Introducing Gamification into teaching Supply Chain Management

- Basic Training course -

Professor Susanne Wilpers

Hochschule Heilbronn

Herbert Streit

Hochschule Heilbronn

[1] This material is part of the application of the game approach in logistics and transport training (Output Title O6) under the Erasmus + strategic partnership project „Building an innovative network for sharing of best educational practices, incl. game approach, in the area of international logistics and transport “, Project number: KA203 / HE-25 / 13.09.2019

Abstract

This course was developed to introduce students into the basic principles of supply chain management. Rather than holding lectures for a whole semester, we spent a good amount of the time with a dedicated game, after the basic knowledge has been taught. The goal is to confront the students with some real-life experience on what it means to manage a supply chain in a company. The game is played in several rounds by teams with increasing complexity. The results are evaluated after each round. As this course is for beginners, their company will exist in a simplified world, where consequent strategies will be rewarded. Other than in the real world, there will be no unforeseen events that can overwrite their planning. Anyways successful rounds can only be achieved with a proper reflection of the learning material.

Introduction

Goals and outcomes of this course

What is the benefit of the gaming approach?

From gamification to experimental learning

Part 1. Supply Chain Management

1.1. Definition of and Introduction to Supply Chains

1.1.1. Definition: What is a Supply Chain?

1.1.2. Resilience of Supply Chains

1.1.3. Disruption of Supply Chains and the consequences

1.2. The fundamentals of Supply Chain Management

1.2.1. What does SCM mean for your business?

1.2.2. What are the technical challenges of a Supply Chain?

1.2.3. How do leadership and teamwork affect Supply Chain Management?

Part II. Introduction to the principals of a supply chain simulation game

Part III. Playing the game and reviewing the results

0. Introduction

To spend valuable lifetime playing online games is sometimes seen as a waste of time. But especially older generations tend to forget that they have learned most of their skills through playing games or learning formats that had gaming elements. The difference – what is not a difference at all – is that they were not sitting in front of a screen, around a table.
Learning through games has always been the most important part of the human evolution and a guarantee for our survival.

Gamification is the introduction of game elements in a non-game situation, like teaching and learning in our case. The gamification of teaching and learning is an educational approach to provide alternative methods of teaching and can be a part of a blended learning design. The goal is to maximize fun, engagement and motivation through capturing the interest of learners, push them forward and inspiring them to continue learning or even to study more.

The gamification of teaching contents might not be suitable for all kinds of learning areas, but Supply Chain Management is for sure one of the subjects that are ideal for gamification.
While the basic concepts of Supply Chain Management are not very hard to understand, their application in the real world can be very complex and challenging. At this point the gamification can kick in. The students experience a part of the real-world challenges of managing a supply chain in a dedicated game.

The authors have experience with games that are available on the market, but the design of this course is not limited to these courses. It is also suitable for self-developed online games or even board games that exist or can be built for the topic of Supply Chain Management.

Gamification of teaching contents is a first step to experimental learning as long as it’s flanked by a good designed lecture and other elements (blended learning).

Experimental learning might be a path to future, like the 21st century skills defined by the World Economic Forum in 2016. They have listed 10 personal traits which would not be achievable with the methods of frontal classroom teaching or the classic lecture, but in the presence of all kind of learning strategies. These traits are

- *Complex problem solving*
- *Critical thinking*
- *Creativity*
- *People management*
- *Coordinating with others*
- *Emotional intelligence*
- *Judgment and decision making*
- *Service orientation*
- *Negotiation*
- *Cognitive flexibility*

Most, if not all of them can be trained and improved with a gamification approach in teaching and learning.

Structure of this course

The goal of this course is to introduce students into the world of Supply Chain Management. This addresses especially students without or with basic knowledge in this area. The authors are convinced that students of logistics and supply chain management should be “confronted” with real life scenarios as early as possible in their education. Although the theory might look quite simply, the challenges of managing a supply chain can be huge and frustrating due to complexity and unexpected changes in real life.

This training course is divided into three main parts. First, we will work through the fundamentals of Supply Chain Management in a lecture-like manner. Once the knowledge has been transferred and evaluated, we will outline the structure and the logic behind the game itself. The students learn what kind of company they are working for. They will get friends with the company's supply chain that starts with the suppliers and ends with the customers. They learn that one of the essentials in the game is to build up a strategy and consequently stick to it during all rounds of the game.

The students will work together in a team within a company that actually faces financial losses due to poor supply chain management. Each team member overlooks a different department of the company.
So, the students are forced to change parameters in the supply chain to avoid further losses and the have to communicate and agree over the strategic changes within the team.
As this is a basic course, they will play in a transparent and stable environment, where they will be rewarded if they are able to apply their knowledge they have learned before. The behavior and reliability of their suppliers and the customers will stay stable within the several rounds of the game.
They will not face risks or broken supply chains in this basic version of the game. This will happen in a more advanced version of the game.

This training course is ideal to be taught and played online by international student groups.

Learning outcomes for training participants

Knowledge & Understanding:

The participants will have experienced a first impression of the complexity of a supply chain. They may or may have not been able to apply their knowledge successfully, but they have made a valuable experience. No matter what the result looks like, they have to do a critical assessment of the team's strategy and result for the final presentation.

Professional & Practical skills:

This course is an ideal introduction into the world of Supply Chain Management. It's a first, even if only partially impression of their future professional life.
They learn how Supply Chain Management impacts the financial health of a company and that strategic decisions have to be understood an accepted by all parts of the company

Intellectual skills

Understanding theories does not necessarily mean that you are able to apply them in a real-life environment. The gamification of this course is an opportunity to challenge the theoretical basics in a simulated environment that is close to real life.

Students might not have had a gamification experience in learning before (assuming that they already have a lot of leisure gaming experience). This will help them to understand that the gamification is a great way to master their learning material during their education.

General & Transferable skills

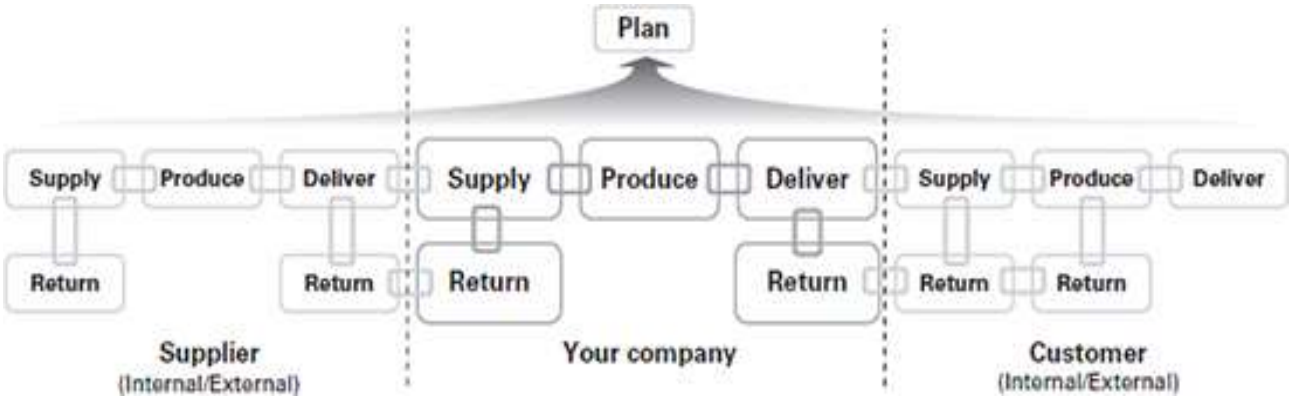
The game itself and the Final presentation is designed as a team effort. So, this is another opportunity to practice teamwork.
Ideally the teams will be international and the language is English anyways. This will be an international and intercultural experience with a chance to reach another level towards business fluent English.
The final presentation requires a critical evaluation of the results. This is an opportunity for the participants to proof their knowledge of the fundamentals und to train a critical self-evaluation.

1. Definition of and Introduction to Supply Chains

1.1.1. Definition: What is a Supply Chain?

According to Kolesnikov et al. (2015) a supply chain is a system of organizations, people, activities, information, and resources involved in supplying a product or service to a consumer. Supply chain activities involve the transformation of natural resources, raw materials, and components into a finished product that is delivered to the end customer.

The Supply Chain operations reference mode (SCOR model) of the Association for Supply Chain Management (APICS) with it's process oriented view might give a better impression on how complex a supply chain may be.



1.1.2. Resilience of Supply Chains

Supply chains can consist between a few to a few thousands of companies involved as suppliers, manufacturers and customers. Companies are no islands, but exist as a part of the society and the natural environment in an world where changes are occurring faster than ever. This creates a huge challenge to keep a supply chains stable and working.

A common approach to overlook the changes is reflected in the PESTEL model. This acronym stands for political, economic, sociological, technological, ecological and legal changes. Changes in these areas are usually accountable while natural and man-made disasters are not.

There are several strategies to guarantee a certain level of resilience for supply chains. In most cases increased resilience comes with additional costs. It's up the risk management techniques where to draw the red line. Some of these strategies are:

- Inventory and capacity buffers to increase the time-to survive.
- Supplier and manufacturing diversification to avoid dependency from one company
- Nearshoring like building regional or local supply chains.
- Harmonization of products, like the use of common vehicle platforms across the car industry.
- Strategic partnerships, especially between suppliers and manufacturers.

Resilience of supply chains was ever since seen as a technical challenge and subject to risk management. The time-to-survive and time-to-recover measurement is used to identify the weak elements of the chain.
While this approach can be good for a short-term resilience, it will not satisfy long term expectations.

The socio-ecological resilience model also includes the human factor (decision making and social interaction) and can be compared with an ecological system, like a rainforest, where instable processes interact with each other and in summary create a stable environment with a high level of resilience.

1.1.3. Disruption of Supply Chains and the consequences (examples)

Unexpected natural or manmade disasters can lead all the planning and risk management around supply chains ad absurdum within a few days. The Covid-19 pandemic in 2020 and 2021 can be seen as a worldwide stress test for the resilience of supply chains. Compared to the impact on social life, the supply chains for most of our essential goods remained remarkably stable.

At this point we preferred to choose some examples that happened more or less unnoticed by the general public but are easy to analyze.

Toilet paper shortage in Taiwan?

Yes, this already happened in 2018 and was caused by heavy forest fires in Canada and a consequently lower amount of wood for paper manufacturing; leading to supply problems in the paper manufacturing industry in Brazil and finally to a toilet-paper shortage in Taiwan, where panic buys of all kinds of sanitary papers did the rest.

No bicycles in Germany?

Several factors lead to an increased demand by 30% for bicycles in Germany starting in 2020. Responsibility for environmental and climate protection is on the rise. Electric bicycles make it easy to get everywhere without hard work and sweating. During the pandemic lockdown, people obviously had more leisure time to ride a bicycle. This pushed the manufacturers towards the capacity limits. At the same time some of the suppliers were not able to deliver certain parts due to problems caused by the Covid pandemic and so a lot of orders, especially customized orders could not be assembled. We have to mention here that the supply chains for (electric) bikes are widespread all over the globe. The expectations are that this situation will last for at least another year.

1.2. The fundamentals of Supply Chain Management

1.2.1. What does SCM mean for your business?

Companies make their money within certain industries and have to decide for a strategy how to be successful in this environment. There is a huge difference in the configuration if a company produces low cost mass products or dedicated high quality products in lower numbers.

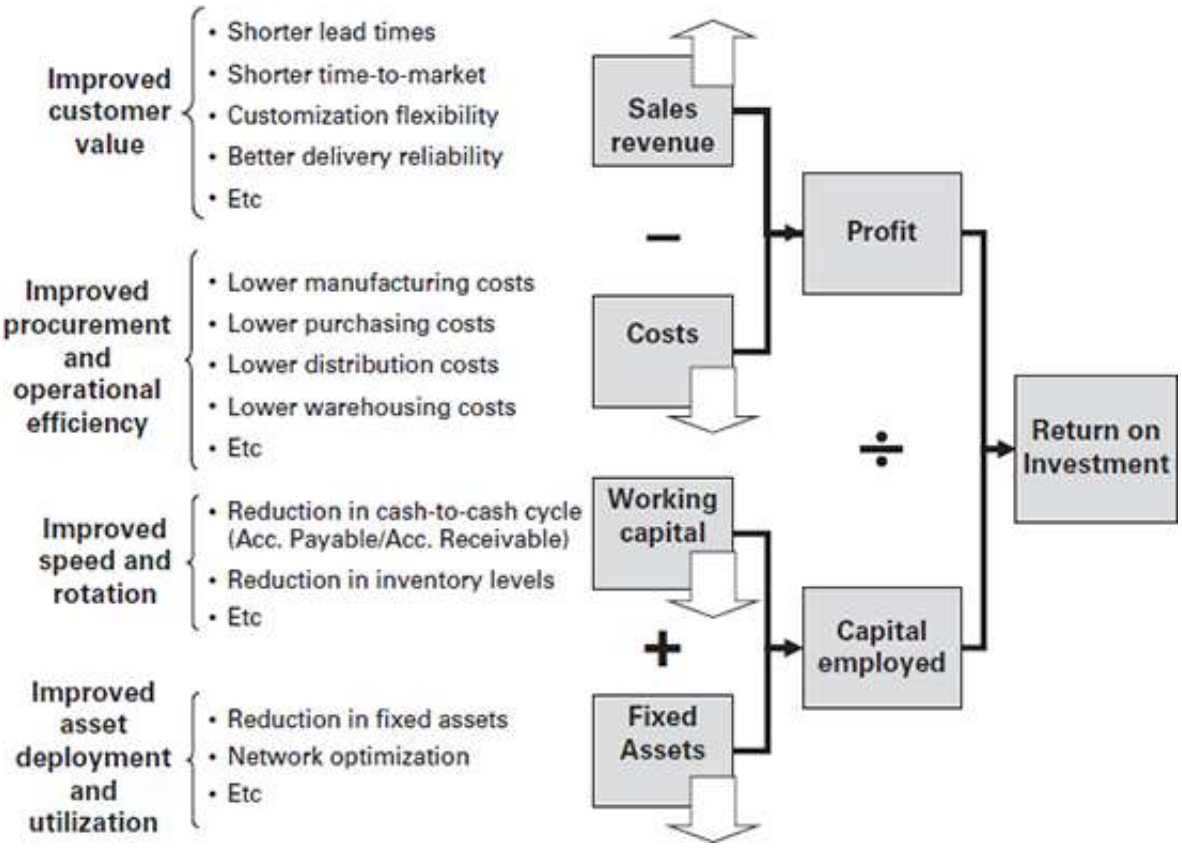
Another aspect is the way a company wants to deliver their value to their customers. This may be a fast delivery based on a “sell and run” philosophy or an extended aftersales service.

Supply chains play an essential role within the company and are a critical factor for the company' financial health. Each and every strategic business decision must be aligned with the supply chain. It's the industry and the market with their customers and competitors who define the strategy. What does the customer want? What can we promise them? Can we keep our promises in terms of quality, product features and delivery? How can we get an advantage over our competitors?
What are the risks for our supply chain? What are the overall financial risks?

Companies usually do not provide one kind of product and the corresponding strategy. They might serve different market segments.
From all possible strategies, these ones are the extremes:
Operational excellence: low cost production, low service, mediocre quality
Customer intimacy: high costs, superior products, excellent service.
A company can only survive if they spend less than they earn – at least on long term. A well calibrated Supply Chain has a huge impact on a positive income.

Since the last ten years supply chains are more than ever monitored by the financial departments. The main focus lies on the inventory of goods already produced, but still not delivered or delivered but not paid for, the so-called "tied-up-capital".

Looking at a company's return-on-investment (ROI) from the supply chain to finance relationship, it becomes clear that all elements of the Supply Chain must be optimized to have a positive effect on the ROI

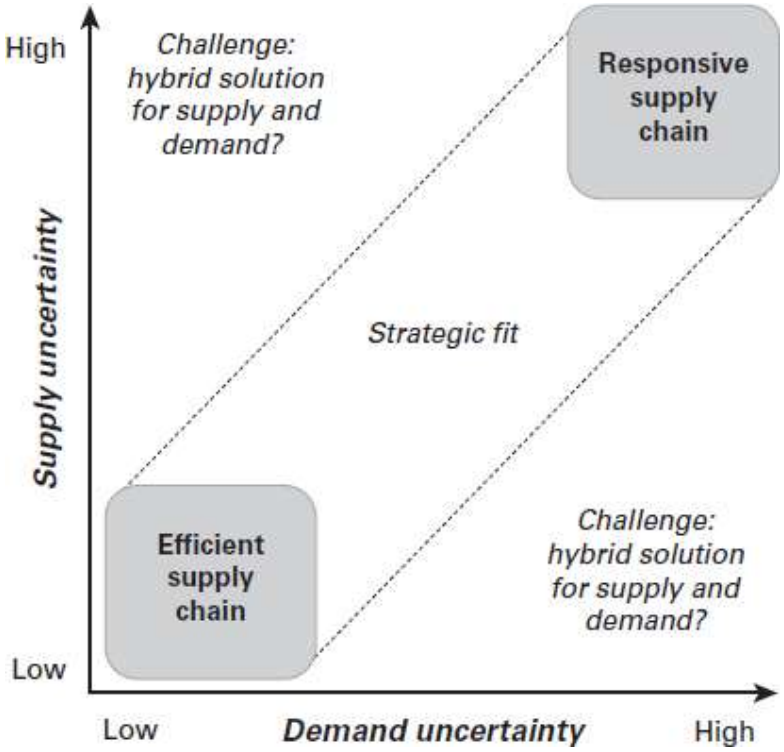


Rushton *et al* (2017) and Christopher (2016)

1.2.2. What are the technical challenges of a Supply Chain?

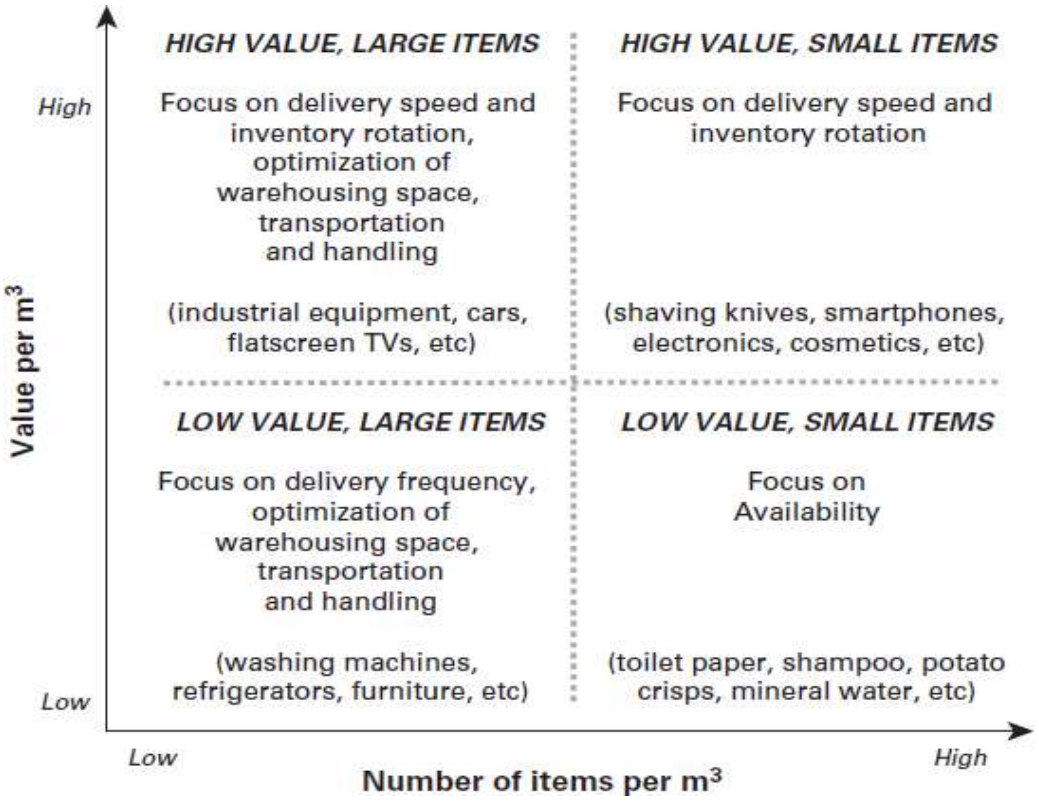
As stated in the last chapter, the supply chain strategy should be closely attached to the company's overall strategy. The two extremes are the efficient supply chain and the responsive supply chain. The first one is a good idea, if the supply and demand certainty is no problem. Your customers are always reliable when it comes to ordering and you can choose between several reliable suppliers. These factors turn into contrary in the

second model, the responsive supply chain. Your customers wish to have a high delivery reliability, but do not order frequently and you suppliers might be unreliable. In this case you have to adapt your supply chain to keeping a higher inventory and run the production on more expensive, but high-quality machinery. As said before, these are the two extremes and everything in between is possible.



Chopra, S and Meindl, P (2016) *Supply Chain Management: Strategy, planning, operation*, 6th edn, Pearson Education, Harlow

There is another aspect which is quite obvious for the supply chain strategy: what kind of products are you manufacturing, storing and transporting. The following matrix shows a very useful approach to master this challenge.



Visser, H and van Goor, A (2011) *Logistics: Principles and practice*, 2nd edn, Hessel Visser, 's Gravendeel, Netherlands

There are other characteristics that have to be considered like weight, fragility, type of material (liquid, dangerous, …), complexity of components and much more.

Customer order decoupling points (COPDs) and their push and pull strategy is another important factor for the design of supply chains, once the factors mentioned above have precipitated into the supply chain strategy.

The COPD 1 strategy is applied for goods made for local stock before they are sold to the customers, while the COPD 2 strategy is useful for goods that go to central stocks. Both are also called "push" strategies.

The COPD 3 strategy is for goods that are made to order and consequently this is called the "pull" strategy. In this case – different to COPD 1,2 – no local or central warehouses would be needed as the product goes directly to the customer once it is ordered and assembled.

In summary, the COPD strategy – if chosen or if necessary – dramatically shapes the design of a supply chain.

In an ideal world, the customers are ordering reliably, frequently and the exact amount of goods that the company is able to manufacture and the delivery of supplies works the same.

In the real world this is never the case. So, forecasting techniques are applied to have at least some kind of certainty. Although there are a lot of methods and formulas to do forecasting, they can only deliver a certain approach for future conditions. But there are a lot of useful tools and “best practices” to avoid heavy failures.
They do exist for decisions like forecasting on actual market demand, capacity planning, production planning (lot sizes, intervals, frozen periods, and more) and inventory management. But the forecast for supply chains is also a part of the company’s financial forecast. Long payment terms and tight capital might put stress on the supply chain if for example the suppliers insist on a pre-payment but the customer insists on the common payment term of 60 days.
Forecasting always founds on historical data. No human and no machine can predict the future, but it’s possible to forecast different scenarios of the future with a certain possibility that they actually will happen. Enterprise resource planning systems (ERP’s) can help us to get to this point. They are actually systems that support decisions by calculation different future scenarios based on the current situation including historical data.

1.2.3. How do leadership and teamwork affect Supply Chain Management?

Finally, we will have a closer look at the most important part of Supply chain Management: the human factor.
Even if the business and the technical aspects of the supply chain are optimized, people have to implement and maintain it. They have to be trained and led into the right direction. There are different methods to achieve this ranging from pressure, threats and punishment to enthusiasm and engagement.
A proven and widely used method is to develop key performance indicators (KPI) as a way to measure the company’s and the individuals’ success over a given period of time. These KPIs should be SMART what stands for

S = Simple: the indicator and it's calculation should be easily understood and comprehensive.
M = Measurable: the indicator must somehow be measurable and the result should be a percentage of the goal achieved or something similar.
A = Acceptable: means that the indicator is regarded as understandable, meaningful and fair
R = Realistic: the target value should be within reach, but not very easy to achieve. This is to foster motivation, but not to destroy it.
T = Time-constrained: KPIs are only valid for a certain period of time, usually a quarter or a business year.

Smart KPI's must be set for the whole company and maybe even for partners and suppliers. The system has to be started at the higher hierarchy levels, then broken down and adapted to the departments. Although each department has a set of their own KPI's, there are also common KPI's all over the company.
A common model, that helps to define the KPIs for the whole company is the balanced scorecard of Kaplan and Norton (1992).

Companies are usually organized in a hierarchy with several reporting line that create some sort of functional silos. This can prevent fast and flexible decisions in a challenging environment.
On the other hand, every fundamental decision made in a department affects most of or even all other departments. Supply chain management has a central role in this game.

The success of a team is dependent on several factors. If they are on the positive side, they will lead to a high-performance team. The following 10 assets are seen to be important.

Participative leadership – using a democratic leadership style that involves and engages team members

Effective decision-making – using a blend of rational and intuitive decision-making methods

Open and clear communication – ensuring that the team mutually constructs shared meaning, using effective communication methods and channels

Valued diversity – valuing a diversity of experience and background in team, contributing to a diversity of viewpoints, leading to better decision making and solutions

Mutual trust – trusting in other team members and trusting in the team as an entity

Managing conflict – dealing with conflict openly and transparently and not allowing grudges to build up and destroy team morale

Clear goals – goals that are developed using SMART criteria; also, each goal must have personal meaning and resonance for each team member, building commitment and engagement

Defined roles and responsibilities – each team member understands what they must do (and what they must not do) to demonstrate their commitment to the team and to support team success

Coordinative relationship – the bonds between the team members allow them to seamlessly coordinate their work to achieve both efficiency and effectiveness

Positive atmosphere – an overall team culture that is open, transparent, positive, future-focused and able to deliver success

It becomes clear that it needs a huge amount of excellent leadership skills and work to move a team into this direction. If we see the whole company as a team, this gets even harder.

Thinking about the company's existing upstream and downstream to the supply chain, we might also think of them as partners or some sort of an extended team. Establishing trust and cooperation with them might be a good idea to optimize the own supply chain. For several reasons that seldom happens. Although the relationship between companies might be good, there is always a certain lack of trust and transparency. Why should you reveal your detailed plans to somebody outside your own company? My suppliers might supply my competition. This might lead to a phenomenon called the bullwhip effect. If your customer won't tell you what they plan to order in the next period, you will build up a slightly bigger inventory to be on the safe side and to assure their loyalty. The effect becomes stronger with each company involved in the upstream direction.

Part II. Introduction to the principals of a supply chain simulation game

Part III. Playing the game and evaluating the results