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Simulations and Simulation Games in Agro and Health Care

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SOCIAL SCIENCES GROUP WAGENINGEN UR

Simulations and simulation games in agro- and health care

An overview and typology

Introduction

How can you experiment with chains and networks? That is an unanswered question in research and training in the field of chains and networks. (Meijer and Hofstede, 2004) Simulations and simulation gaming could offer experimental playgrounds and training tools for the field of chains and networks. KLICT wanted to know which simulations and simulation games are already developed and in use in the field of agro and health care chains. In answer to this, we carried out an investigation in the field with major focus to Dutch activities . We asked experts about their own simulations and simulation games, their contacts and their knowledge of the methodological developments. The result of this investigation is this paper.
First it describes our view on simulation and simulation gaming. Then it gives a matrix categorizing the simulations and simulation games found. This matrix is follow by a list with a summary of each item found. In the addendum we describe five items in more detail as "good examples". This addendum is meant for readers who want a quick impression of some current applications.

Simulations, games and simulation games

Simulation games have been around for as long as, even longer than, humans. All children enact various social roles in play. Our species has even been termed Homo ludens (Huizinga, 1971). This is no accident. Play in which we simulate social interaction, e.g. playing shop or school or doctor, is crucial for forming and calibrating our social intelligence. Still, we understand our machines much better than we do ourselves. No wonder, then, that simulation games have become, since the nineteen sixties, a successful training tool for many areas of organised life (Crookall, 1994).
Simulation can be defined as modelling a real-world system – such as a supply chain. A game can be defined as a clearly delineated activity with its own roles, rules and incentives, carried out for its own sake. A simulation game combines simulation and gaming. This implies that the roles, rules and incentives of the game mimic some real-world phenomenon. Simulation gaming is not usually carried out for its own sake but to train the participants in decision-making in a role similar to one in the real world (Armstrong, 1994, p. 217). It can also be used as a tool for experimenting, in which case the roles, rules and incentives should allow testing the validity of a theory, e.g. the prisoner's dilemma.

Simulation gaming is not a new discipline. Crookall (1994) starts in his "Guide to the Literature" with main works from the early 1970s. He notices too, that the awareness of work done before on gaming is often small. "With notable exceptions, it seemed to me that some presentations (…) implied that little previous work had been done in the field, while other presenters claimed that simulation/gaming is already a discipline." (Crookall, 1994, p.152) By now, simulation gaming is a widely used training tool (Roelofs, 2000) and it is becoming increasingly important as a research tool, as well (Meijer and Hofstede, 2003). Recently (2003), a special issue of the Journal on Production Planning and Control saw birth, dedicated to the use of gaming for training and research in the field of production management.

To enable a structured comparison of various games, Meijer and Hofstede developed a taxonomy in analogy with the three questions of Hofstede et al (2002) and the two problem situation aspects introduced before. The most important sub-aspects are between brackets.

What is the goal? Educational goals (Intellectual, Social, Managerial), Research goals (Subject matters, Social sciences)
Who is the audience? (Subject, sector specifity, techniques used)
What are the constraints of a session? (Number of participants, Duration of session, Venue requirements, Costs of play)
What is the world model? (What roles, Reward structure, win / lose criteria, game money, zero sum game, role of chance, pay-off matrix (roles versus outcomes))
What is the participant action space for each role? (Decision variables, unit of action, cooperation, simultaneous play, communication structure)

In this overview we gathered information on the name, field of application, developers, goals, experiences and techniques used, plus a short description of the tool. In the appendix, one finds a list, ordered alphabetically on the name, of all simulations and simulation games found.

A simulation game about a problem in chains and networks combines a simulation part with a game part. The simulation part describes the world of the problem in a *world model*. A formal problem has its equivalent in a *bounded* world model. This places the participants in a finite space. This type of model can result from rigorous abstraction of the model from its real world example, as in board games. An open problem has its equivalent in an *unbounded* world model. It places the participants in an open world with inputs and interactions that cannot be enumerated a priori and may be unique to the particular session.
The action space is the game part of a simulation game. In a game, we call this the *participant action space*. We define this as the number of options that a participant has in his behaviour while playing the game. These options can be values of one variable (e.g. places to put the cube in Go) or consist of various variables (e.g. negotiation and strategy formulation in policy making games) Incorporation of open human interaction generally expands the participation action space.

Building on the taxonomy of Meijer and Hofstede, 2003, we ordered the items found in a three-dimensional matrix. (Figures 1 and 2 on pages 4 and 5.) The two axes are: Goal and Audience. Within the cells of this matrix, items are colour-coded. The colour refers to the quadrant the item belongs to when we plot the *world model* against the *participant action space*. We placed the item in a quadrant based on the description , techniques used (which sometimes reveals the structure of the game or simulation) and more specific other information from the developers or suppliers.
There are some more items in the appendix then there are in the matrix. This is because of the few interesting items found that have no educational purpose at the moment, or that are not simulations or simulation games in the strict sense, but related to the field.

The match between a real-world problem situation and a simulation game that models it can be termed *fidelity*. Druckman (1994, p. 185) suggests that high levels of fidelity may be more important for the learning of specific job related skills than for the learning of more general concepts. We would like to add from our experience that some trainings benefit from a more bounded world model than the real problem situation, while keeping fidelity on the action space aspect, because it focusses the participants on a specific part of the problem.

To decide upon the choice of a particular simulation game to improve chains and networks one needs to relate the answers to the first three questions of the matrix to a choice for fidelity on the latter two. When the goal is social training, a large participant action space is preferred. In case of intellectual training an abstract, more bounded world model is preferred. When the audience exists of novices, a small participant action space learns them to make specific decisions. An expert needs the experience of a large participant action space with an unbounded world model. When the constraints are tight, especially for time, a bounded world model, or pre-configured unbounded world model is most appropriate.
In the matrix, there are no items present with a small participant action space and an unbounded world model. This is not surprising, as these types of simulations games wouldn't be very useful for training purposes. In this quadrant, a participant would only have the ability to say yes or no, while being faced with complex problems. This is useful for Casino style games, but hardly for purposes where the participants should learn about their behaviour.

Audience -->	Students	Staff / Floor workers
Educational goals		
Operate daily business Focus on selling / buying, marketing and strategy External processes	Food for thought LOBUS++ Student in het virtuele bedrijf Theme hospital Trust and Tracing game	Creating the Climate Survival game Theme hospital
Operations management Focus on production, technology and product flows Internal processes	DPS Glastuinders Managing Strategy Online Beergame Port of Rotterdam Theme hospital	Bartholomeus Brazzelton Flightpath Kretos Online Beergame Stichting Compagne Theme hospital Varkenshouders
Crisismanagement	DPP2000	
Innovation Management		
Demonstrating state-of-the art in chain management	Myosotis	Myosotis

Unbounded World Model, large Participant Action Space
Bounded World Model, small Participant Action Space
Unbounded World Model, Small Paticipant Action Space
Bounded World Model, large Participant Action Space

Figure 1: Matrix of simulations and simulation games ordered for audience, educational goal and quadrant of world model versus participant action space. Part one

Audience -->	Operational managers	Strategic managers/ policy makers
Educational goals		
Operate daily business Focus on selling / buying, marketing and strategy External processes	Apples and Oranges- Health C Apples and Oranges-SCM BANS Business networking game Creating the Climate Day-in-a-life simulations Food for thought ICT management simulation International Management Sir Netwerk Netwerk Simulatie Quartier Responsive simulations Salsa Parilla SimRuralis Splash Survival game Theme hospital Trust and Tracing game Uncovering value in the supp	BANS Business networking game De gemeentelijke herindeling Diagnost Food for thought GES Hospital-TIAS International Management Simulatie La vie en Rose Netwerk Simulatie Responsive simulations Sante SCP-model SimRuralis Splash Squaring the circle Stratal Theme hospital Trust and Tracing game Uncovering value in the supply chain VLS-spel
Operations management Focus on production, technology and product flows Internal processes	ABACUS ALADIN/Foodprint ALADIN/Logistiek Day-in-a-life simulations Flightpath Game Simulation Dairy GP SASSG HEX game Hospital management game ICT management simulation Kretos Managing Strategy Managing the supply chain Quartier Salsa Parilla Theme hospital Trostomatenspel	ALADIN/Foodprint ALADIN/Logistiek Game Simulation Dairy HEX game Hospital management game Hospital-TIAS ICT management simulation Kretos La Vie en Rose Managing diversity Managing the supply chain Theme hospital Trostomatenspel
Crisismanagement		InterCSF InterFMD InterIBR
Innovation Management	Midas Vrolijkheidsgame	Midas Vrolijkheidsgame
Demonstrating state-of-the art in chain management	Myosotis	Myosotis

Unbounded World Model, large Participant Action Space
Bounded World Model, small Participant Action Space
Unbounded World Model, Small Paticipant Action Space
Bounded World Model, large Participant Action Space

Figure 2: Matrix of simulations and simulation games ordered for audience, educational goal and quadrant of world model versus participant action space. Part two.

Appendix: List of simulations and simulation games found.

Name	ABACUS
Field	Supply chain management in general
Goal	Experience the practice of a company in a network
Developers	Company Coaching BV (www.companycoaching.nl)
Description	Board game where participants have to manage the daily operations in a company.
Experiences	?
Techniques	Paper based simulation game

Name	ALADIN/foodprint
Field	Agro
Goal	Support design of a Traceability infrastructure.
Developers	ATO, WUR, Jan Top (www.agrotechnologyandfood.wur.nl)
Description	Extension for the ALADIN/logistiek suite, introducing Traceability of products. The tool should support the design of Traceability infrastructures.
Experiences	Developments nearly finished (Octoiber 2003)
Techniques	Enterprise Dynamics simulation.

Name	ALADIN/logistiek
Field	Agro
Goal	Simulate logistics chains of fresh products.
Developers	ATO, WUR, Seth Tromp (www.agrotechnologyandfood.wur.nl)
Description	Simulation environment based on the Enterprise Dynamics suite. It consists of modules to simulate logistics chains, with special attention for the quality of fresh products.
Experiences	Used in research and business analysis.
Techniques	Enterprise Dynamics simulation.

Name	Apples and Oranges / Distribution
Field	Supply Chains
Goal	Participants gain insight in the interdependence of processes in supply chains
Developers	Business Practice, Paul Olivier. Developer is Celemi, Sweden. (www.businesspractice.nl)
Description	Board game, creating awareness and involvement of employees for their business in a chain. Key aspects are critical success factors, budgeting and planning of logistics.
Experiences	Many
Techniques	Paper based simulation game.

Name	Apples and Oranges / Health Care
Field	Health Care
Goal	Participants gain insight in the interdependence of processes in health care

Developers	Business Practice, Paul Olivier. Developer is Celemi, Sweden. (www.businesspractice.nl)
Description	Board game, creating awareness and involvement of employees for their institution in health care.
Experiences	Game is very new, but there are some clients worldwide.
Techniques	Paper based simulation game.

Name	BANS
Field	Policy making
Goal	Evaluate the effectiveness of BANS in local policy making.
Developers	A.M.E. Roelofs, Jac Geurts. (http://www.uvt.nl/webwijs/show.html?anr=120146)
Description	Policy making game in which groups get the BANS tool to facilitate the decision making in local governmental issues. Game was meant for research.
Experiences	Used for PhD thesis
Techniques	Paper based simulation game.

Name	Bartholomeus Brazzelton
Field	Health Care
Goal	Open a discussion about many issues in the children day care.
Developers	VBJK, Veronique Willaert, Vlaanderen. (veroniek.willaert@rug.ac.be)
Description	This game is a board game, leading to discussions about raising children, and development for children day care employees and education. A game leader steers the discussion of experiences and values and ensures the depth of the discussion.
Experiences	?
Techniques	Paper based simulation game.

Name	Business Networking Game (Version two)
Field	Supply Chains
Goal	Create awareness among employees for chain dynamics and be able to formulate and review alternative business strategies.
Developers	FBK, EUR, Diederik van Liere (www.fbk.eur.nl)
Description	Website based simulation game for training and research purposes in business strategies for supply chain-bounded firms. Strong focus on the logistics management.
Experiences	Yes
Techniques	Website based simulation game

Name	Creating the Climate
Field	Health Care
Goal	Assist stakeholder of NHS think about the long-term vision for the NHS in Wales.
Developers	OPM, Londen, Great Britain. (www.opm.co.uk)
Description	Open simulation event of the functioning of the NHS in Wales
Experiences	Four rounds
Techniques	Paper based simulation game.

Remarks	Language is English

Name	De gemeentelijke herindeling
Field	Policy making
Goal	Gain insight in the negotiation processes among stakeholders in local governments when joining communities.
Developers	MDP / RUG (www.mdp.nl)
Description	Policy making game around the join of two communities. How to divide the powers?
Experiences	Many
Techniques	Paper based simulation game

Name	Diagnost
Field	Health Care
Goal	Participants gain insight in the tuning of the health care chain for elderly people.
Developers	IVA, Tilburg, Juliette Vermaas, Rob Pranger (www.iva.nl)
Description	Game that gives participants insight in the complexity of managing the health care chain for elderly people.
Experiences	Many
Techniques	Paper based simulation game.

Name	DPP2000
Field	Agro
Goal	Show the importance of a crisis management plan
Developers	Sectie Methoden en Technieken, ITS, KUN, Drs. B. Wein Felling (www.its.kun.nl)
Description	Simulation of a crisis in a fish pool. Participants are in the virtual control room, where one of the 24 indicators turns red. Under pressure of a director, and with the help of 6 virtual teams, the participants have to manage the crisis.
Experiences	Played in various curricula.
Techniques	PC supported Simulation Game

Name	DPS (Dynamische Patient Simulator)
Field	Health care.
Goal	Training of health care students in diagnosis and medication.
Developers	Leids Universitair Medisch Centrum, Peter Bloemendaal (http://www.lumc.nl/5000/coo-ontwikkelaars.htm)
Description	Program representing a patient with a medical problem and one or more complications. Students have to diagnose and treat the virtual patient. Meanwhile the normal stressors of the daily practice are imposed on the student. The virtual patient reacts to the treatments.
Experiences	Many. Cases are developed for many deceases.
Techniques	PC program

Name	Flightpath
Field	Supply Chains
Goal	Make participants aware of the complexity of information services

	and exchange.
Developers	KPMG, Marc Petit (www.kpmg.nl)
Description	Participants (in the role of flight leaders of a space program) solve an information supply problem together. Each participant has a part of the solution.
Experiences	Many
Techniques	Paper based simulation game.

Name	Game Simulation Dairy
Goal	Write a strategic plan for a dairy farm.
Developers	WUR, Farm management group / LEI, Alfons Beldman (http://www.sls.wau.nl/fma/)
Description	In two sessions, farmers formulate a strategy and get insight in simulated results of this strategy on a model of their own farm.
Experiences	Many
Techniques	Computer and paper based..

Name	GES (Gezondheidseffectscreening)
Field	Health care.
Goal	Responsive simulations to evaluate policy making with GES
Developers	EUR, Marleen Bekker.(www.bmg.eur.nl)
Description	Set of responsive simulations to evaluate the effectiveness of policy making with GES tools, and the bureaucratic experiences.
Experiences	Not yet
Techniques	Responsive simulation, paper / instruction based.

Name	Glastuinders
Field	Agro
Goal	Experiment about investment options in horticulture.
Developers	Farm management group, WUR, Jos Verstegen. (http://www.sls.wau.nl/fma/)
Description	Experiment giving horticulture students a choice between several investment options. Stand-alone and network options (INVEST) with monte carlo simulation. Consequences are simulated.
Experiences	Used in research
Techniques	Stand alone simulation model. With Monte Carlo analysis.

Name	GPSASSG
Field	Health Care
Goal	Train GP's for a new surgery appointment system
Developers	HSMC, Penelope M. Mullen, Birmingham, Great Britain. (http://www.hsmc.bham.ac.uk/)
Description	Game developed to train General Practitioners to use a newly developed surgery appointment system. This game was used nationwide in the end of the eighties.
Experiences	Nation wide used
Techniques	Computer and paper based simulation game.
Remarks	Language is English

Name	Hospital Management Game
Field	Health Care
Goal	Participants gain insight in internal processes of a hospital.
Developers	IVA, Tilburg, Juliette Vermaas, Rob Pranger (www.iva.nl)
Description	Participants gain insight in the internal processes of a hospital. Game has to be configured differently for each hospital.
Experiences	A.o. AZR and AMC
Techniques	Paper based simulation game.

Name	ICT Management Simulatie
Field	Supply Chains
Goal	Experience the power of ICT solutions, and the interaction of ICT with the company model.
Developers	MCC (www.mcc.nl)
Description	Participants manage a distributed company in a branch with 4 competitors. ICT / ERP solutions form an integrated part of the management.
Experiences	Many
Techniques	Software and paper-based simulation game

Name	IMMS
Field	Agro
Goal	Simulate physical attributes of a product.
Developers	ATO, WUR, Jan Top (www.agrotechnologyandfood.wur.nl)
Description	Simulation of physical properties of a product. The tool is meant especially for model builders.
Experiences	Used for model design..
Techniques	?

Name	InterFMD, InterCSF and InterIBR
Field	Agro
Goal	Models to predict the spread of animal deceases.
Developers	Farm management group, WUR, Monique Mourits. (http://www.sls.wau.nl/fma/)
Description	Each of the three in an independent model simulating the behavior of a particular animal decease.
Experiences	Used in research and policy-making.
Techniques	Stand alone simulation model.

Name	Infrastructure games
Field	Supply Chains
Goal	Collection of games with infrastructures as topic.
Developers	Book: Gaming in a world of infrastructures, Igor Mayer and Wijnand Veeneman. (www.gymnasion.tudelft.nl)
Description	This book describes several games used for issue with infrastructures. Mayer and Veeneman distinguish four different types of infrastructure issues: 1. Infrastructure-related issues: the embedding of infrastructures in their spatial and institutional

	environments 2. Project and process management for infrastructures: the use of tools, project and process management for complex technological projects. 3. Services on infrastructures: the development of new and better services for infrastructures 4. Management of the strategic environment: the exploration and management of the strategic behavior of the stakeholders in infrastructure systems. Games on the items 2, 3 and 4 can be usefull for chains and networks too, as the issues are very similar.
Experiences	Differ per game
Techniques	Both computer and paper based games

Name	International Management Game
Field	Supply Chains
Goal	Practice the management of a firm in a competitive branch.
Developers	MCC, Erwin Fransen. (www.mcc.nl)
Description	Simulation game in which participants have to manage a firm in a competitive branch. In teams of 4 people they compete against 4 other teams. Currently MCC introducing supply chains in the game. Game contains 45 decision variables.
Experiences	75000 participants
Techniques	Both electronic and paper based versions.

Name	Kretos
Field	Supply chains
Goal	Participants learn to recognize an effective relation between research, production and marketing
Developers	KPMG, Marc Petit (www.kpmg.nl)
Description	Participants have to manage a production firm of slogans
Experiences	Many
Techniques	Paper based simulation game.

Name	La Vie en Rose
Field	Health Care
Goal	Learn about the dynamics and new solutions between stakeholders in a modernized health care system of the AWBZ.
Developers	Twijnstra Gudde, Leon de Caluwe / Peter van der Lugt (www.tg.nl)
Description	La Vie en Rose simulates the modernized world around the Dutch AWBZ law, where person-bounded budgets and function oriented indications are a fact and divisions between sectors are gone. Participants play a health office, local government, social housing cooperation, patient board and health care institution in the Beekensteijn city. Playing the game should lead to new, creative solutions for the AWBZ-care under the new circumstances. The dynamics and creative solutions are the main focus points.
Experiences	Many
Techniques	Paper based simulation game.

Name	LOBUS
Field	Supply chain management in general
Goal	Teach students planning and performing a business in a chain.
Developers	UvT, Jos Vermunt (http://www.tilburguniversity.nl/faculties/few/)
Description	Simulation of an automotive chain. Performance depends on the inputs of several human decision makers. No human interaction.
Experiences	Played in various curricula.
Techniques	Networked PC simulation, human input in computer simulation.

Name	Managing Diversity, Solving the Puzzle
Field	Policy making
Goal	Gain insight in management of diversity in organizations
Developers	EGA-HRM-consulting / FORUM.(http://www.ega-hrmconsult.nl/)
Description	Policy making game to train participant in managing the diversity in their organizations. Focus on standardization and the strength of diversity.
Experiences	Many
Techniques	Paper based simulation game.

Name	Managing Strategy, Creating the balanced scorecard
Field	Supply chain management in general
Goal	Learning about the sensitivity of a firm for steering variables.
Developers	OASIS, Jochem Messelink (www.oasis.nl)
Description	Simulation of a production company, which the user can manage from a virtual cockpit. The company is part of a network.
Experiences	?
Techniques	Stand-alone computer simulation with nice graphics and human input.

Name	Managing the supply chain
Field	Supply Chains
Goal	Achieve the optimal balance between supply and demand to increase customer satisfaction and manage costs.
Developers	Accenture, Ivo Wenzler (and Ananth V Iyer, Ph.D., Purdue University as content partner for the supply chain suite of games.) (www.accenture.nl)
Description	Partially simulated game to build the skills for coordinating and integrating demand inventory and distribution planning, and gain insight in demand, costs and relationships influencing the company performance.
Experiences	Many
Techniques	Paper and computer based simulation game.

Name	Midas
Field	Innovation management
Goal	Give participants insight in management of innovation processes to make decisions about heir own organization.
Developers	KPMG, Marc Petit (www.kpmg.nl)
Description	Participants play the board of directors of a company and have to

	make decisions about the allocation of assets for new ideas.
Experiences	Many
Techniques	Paper based simulation game.

Name	Myosotis
Field	Health care.
Goal	Show state of the art in information tools for Health Care manegement
Developers	Stichting Mysosotis, Hans van der Heijden (www.stichtingmyosotis.nl)
Description	Truck, loaded with series of computers, able to show innovative solutions in information systems for Health Care management. The truck is a cooperation of 27 tool vendors.
Experiences	Touring through the Netherlands in 2003.
Techniques	Computer tools.

Name	NetChainGame
Field	Supply Chains
Goal	Experience the difficulty of logistics management in chains.
Developers	Klict project. (CentER, UvT, EUR, WUR, Paragon Decision Technology) (www.klict.org)
Description	Follow-up game of LOBUS. Participants (Students) manage a virtual company and have to decide on many variables regarding buying, selling and logistics management. The company is placed in a chain. Particular focus is on the negotiation between companies and the development of trust.
Experiences	Not yet (October 2003)
Techniques	Software based simulation game

Name	Netwerk
Field	Supply chains
Goal	Let participants experience success and failure factors of a well functioning relations network
Developers	KPMG, Marc Petit (www.kpmg.nl)\
Description	Participants (in the role of project leaders) work within a development organization on the establishing of large infrastructure projects. Building and maintaining a good relations network is of vital importance.
Experiences	Many
Techniques	Paper based simulation game.

Name	Netwerk Simulatie
Field	Supply Chains
Goal	Gain insight in a successful network and strengthen synergy
Developers	MCC, Erwin Fransen (www.mcc.nl)
Description	Participants play specialists in a project team that is loosely coupled. How to get the best performance from the team through different stages of co-development.
Experiences	Many
Techniques	Paper based simulation game.

Name	Online Beergame
Field	Supply chain management in general
Goal	Learn managing inventory in a supply chain and learn about bullwhip effect.
Developers	Massachusset Institute of Technology (beergame.mit.edu)
Description	Online version of the famous beergame (beergame.mit.edu). Users can experience the problem of managing inventory under varying demand. Simulation feeds back on performance of users.
Experiences	Countless
Techniques	Online simulation with human input.

Name	Port of Rotterdam
Field	Supply Chains
Goal	Experience EDI implementation in a chain business
Developers	Rotterdam School of Management, Bureau Bakkenist (www.rsm.eur.nl)
Description	Students experiment with the process flow in a company when introducing EDI in the organization.
Experiences	Many in curricula
Techniques	Software simulation

Name	Responsive simulations
Field	Policy making
Goal	Gain insight in policy making processes
Developers	EUR, Richard Scalzo, Hanneke Mastik.(www.fsw.eur.nl)
Description	Special type of simulations, meant to trigger the participants to act like they do in reality when making plans and policies. Application fields are many, but recently the focus in on utility management.
Experiences	Many
Techniques	Paper based simulation game.

Name	Santé
Field	Health Care
Goal	Participants train negotiation, cooperation, positioning and strategy formulation in and between health care institutions and insurance companies
Developers	Twijnstra Gudde, Leon de Caluwe / Peter van der Lugt (www.tg.nl)
Description	Participants play specific functions in an insurance company, two hospitals and an independent treatment centre in the region “Zeerand” where market forces are normal practice. In this role, participants discuss how they can provide sufficient, good and affordable health care in Zeerand. Participants experience the (im)possibilities of interactions in this new context, and gain understanding for each others position.
Experiences	Many
Techniques	Paper based simulation game.

Name	Salsa Parilla

Field	Health Care
Goal	Train front line health care managers
Developers	Salsa Parilla, Marco Tankink (www.salsaparilla.nl)
Description	Salsa Parilla works on a new game to train managers in the front line health care to do their job under new governance structures of the health care sector.
Experiences	Not yet
Techniques	Paper based simulation game.

Name	SimRuralis
Field	Agro
Goal	Gain insight in the negotiation processes among stakeholders in rural planning.
Developers	Alterra, WUR. (www.alterra.nl)
Description	Game simulating rural land resources that have to be managed. Bargaining power and negotiation processes between different stakeholders of the resources are analyzed and lead to a mapping of the power.
Experiences	Many
Techniques	Paper based and computer supported simulation game.

Name	Splash
Field	Agro
Goal	Gain insight in the negotiation processes among stakeholders in water management.
Developers	Alterra, WUR. (www.alterra.nl)
Description	Game simulating resources with water that have to be managed. Bargaining power and negotiation processes between different stakeholders of the resources are analyzed and lead to a mapping of the power over the water.
Experiences	Many
Techniques	Paper based and computer supported simulation game.

Name	Stichting Compagne
Field	Health Care
Goal	Train members of the stakeholder board.
Developers	Stavoor Groep, Isaak Mol (www.stavoor.nl)
Description	Training to facilitate members of the stakeholder board to be more effective and make better decisions.
Experiences	?
Techniques	Paper based simulation game.

Name	Strawberry Chain and Food for Thought.
Field	Supply Chains
Goal	Experience a food market with consumers holding different preferences and values.
Developers	WUR, Gert Jan Hofstede (www.informatics.wur.nl)
Description	Traders (congress attendants) with several roles within a food supply network have to sell real food to consumers. The consumers have

	different synthetic cultures. Actors in the network have to be profitable while keeping a good reputation.
Experiences	Two sessions
Techniques	Paper based simulation games with real food.

Name	Student in het virtuele bedrijf
Field	Supply chain management in general
Goal	Prepare students for management of a profit company. Teach the effect of the own actions.
Developers	Rematch BV. (www.rematch.nl)
Description	Computerized simulation of a multi-departed firm in a production network. Student groups play a department and get feedback on their performance. The game leader coordinates the qualitative interpretation of business plans made.
Experiences	Several years.
Techniques	Computer simulation, game leaders.

Name	Stratal
Field	Supply Chains
Goal	Let participants experience the emergence of strategic alliances.
Developers	KPMG, Marc Petit (www.kpmg.nl)
Description	Participants (in the role of the executives) are introduced to several different companies and have to look for one or more partners with whom they can form different types of relations.
Experiences	Many
Techniques	Paper based simulation game.

Name	Survival game
Field	Supply chains
Goal	Experience the necessity of cooperation between competing companies.
Developers	KPMG, Marc Petit (www.kpmg.nl)
Description	Participants (in the role of a department in a company) have to solve a puzzle in a number of predefined steps.
Experiences	Many
Techniques	Paper based simulation game.

Name	Squaring the circle
Field	Health Care
Goal	Make participants understand the NHS internal market
Developers	OPM, Londen, Great Britain. (www.opm.co.uk)
Description	Powerful inter-organizational change process that has helped managers, clinicians, politicians and other interest groups to agree ways of reconfiguring local health services while maintaining quality, efficiency equity and consumer responsiveness
Experiences	It has been used by health authorities and local authorities across the UK
Techniques	Paper based simulation game.
Remarks	Language is English

Name	The Rubber Windmill
Field	Health Care
Goal	Make participants understand the NHS internal market
Developers	OPM, Londen, Great Britain. (www.opm.co.uk)
Description	Board game simulating the new NHS internal market. Participants need to understand the new situation and the way to protect quality and equity.
Experiences	Many
Techniques	Paper based simulation game.
Remarks	Language is English

Name	Theme Hospital
Field	Health care.
Goal	Entertainment
Developers	Electronic Arts and Take 2. (www.ea.com)
Description	SimCity-like game to play on your computer. Purely entertaining and a little childish.
Experiences	?
Techniques	PC program for Windows.

Name	Thuiszorg
Field	Health care.
Goal	Explore alternatives in the home-supplied health care.
Developers	Sociaal Cultureel Planbureau (http://www.scp.nl/boeken/werkdocumenten/doc63/nl/acrobat/docu063.pdf)
Description	Mathematical model describing the home-supplied health care sector. The model predicts developments and explores alternative policies.
Experiences	Yes, for policy advise.
Techniques	Mathematical model.

Name	TIAS-game
Field	Health Care
Goal	Participants gain insight how to function with different institutions within one holding.
Developers	IVA, Tilburg, Aad de Roo (www.iva.nl)
Description	Game that trains participants how to function with several health care institutions within one holding. the morning focusses on internal affairs, the afternoon on external contacts, like insurance companies.
Experiences	Many
Techniques	Paper based simulation game.

Name	Topfok
Field	Agro
Goal	Insight in movement strategies of pork farms.
Developers	Farm management group, WUR, Jos Verstegen.(www.sls.wau.nl/fma)
Description	Monte Carlo stand alone simulation model, in which the human behavior is simulated aiming for a optimal usage rate of a pork farm,

	including emergency scenarios.
Experiences	Used in research
Techniques	Stand alone simulation model. No real time decision makers.

Name	Trostomatenspel
Field	Agro
Goal	Create awareness of the problems at each node in a fresh food supply chain.
Developers	ATO, WUR, Floor Verdenius. (www.agrotechnologyandfood.wur.nl)
Description	Paper based simulation of a tomato-chain. Participants get awareness of the issues at each node, depending on the chain as a whole.
Experiences	Many
Techniques	Paper based simulation game.

Name	Trust and Tracing game
Field	Supply Chains
Goal	Research on the relation between trust, network governance and communication.
Developers	WUR, Sebastiaan Meijer and Gert Jan Hofstede (www.chaingame.org)
Description	Traders (students, practitioners) with several roles within a food supply network have to sell 3 types of envelopes. Each envelope has an invisible quality. This quality can be made visible when a trace is conducted. Traders have to choose between the danger of trust and the cost of tracing.
Experiences	14 sessions
Techniques	Paper based simulation game.

Name	Uncovering value in the supply chain
Field	Supply Chains
Goal	Improve profitability by identifying and recommending cost-saving changes to supply chain strategies.
Developers	Accenture, Ivo Wenzler (and Ananth V Iyer, Ph.D., Purdue University as content partner for the supply chain suite of games.) (www.accenture.nl)
Description	Game to get insight in chain wide optimizations and strategies, including financial and logistics performance.
Experiences	Many
Techniques	Paper based simulation game.

Name	Varkenshouders-simulatie
Field	Agro
Goal	Research in movement strategies of pork farms.
Developers	Farm management group, WUR, Jos Verstegen. (www.sls.wau.nl/fma)
Description	Monte Carlo stand alone simulation model, in which the human behavior is simulated aiming for a optimal usage rate of a pork farm, including emergency scenarios.
Experiences	Used in research

Techniques	Stand alone simulation model. No real time decision makers.

Name	Varkenshouders
Field	Agro
Goal	Experiment about replacement decisions with female pigs.
Developers	Farm management group, WUR, Jos Verstegen. (www.sls.wau.nl/fma)
Description	Experiment about replacement decisions with female pigs by farmers. Real farmers make replacement decisions in real time. Consequences are simulated.
Experiences	Used in research
Techniques	Stand alone simulation model. With Monte Carlo analysis.

Name	Virtual Factory
Field	Agro
Goal	Simulate processes in a food factory.
Developers	ATO, WUR, Wouter van der Heij (www.agrotechnologyandfood.wur.nl)
Description	Website with tools to simulate processes in a food factory. Examples are microbiological growth, high-pressure conservation among others.
Experiences	Used in research and business analysis.
Techniques	Web site.

Name	VLS-Spel
Field	Health Care
Goal	Insight in what happens when you change the rules in the health care sector.
Developers	VLS Consultancy, Marcel Paul Hasberg. (www.vls-consultance.nl)
Description	Game for ministry of VWS to evaluate the effects of changes of the rules in health care. Recently the project has been restarted after some political delay.
Experiences	None yet
Techniques	Paper and computer based simulation game.

Name	Vrolijkheidsgame
Field	Innovation management
Goal	Learn participants how to manage innovation processes in a complex societal field.
Developers	KPMG, Marc Petit (www.kpmg.nl)
Description	Learn participants how to manage innovation processes in a complex societal field.
Experiences	Many
Techniques	Paper based simulation game.

Name	Wander Jager
Field	Spreading innovations.
Goal	Simulation of innovation spread through groups.
Developers	RUG, Wander Jager (http://www.rug.nl/bdk/)
Description	Computer simulation of the human behavior when faced with

	innovations. Particular focus on group adoption/
Experiences	Very new.
Techniques	Simulation model.

Name	Quartier
Field	Health Care
Goal	Participants search for a good solution for the general practitioners problems in an urban section.
Developers	Twijnstra Gudde, Leon de Caluwe / Peter van der Lugt (www.tg.nl)
Description	This simulation game sketches the dynamics between actors in the first and second corridor of the health care system due to the general practitioners problems currently experienced. Participants represent a hospital, an insurance company, the regional GP foundation, the health centre and the local authorities in the "Quartier" urban section. The leadership and cooperation and the achievement of a long-term solution are key aspects. The balance between the private and community interests is important.
Experiences	Many
Techniques	Paper based simulation game.

References

Armstrong, Robert H.R.:
Gaming-Simulation in Perspective
In: Simulation and gaming across disciplines and cultures
Edts.: Crookall, David, Arai, Kiroshi
SAGE publications, Inc, 1994, pp. 213-224.

Crookall, David:
A guide to the literature on Simulation/Gaming
In: Simulation and gaming across disciplines and cultures
Edts.: Crookall, David, Arai, Kiroshi
SAGE publications, Inc, 1994, pp. 151-177.

Druckman, Daniel:
The educational effectiveness of interactive games
In: Simulation and gaming across disciplines and cultures
Edts.: Crookall, David; Arai, Kiroshi
SAGE publications, Inc, 1994, pp. 178-187.

Hofstede, Gert Jan; Pedersen, Paul B.; Hofstede, Geert H.:
Exploring culture: exercises, stories and synthetic cultures.
Yarmouth: Intercultural Press, Inc, 2002.

Huizinga, Johan:
Homo Ludens: a study of the play-element in culture.
Beacon Press, 1971.

Meijer, Sebastiaan and Gert Jan Hofstede (2003):
Simulation games for improving the human side of production management.
In: Current trends in Production Management, Proceedings of the IFIP WG 5.7 Working Conference on Human Aspects in Production Management
Edts.: Zülch, Gert, Stowasser, Sascha, Jagdev, Harinder S.
Shaker Verlag, 2003, ESIM, volume 6.

Meijer, Sebastiaan and Gert Jan Hofstede (2004)
The netchain laboratory.
Paper accepted for the International Conference on Chain Management, May 2004, Ede, The Netherlands.

Roelofs, A.M.E.
Structuring Policy Issues, Testing a mapping technique with gaming / simulation.
Ph.D. thesis Katholieke Universiteit Brabant, 2000

Addendum overview simulations and simulation games in agro and health care.

Some good examples in the spotlights.

The body of the paper consists of an overview of all simulations and simulation games in agro and health care chains we could find. The list of items found is very long and describes the items briefly. To give a quick overview over the diversity in the list, we added this addendum. It describes five items in more detail. This list of five includes:

A simulation in the agro sector. (Game Simulation Dairy)
A simulation in the health care sector (DPS)
A simulation game in the agro sector (NetChainGame)
A simulation game in the health care sector (Sante)
A special simulation used as a show model for chain automation in health care (Myosotis)

Each example is what we feel to be a fully developed simulation or simulation game with good practical value. They are all in use currently.

Game Simulation Dairy

Made by:
WUR, Farm management group / LEI, Alfons Beldman (http://www.sls.wau.nl/fma/)

To be used by:
Dairy farmers willing to write a strategic plan for their company.

Goal:
Write a strategic plan for your own dairy farm and get feedback on the likely outcome of this plan.

Number of participants:
This is a personal activity, but is practically organized in groups of 8 to 10 farmers.

Availability:
Contact Alfons Beldman.

Description:
Ussually, the GSD is done in two sessions of one day. The farmer sits behind a computer individually. One the first day he writes a so-called Strategic Management Report. The participant fills out an electronic questionnaire with questions like “What is the goal of your company? What are your strengths and weaknesses? Et cetera. After the questionnaire, the answers are discussed in the group. The participant goes home and receives a written version of the SMR to give some afterthoughts.
The next session confronts the farmer via the computer with his company, his operations management and the results of that. Now they have to develop a strategy for the next 5 to 10 years, choosing from a range of viable options. The participants choose a set of options and a

simulation model calculates the consequences of it based on regression models. These regression models are based on an extensive data set from the LEI.
Farmers can go back and forth between the set of options and the expected results to optimize their strategy.

DPS

Made by:
Leids Universitair Medisch Centrum, Peter Bloemendaal. (http://www.lumc.nl/5000/coo-ontwikkelaars.htm)

To be used by:
Students medicines

Goal:
Train students in curing a patient in a close to real-life situation.

Number of participants:
1 per session, but several sessions can run simultaneously.

Availability:
Used in training permanently

Description:
The Dynamic Patient Simulator (DPS) is software presenting a patient with a health problem and one or more complications. Students have to treat the patient. All regular cures are available. Via questions and further examinations of the patient, the student should discover the root of the problem, and he has to decide what to do. Patients react by getting healthier or less healthy. Meanwhile this process, the student is disturb with telephones, and emergency, moving the patient to an other place because of space requirements, et cetera, et cetera. Students can ask a senior doctor, and can consult other students. They are consulted themselves too.
The program is web-based and runs various cases for different diseases and health issues. These cases are written by professional doctors, and worked out by programmers.

NetChainGame

Made by:
Klict project. (CentER, UvT, EUR, WUR, Paragon Decision Technology) (www.klict.org)

To be used by:
Teachers and trainers in supply chain management on B.Sc, M.Sc. and MBA level.

Goal:
- Teach participants about the enormous amount of information that flows through a company in a netchain.
- Teach participants the difficulties of matching supply and demand of a company.
- Give participants a clue of the importance of logistic structures in practice.
- Provide a safe playground to test-drive a business.

Number of participants:
Very flexible, anywhere between 3 and 90.

Availability:
2004: Available for courses to the development partners only.
2005: Commercially available.

Description:
The NetChainGame is a computer based simulation game, placing participants in the role of managers of a business. Each computer stands for one company, and one to three people can play on each computer. There is one central computer coordinating the game and one central computer simulating all non-human players. Companies in the game are: supplier (simulated), producer (human and simulated), wholesaler (human and simulated), retailer (human and simulated) and end user market (simulated). The software is able to simulate any netchain with these companies. Technology limits the total number of companies to 30 at the moment.
At the beginning of the game participants have to choose their logistics structure. They do this, based on educational information from the accompanying website. Then participants make offers to buy or to sell. Next step is deciding which offers on the market they want to negotiate about. This involves selection of the trade partners. Selected offers go in the negotiation mode: refinements are sent back and forth until partners agree about a contract.
When all the contracts are made the real-time phase of the game starts. Contracts are carried out and the simulated markets start to supply and demand goods. Participants can see the performance of their company in the real-time game cockpit. When they run out of stock and don't get enough supply they can do an emergency order.
The game lasts several rounds, after which participants get feedback on their performance with a financial balance. Reputation questionnaires filled out after each round lead to conclusions about reputation of companies too.

Santé

Made by:
Twijnstra Gudde (www.tg.nl)

To be used by:
TG consultants in their consultancy work with health care institutions.

Goal:
Facilitating the preparation of health care institutions in the fast changing market of health care in The Netherlands. Topics are:

- Gain experience and insight in topics and mechanisms important for selling and buying health care between insurance company and hospitals.
- Learn to recognize goals, pre-occupations and motives of the major players in the market and make them more explicit.
- Learn to cope with strategic behavior of other parties.
- Conclude about the do's and don'ts in the changing environment.

Number of participants:
10 - 200

Availability:

Part of consultancy project. Contact TG.

Description:
In the simulation game 'Santé', participants are placed in the hypothetical 'Zeerand' area, where market forces in health care are normal, often in the form of DBC's. (Diagnosis Treatment Combinations). In the area, two hospitals, an insurance company and an independent treatment centre are active. The participants play specific roles in each of the organizations. In these roles, they are going to discuss about the problem how to realize sufficient, good quality, and affordable health care in the area. The participants experience how the cooperation in this new situation works and what can't be done, and get a better understanding of each others positions.
During the Santé game, the focus is on negotiation, cooperation and the choice of a clear position and strategy in and between de health care organization and the insurance company. Game materials include short films, posters, cards and role descriptions.

Myosotis

Made by:
Stichting Myosotis (www.stichtingmyosotis.nl) and Stichting Informatieverzorging Zorg (IVZ)

To be used by:
Health care institutions willing to see the state of the art in information systems, supporting chain coordination.

Goal:
Commercial goal: this project is financed by twenty-one software businesses. In the end these firms want to sell their software.
Goal of the simulation model: show the state of the art in health care chain automation.

Number of participants:
The simulation model is portable and can be placed anywhere for a demonstration specifically. Participants can be several partners working together and wanting to share one information system or one organization willing to update its information system.

Availability:
On demand, contact Myosotis.

Description:
The simulation model simulates a health care chain consisting of a client, a general practitioner, hospital, nursing home (verpleeghuis), rehabilitation centre and home care. A laptop represents the work place of a specific worker in one of the parts of the chain. The model simulates the processes happening in such a chain and participants can try the software to get a good insight in the possibilities of these products. There are two guides through the software: one follows the path of a client and shows all information and knowledge throughout the chain. The second possibility is to focus on one specific component. There are descriptions available of each component specifically.