The Liner Shipping Game™

Simulation Based Training for the global Shipping and Logistics Industry

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Simulation Based Training (SBT) has for many years been applied within manufacturing and service industries when to teach students and business professionals how to make their organizations more efficient and competitive in the global market place using modern management principles and IT applications. However within the transportation and logistics area, SBT is not well known, and there are very few business simulations and games available for teaching the mentioned topics to an audience from those sectors. This article elaborates further on the benefits SBT offers to lecturers and professional trainers in general compared to a range of other instruction methods. Next, it provides an introduction to the relevance for and specific aspects of The Liner Shipping Game \textsuperscript{TM} which is a unique business simulation developed to match future training needs for the (liner) shipping industry and associated business areas as freight forwarding, port operations etc. The Liner Shipping Game \textsuperscript{TM} was available in a prototype version spring 2014 but ongoing adjustments and improvements have been made to the game since then. In a relatively short time, it has gained attention in the Scandinavian and International shipping and logistics community; per January 2016 it has thus been tried out successfully in 6 countries across 3 continents where sessions have been held for around 500 shipping students and professionals. Though being in it’s infancy, it’s success so far, indicates that this or similar business simulations likely will play an important role for future training and skill building efforts in these industries.

Simulation based training should support other training methods

Classical large lecture or class room based teaching is traditionally considered as the most attractive instruction method allowing for a controllable and cost-efficient (scalable) dissemination of subject information to students and business practitioners. A competent and enthusiastic lecturer, a good structuring of curriculum taught across several lectures, exercises for students to solve after classes and a final exam – is likely to succeed in closing the knowledge gaps between the lecturer and the audience with relatively little time and resources spent compared to other instruction methods. However the large lecturing format also has a number of shortages (Brandon-Jones et al., 2012): It often fails to provide
lecturers with feedback regarding student understanding of matters; emphasis is mainly on auditory learning as opposed to other learning styles, including visual, reading/writing, or kinaesthetic learning; it bases itself on the assumption that all students learn at the same pace and have similar levels of understanding; and finally there is a significant risk of information loss due to lack of student engagement during activities. The latter is critical given the evidence that involvement in the learning process significantly improves knowledge retention and the ability to apply that knowledge in practice (Kolb, 1984). Furthermore, research has demonstrated that teaching or training should not be restricted to become simple dissemination of knowledge but perceived more as “the passing on of knowledge, this also including a preparation for working life and the internalisation of value systems and culture” (Baruch, 2006) which indicates that, lectures may not at all be suited to teach higher order learning skills covering application, analysis, synthesis, or evaluation of knowledge.

To complement the large lecturing format, lecturers many years ago began adding a range of other pedagogical instruments to their courses, as the use of film clips, real world based case assignments and problem based learning methods into their courses means. The international publishers of text books (Pearson, McGraw-Hill, Wiley etc.) early on also recognized this tendency, and over the last decade they have offered “value added services” in the form of complete course packages, including a standardized lecturing setup, curriculum, teaching and presentation materials, multimedia, exam assignments etc. to lecturers and / or students. Materials are available on a CD Rom complementing the text books, or on the internet for almost no costs and with a potential positive impact on lecturing quality and student learnings.

In the recent years, a plethora of internet or e-learning based course offerings have entered the global market for student and professional training. E-learning based course offerings exists in many different forms, but they typically allow the student the flexibility of studying and completing the course when and with a pace that he / she desires. E-learning will often be more cost-efficient to run for the training provider, than the large lecturing format. An e-learning program is often assisted by a lecturer or coach available for questions and to give guidance or check evaluations - but the course provider can in principle re-run their course multiple times when they have first been developed –also targeting a global audience - with very few additional costs to cover. The two online course portals Coursera (Coursera, 2015) and Edx (Edx, 2015) have recently achieved a global breakthrough and success in the marketplace, by providing access to and offering online (undergraduate or graduate) courses from universities and business schools from across the world, to students or professionals for free or against a fee if an official exam and diploma is desired from the respective university / business school hosting the course. Though these portals and e-learning offerings, pose a fundamental challenge to monopolies and current business models of universities, engineering and business schools, there is not much reason to believe that e-learning programs in their current setup and form will impact student learnings better than the classical large lecturing format mentioned earlier; from a pedagogical perspective there is still much room for improvements on the learning technology side.

In the search for cost-efficient but also high impacting training methods, there are currently alternative trails to follow which might lead us in more promising directions, and one of these leads us towards a category of experiential learning methods labeled as simulation based training (SBT) or educational game methods (Fish, 2007; Tan, 2007). For decades, SBT has been an integrated part of educations for officers
and chief engineers on ships or airline pilots; they have been requested to use and train their skills in virtual simulators before given authority to operate a vessel or an airplane in the real world. However when teaching other topics in the same industries, there is not the same tradition for applying SBT despite that it activates and engages participants in their study / learning process and appears to be superior in developing participant knowledge, skills and behavior (Kolb, 1984) compared to other methods. Typically SBT is defined as a training and learning methodology which according to Salas et al. (2009) for business or management education has the purpose of imparting to students or business practitioners the competencies (i.e., knowledge, skills, and attitudes) that will ultimately improve their performance and the overall performance of the organizations that eventually employ them by offering a simplified and simulated, yet natural, entertaining and motivating way of learning for the students or business people. SBT typically includes physical or computerized business simulation games, where individuals or groups are given tasks to complete, often in real-time and in collaboration and / or competition with others; role-plays, where participants assume or simulate the characteristics of other individuals or groups; and live cases, where a real-life or simulated case is examined in depth and often over an extended period of time. SBT is typically assumed to have a number of benefits compared to the training methods mentioned above (Salas et al., 2009):

- SBT is superior to other training strategies for imparting complex applied competencies.
- SBT can lead to learning in a reduced time frame
- SBT provides a more complex and realistic learning environment than other training strategies
- SBT more readily allows for reality to be simplified and manageable
- SBT provides a (relatively) risk-free environment for learning and experimentation
- SBT is an ideal method for training infrequently engaged but critical skills
- SBT can be quite affordable
- SBT is (usually) simple to learn and operate
- SBT is a form of learner-controlled training
- SBT is inherently more engaging than other training methods

Experts thus predict that SBT, whether implemented in one form or another, will play a significant role in recruiting, training and skill building across all fields and industries in the future (Forbes, 2013).

**Simulation Based Training across Industries**

In manufacturing and service industries, there is a long tradition for applying SBT to train individual and teams in application of Production Planning and Control (MRP, JIT), Lean, TQM or Six Sigma principles and methods (Brandon-Jones et al., 2012; Chen and Roth, 2005). Business simulations and games are widely applied across segments on a global scale, and well known and successfully applied examples are e.g. the Paper Airplanes Game (Billington, 2004), the Buckingham Lean Game, the Heijunka Game and the Lean Service / Housing Game (Bicheno, 2015), the Red Beads Game (Red beads website, 2005), the Dice game (Lambrech et al., 2012), the Catapult exercise (Antony and Cheng, 2003) or the recently developed Toyota

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Kata Simulation (Lean Kata website, 2015). Another reputed business simulation in the area of Supply Chain Management is “The Beer Distribution Game” (The Beergame Portal, 2015). It was originally invented by researchers at MIT to demonstrate supply chain and system dynamics, and it illustrates that agents in a supply chain must share information and coordinate their decisions and actions if they are to minimize the so called Forrester / Bullwhip effect and improve overall supply chain performance (improve on time delivery and reduce inventory costs). Recently a more modern and advance Supply Chain Game was developed called “The Fresh Connection”, which against a fee, allows multiple teams of students or professional across the world to sign up and play in competition with each other on an interactive web based platform. Complementary to The Beer Game, this game highlights how companies can benefit from consistent strategic thinking and aligning tactical and operational decisions across functions when to run a smooth and profitable supply chain in the global market place. Individuals or organizations with an interest in trying out or deploying the above mentioned games for educational and skill building purposes, can either pay some trainers experienced in organizing and facilitating game sessions to assist them, or they can choose to make an effort and run sessions on their own – either based on game “recipes” available in books or on relevant websites or through purchasing game sets, with instruction manuals, game materials etc.

Several of the “iconic” business simulations and game mentioned above, are of relevance for transportation, shipping or logistics industries, and most students or professionals have either tried or will sooner or later become familiar with some of them during their careers. It is however important to stress that business and industry fundamentals of transportation are very different compared to manufacturing or service sectors. Manufacturing companies transform resources (materials and energy being physical objects) into products and services they typically strive to optimize their material flow and utilize critical production assets well to remain competitive and add value to their clients. Service companies hardly have any flow of materials to optimize, but must streamline the throughput of information, documents or customers across the organization to excel in service quality and stay in business. Transportation companies include some support processes of a service nature, but their core activity is moving goods or passengers from A to B between (a more or less complex) network of origin-destination locations – a task which is not done handled in production or service companies. Pricing of products and services and capacity management of critical transportation assets is essential to satisfy customer requirements for on-time delivery and to remain cost-competitive and profitable at the same time. That said, in some cases, transportation companies must also do some inventory management for required transportation equipment which must be repositioned and stored in depots after delivery of goods to the customer (e.g. ISO containers, trailers etc.).

When the above mentioned business simulations and games are used for training students and professionals with transportation profiles, the difference in industry background quickly becomes visible. They participate, engage in, have fun, enjoy and develop their knowledge and skills in the sessions. But they also claim that they “find it hard to challenging to transfer and apply the demonstrated management principles and tools to their own industry and companies”. Their feedback illustrates that there is a demand for business simulations and games tailored more to the commercial and operational realities of their businesses. A few years ago, this sparked a group of Danish located university researchers and industry
professionals / experts to develop a range of business simulations and games targeting a particular segment within transportation which became the global liner shipping industry and related businesses. The remaining part of this paper is dedicated to a more detailed introduction to one of the outcomes of their work, which is called The Liner Shipping Game™.

**The Liner Shipping Game™**

Purpose of this business simulation or game is to convey an insight into the following topics for participants playing the game:

- Commercial and Operational fundamentals of Liner Shipping.
- Business processes and activities of core functions in a modern container shipping line.
- Importance of communication and coordination of decisions across geographical units in a transportation / shipping network and organizational functions to maximize profitability (Jensen, 2014).
- The importance of process standardization (Liker and Meier, 2007), data availability and quality for quality decision making, particularly when to apply mathematical-economical models and implement computer based support tools for critical business processes (Davenport, 2007; Rytter et al., 2014).
- Relevance of methods for commercial and operational process optimization, as e.g. Operations Research based tools for Revenue Management (Zurheide, 2015) and Stowage (Wilson and Roach, 2000), when to maximize profitability (increase revenue and reduce costs) across the liner network or per ship.
- Finally, the purpose is also to foster team spirit playing with Lego® models and documents, and obtain a fun and motivating day together with peers.

The game is setup so that a team of participants must manage a shipping line together operating a round trip service with 4 container vessels transporting 2 types of containers (Dry and Reefer) for 2 customer types (Contract and Spot business clients) between 4 ports in 2 geographical regions (Asia and Europe). Every port includes a container terminal with a simple yard layout, and a common depot of empty / full containers. The 4 container vessels for the game are rebuilt (retrofitted) versions of Maersk Line Lego Container Vessel models having identical deployed slot capacity and carrying dry (grey) and reefer (white) containers also built from Lego bricks. The four vessels of the service rotate between the ports with a fixed weekly schedule / port call, and for every week participants must accomplish commercial and operational tasks for the shipping line and visited terminals, see Table 1.
Besides the Lego ship models, a flow of documents / information and other materials is also part of the game, which participants use to accomplish their tasks, document decision outcomes and calculate consequences of their actions. Documents have been developed, so they content wise and visually are similar to papers and IT tools currently applied in the industry, see Figure 1.

![Lego models and documents](image)

Figure 1 Lego based ship models and reality alike documents foster understanding of problems and solutions and how to reduce costs and increase revenues in The Liner Shipping Game™

A game session typically lasts up to 8 eight weeks in the lifetime of a shipping line, but can be shorter or longer depending on time available and learning progress of participants. The game is designed for 12 players, but it can be run with fewer or more participants if required. During the game, the participants must fulfil 3 roles and belonging tasks, see Table 1.

<table>
<thead>
<tr>
<th>Role</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Service &amp; Uptake Management</td>
<td>To accept / reject bookings, steer booking uptake and allocate capacity to customer segments, Origin-Destination Port combinations and orders to maximize profits and log commercial data on region or port basis</td>
</tr>
<tr>
<td>Captain and stowage planner</td>
<td>To sail vessels, plan vessel stowage according to rules to maximize intake and minimize port costs and time, and estimate and monitor available vessel capacity, and prioritize cargo in backlog situations in collaboration with other functions</td>
</tr>
<tr>
<td>Terminal operator</td>
<td>To discharge, load and containers according to stowage plan, administrate cargo at berth and in yard, and record operational (vessel and terminal) data</td>
</tr>
</tbody>
</table>

Table 1 Roles and tasks of participants in The Liner Shipping Game™ (Basic version)

During the game, participants must accomplish a range of operational tasks, while more strategic and tactical decisions have been made at game start. Participants will typically try all roles during a game session, and this is done to ensure that they achieve an end2end process understanding of problems and solutions of the container shipping line.
Performance metrics have been developed to monitor how well a team of participants execute their tasks in collaboration - the idea is to foster a collaborative rather than competitive behavior among them while playing. Aspects of competition will only be brought into the setup when 2 or more teams play in parallel. During the 8 weeks period of the game, the team is measured on their ability to maximize revenue and minimize their costs at the same time. KPI’s are in place for e.g.: Revenue, Vessel Utilization, Backlog / Rollings, Container moves in ports, Utilization of terminal assets and port stay duration etc. At session completion, the final team score is summed up in US$, and it can be compared either across teams or against an “optimal solution” calculated with a computer. To achieve a high final team score is however not in itself the ultimate aim of the game, but it is in place, to create a foundation for discussing what individual players and the team could have done different to improve the total profitability of the shipping line.

A game session typically lasts a whole day, and is managed by 2 facilitators with responsibility for preparation, instructions and administration of the session as well as coaching participants during game playing. They also ensure that relevant performance data are gathered as the game proceeds, so team performance can be tracked and displayed on a performance board visual for participants. When the session is complete, they present the final team score to participants and facilitate an interactive discussion session where game learnings are identified – ultimately with the purpose of clarifying how some of the game learnings can be applied to the real world of liner shipping. The business simulation is more facilitator demanding compared to most business simulations of other industries, and it is not without importance that one or more of the facilitators have a good familiarity or working experience from the liner shipping industry as this can be required to engage into a competent dialogue with participants about game aspects and realities of liner shipping.

The game represents a significant simplification of complexity and reality of a modern regional or global container shipping line, see e.g. Song and Panayides (2012), but anyhow illustrates critical challenges and dilemmas face by business professionals in daily work. Professionals working in other cargo transportation segments - as e.g. cargo rail operators or cargo airlines - face commercial and operational business challenges and dilemmas similar to those which participants deal with in this game.

**Status on the game’s development and dissemination so far**

The game has so far been played by approximately to 500 participants and has proven of relevance and value to a range of different audiences. Participants have had a mix of backgrounds, being e.g. affiliated with shipping lines, ports, logistics companies, forwarders, equipment and software providers, consultancy companies, financial institutions, legal advisors, business and engineering schools or completely different industries. Also various versions of the game and features have been tested in sessions, and whether participants have been newcomers in the area of liner shipping, experienced professionals or senior executives, they have all gained much from joining the sessions. Overall, the feedback received post sessions, has been very positive whether captured in a more informal manner or through a formalized evaluation scheme handed out by us after sessions. Since the first prototype was ready spring 2014, game sets and sessions have been sold and executed for private businesses, public institutions and industry
associations in Europe, Asia and US. Private businesses, commercial and technical oriented educational institutions and professional associations, as well as SMEs and large international companies, are still showing an interest in using the business simulation to train their students, employees and managers.

The Liner Shipping Game™ exists in several versions (Basic, Enhanced & Advanced) which differ in content and complexity to match various skill levels and professional experience of participants, see Table 2.

<table>
<thead>
<tr>
<th>Features and learning objectives</th>
<th>Game version</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple</td>
</tr>
<tr>
<td>Fundamentals of liner shipping and terminals</td>
<td>X</td>
</tr>
<tr>
<td>End2end process understanding</td>
<td>X</td>
</tr>
<tr>
<td>Need for cross functional collaboration and communication</td>
<td>X</td>
</tr>
<tr>
<td>Process standardization and improvement (Lean-Six Sigma)</td>
<td>X</td>
</tr>
<tr>
<td>Data quality and impact on performance</td>
<td>X</td>
</tr>
<tr>
<td>Downfalls management and setting of overbooking limits</td>
<td>X</td>
</tr>
<tr>
<td>Recovery of empty containers</td>
<td>X</td>
</tr>
<tr>
<td>Contingency Planning</td>
<td>X</td>
</tr>
<tr>
<td>Dangerous cargo and additional stowage constraints</td>
<td>X</td>
</tr>
<tr>
<td>Forecasting, Pricing and Revenue Management</td>
<td>(x)</td>
</tr>
<tr>
<td>Stowage optimization</td>
<td>(x)</td>
</tr>
<tr>
<td>IT and Operations Research for decision support</td>
<td>X</td>
</tr>
<tr>
<td>People skills and analytical capabilities</td>
<td>X</td>
</tr>
<tr>
<td>KPIs and performance management</td>
<td>X</td>
</tr>
<tr>
<td>Vessel sharing agreements</td>
<td>X</td>
</tr>
<tr>
<td>Competition aspects and Market Dynamics</td>
<td>X</td>
</tr>
<tr>
<td>Team Building and Fun</td>
<td>X</td>
</tr>
<tr>
<td>Minimum no of participants</td>
<td>8-12</td>
</tr>
<tr>
<td>Duration</td>
<td>½-1 Day</td>
</tr>
</tbody>
</table>

*Table 2 The Liner Shipping Game™ versions, main features and learning objectives*

Based on the 3 different ground versions of the game, game sessions are designed to match and emphasize particular aspects of target groups resulting in bespoke offerings to clients. Typical target audiences for game sessions will be e.g.:

- Students in shipping and logistics
- Beginners in shipping / logistics companies
- Support functions in shipping / logistics
- Experienced shipping / logistics professionals
- Freight Forwarders and 3PL providers
- Ports and canals
- Equipment and software vendors
- Financial, insurance, classification companies
- Shipping / Logistics Executives
- Professionals from other industries
Game sessions can be tailored so they emphasize particular aspects or topics related to liner shipping: Liner Shipping Fundamentals, Process Improvement and Performance Management, Commercial and Operational Optimization and IT based Decision Support, Revenue Management, Stowage Optimization, Strategy and organizational capabilities required to develop a competitive edge in the industry etc.

A game session is designed to run as an isolated activity for ½-1 day with an educational purpose, but will often also be part of training and course programs of longer duration. The game can potentially be used for a range of other purposes, e.g. as a business process simulation or change management tool in company business transformation projects or as a recruiting tool to test skills and behavior of candidates potentially to be hired in a company.

**Plans for further Research and Development**

Research and development of the game is still done on a number of fronts. Current efforts are focused on development of various game features and IT based decision support as well as educational / training modules including use of the game are under development. Finally, it is being planned to initiate a more systematic evaluation of learning outcome from sessions and impact on participants and their organizations. As mentioned by Kirkpatrick & Kirkpatrick (2006) outcomes can be measured on 4 levels for participants having been part of training activities: 1) The immediate reaction and satisfaction, 2) Learning or acquiring of new knowledge and insights, 3) behavioral changes and 4) Organizational capabilities and results. SBT aims for an impact on all 4 levels, and so does The Liner Shipping Game™; but it is critical that an extensive data collection and thorough investigation of whether this is the case or not, is achieved in reality.

**References / Links**


Coursera, 2015 - https://www.coursera.org


Edx, 2015 - https://www.edx.org/


Lean Kata Website, 2015 - http://www.leankata.se


The Beergame Portal, 2015 - [http://www.beergame.org](http://www.beergame.org)


**About The Liner Shipping Game™ and the company LinerGame**

The Liner Shipping Game™ was developed by researchers from Aalborg University and consultants & software developers from Ange Optimization in collaboration with Maersk Line from 2012-2014 with support from *The Danish Maritime Fund* through grants no. 2011-58 and 2013-4. It has since been enhanced on commercial basis by a team of people from the venture LinerGame which today develops and sells, own training products, courses and advisory services to the global liner shipping industry – for further / updated information please check the following link: [http://linergame.com/](http://linergame.com/).

**Appendix A – The Liner Shipping Game™ – Bill of Materials**

A complete game kit in the basic version includes the following parts (check website mentioned above for updates):

- 1 suit case and plastic boxes for all game materials, inclusive plastic bags and bubble plast
- 4 Liner Shipping Game container vessels re-built to match game needs from relevant Lego® bricksets (versions no 10152 or 10155 or 10241) or similar bricks, see Figure 2
- 400 Grey Dry and White Reefer Containers built from Lego® or similar bricks with 3 digit numbers on (e.g. 001-400)
- Container Terminal boards with overview of yard space (preferably laminated)
- Port signs with names in the 4 chosen game colors
- Deck of Booking cards consisting of 460 cards in total covering starting situation, 8 weeks of game playing and “break” cards for all ports
- Forecast sheets –2 x 2 per region (Asia and Europe) (pre filled)
- Booking & Uptake Management sheets for log of commercial decisions and performance data
- Stowage / Bay plan sheets for starting situation and 8 weeks of game playing
- Capacity calculation sheets
• Terminal and vessel performance sheets for log of operational performance data
• Role description sheets for all 3 roles
• Instruction power point show
• Supporting Facilitators guide (this document)
• Performance Monitoring and Benchmarking Template in MS Excel
• Several Pencils in relevant colors matching different cargo port destinations to be used for stowage sheets
• Standard pencils (blue / black) for filling data into game sheets

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Figure 2 The Lego Brick sets 10152 / 10155 or set 10241 have been used as basis for developing Vessels and Containers for the The Liner Shipping Game™

When to host a game session is also required seminar room facilities with plenty of tables, projector, whiteboard(s) and markers as well as 1 laptop / PC for the facilitators to use. Besides this refreshments, drinks, lunch etc. as game session typically last ½-1 day.