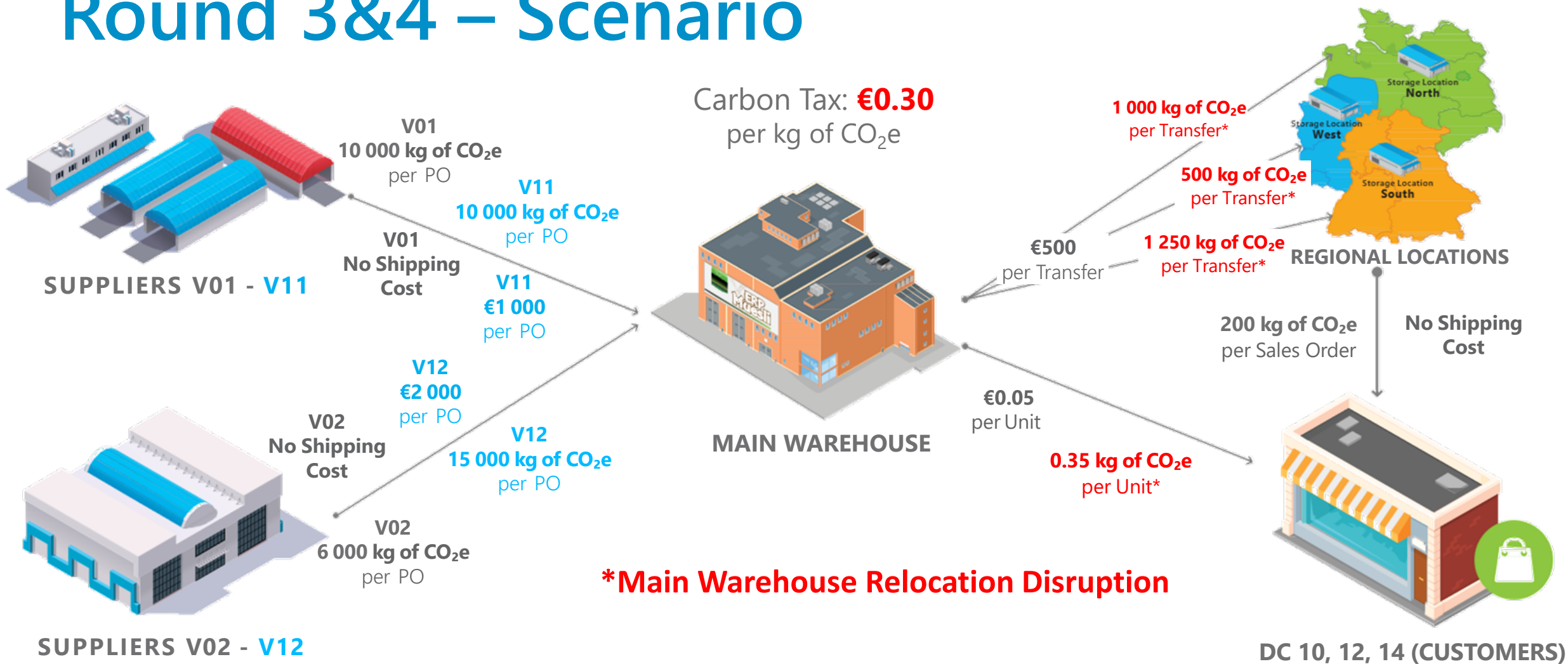
Team	Credit ratings	Interest Rate (%)	Rank	Company valuation	Cumulative Net Income	Total sales	Gross Margin (%)	Net Margin (%)	ROE (%)	ROA (%)	D/E (%)	Mktg/S (%)	Round Net Income	Round Productivity	Round Sales per Team	CO2e (kg)	CO2e per Unit Sold (kg/unit)	CO2e per Sales (kg/€)
B	AA	7.000	1	201,752,679.09	3,232,132.45	6,608,746.03	75.925	48.907	13.338	10.407	28.165	0.380	2,035,309.72	94.583	3,415,526.73	942,370.71	1.01	0.14
N	A	8.000	2	199,587,243.33	2,900,078.20	7,336,468.73	74.750	39.530	12.134	8.653	40.236	0.132	2,351,738.60	93.750	3,913,718.89	832,801.86	0.77	0.11
K	AAA+	6.000	3	182,674,421.00	2,786,240.35	5,666,370.85	74.589	49.172	11.714	9.700	20.764	0.344	1,369,393.83	92.500	2,890,932.35	685,201.33	0.70	0.12
C	AA+	6.500	4	163,728,072.93	2,779,294.64	5,940,291.12	74.967	46.787	11.688	8.551	36.686	6.470	1,464,109.35	96.250	2,913,290.67	720,178.45	0.82	0.12
T	A-	8.250	5	152,921,476.24	2,655,480.14	6,410,127.32	73.623	41.426	11.226	7.698	45.829	0.000	1,504,794.51	94.167	3,002,856.60	779,144.24	0.73	0.12
A	A-	8.250	6	141,162,962.78	2,465,410.49	6,052,322.93	70.627	40.735	10.507	7.763	35.335	0.228	1,826,673.27	89.166	3,325,122.70	1,246,854.75	1.14	0.21
H	A+	7.750	7	123,772,536.00	1,923,878.83	5,057,997.50	72.995	38.036	8.392	6.800	23.422	0.506	974,000.30	90.294	2,062,106.00	1,055,286.00	1.26	0.21
E	A+	7.750	8	117,634,457.53	1,482,841.46	5,198,106.69	71.601	28.527	6.595	5.180	27.313	0.208	958,946.42	86.365	2,245,193.15	885,767.36	1.09	0.17
J	BBB+	8.750	9	114,376,733.65	505,505.59	5,641,642.42	72.322	8.960	2.351	1.590	47.837	0.000	376,867.29	92.155	3,067,343.25	1,072,932.94	1.10	0.19
O	AA-	7.250	10	104,316,972.62	1,864,276.57	4,736,408.09	66.199	39.361	8.154	5.849	39.399	0.016	900,227.58	86.874	2,193,396.60	957,108.85	0.98	0.20
U	A	8.000	11	74,935,002.67	1,065,366.72	4,395,530.65	63.089	24.238	4.828	3.449	39.980	0.000	331,801.10	88.333	1,912,981.58	1,315,051.00	1.32	0.30
F	B-	11.250	12	62,604,480.26	1,549,530.54	4,464,185.60	71.938	34.710	6.872	4.084	68.247	0.167	974,847.04	70.095	2,393,706.00	1,189,108.86	1.26	0.27
L	AA	7.000	13	51,291,001.45	473,668.36	3,228,821.55	66.600	14.670	2.206	1.634	35.005	0.000	1,017,254.35	50.000	2,284,926.55	405,244.34	0.70	0.13
G	AA-	7.250	14	28,375,034.49	90,365.23	2,482,370.91	70.366	3.640	0.428	0.318	34.862	0.620	450,922.06	45.208	1,419,251.80	510,295.25	0.96	0.21
I	A-	8.250	15	27,806,110.04	567,708.08	2,933,294.00	71.849	19.354	2.632	2.026	29.948	0.000	145,998.92	95.000	1,227,545.00	1,773,266.75	3.73	0.60
D	A-	8.250	16	25,817,176.33	293,767.35	2,445,170.00	70.058	12.014	1.380	1.003	37.598	0.034	(436,536.99)	67.917	242,416.00	707,690.44	1.57	0.29
V	A+	7.750	17	24,837,175.15	486,394.68	2,552,870.63	62.766	19.053	2.264	1.631	38.814	0.000	(39,999.55)	41.667	853,079.75	626,595.75	1.09	0.25
Q	BBB-	9.250	18	(5,737,913.21)	(5,739,212.25)	3,340,001.50	65.762	(171.833)	(37.608)	(20.119)	86.928	0.000	1,099,366.23	82.224	2,668,282.00	702,990.10	0.99	0.21
M	A	8.000	19	(10,713,915.50)	(214,278.31)	1,412,880.00	64.000	(15.166)	(1.031)	(0.737)	39.847	0.000	(203,728.90)	26.667	557,170.50	331,556.00	1.04	0.23
P	A+	7.750	20	(29,093,958.64)	(569,756.69)	856,080.00	64.335	(66.554)	(2.789)	(2.004)	39.158	0.000	(540,000.53)	0.000	28,466.47	181,420.00	0.94	0.21
R	BBB	9.000	21	(46,061,753.54)	(998,004.66)	203,211.10	71.292	(491.117)	(4.990)	(3.564)	39.996	0.196	(471,814.91)	6.667	124,587.85	182,113.25	6.60	0.90
S	A-	8.250	22	(87,074,872.65)	(1,777,778.65)	2,289,946.15	63.023	(77.634)	(9.249)	(6.422)	44.020	91.523	(211,337.42)	40.000	876,727.14	546,542.00	1.07	0.24

# Round 3&4

# Round 3&4 - Random Disruption

Event	Name	Context	Scope
1	Cold Spell	The cold spell increases the carbon emission per unit of raw material purchased, as suppliers must use energy-intensive protection measures to protect the fruits/nuts/cereals from the cold. However, your company requires less energy to stock them in a cool environment.	All suppliers, 2 random raw materials
2	Heat Wave	The heat wave increases the carbon per unit of raw material purchased, as suppliers must use energy to protect the fruits and/or nuts from the intense heat before the harvest. Furthermore, your company requires more energy to stock them in a cool environment.	All suppliers, 2 random raw materials
3	Disruption in Supply Chain (Vendors)	Disruptions in your supplier's supply chain required them to use less-optimal sourcing and routing. Therefore, all products purchased from this supplier will be generating more carbon emissions.	Random suppliers, All products
4	New Legislation, Renewable Energy Adoption	New legislations in Germany increases drastically the carbon tax while reducing the carbon footprint of purchasing energy as more energy is now generated by renewable sources.	-
5	Waste Heat Recovery System	Newly installed waste heat recovery system on your machineries allow your company to reuse heat from your production process, thus reducing the amount of energy purchased. However, the more complex machineries require more care when cleaning up between production batches.	-
6	Main Warehouse Relocation	A recent relocation of your main warehouse increases the distance between your main hub and two regions and Germany while reducing the distance with the third region. The distance difference will be impacting the carbon emissions generated by deliveries from the main warehouse to the regions and by sales delivered directly from the main warehouse.	Random regions

# Round 3&4 – Scenario



# Thank you!

Learn more about ERPsim

[erpsim.hec.ca](http://erpsim.hec.ca)    [erpsim@hec.ca](mailto:erpsim@hec.ca)