Intelligent Personalized Trading Agents that facilitate Real-time Decisionmaking for Auctioneers and Buyers in the Dutch Flower Auctions

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ABSTRACT AND KEYWORDS	
Abstract	In this case the Dutch Flower Auctions (DFA) are discussed. The DFA are part of the supply network in which flowers are produced, stocked, and then sold through either mediation or auctioning. This case focuses on the buyers' and auctioneers' positions when flowers are traded through auctions. This case deals with the application of personalized agents as part of a Decision Support System which empowers the decision maker. The decision makers discussed in this case are the auctioneers who control the auction process, and the buyers who bid at the clock auction. Agents are defined as software programs that sense their environment and react autonomously on their environment in order to maximize a certain outcome. The agents, as envisioned in this case, are able to determine users' preferences and based on these preferences agents can proactively make recommendations. Agents as applied to the auction process could empower the auctioneers in their decisions. Another type of agent could empower the buyer, since buyers have the high-pressure task of buying at the clock auction.
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1. Introduction

In this case the Dutch Flower Auctions (DFA) are discussed. The DFA are part of the supply network in which flowers are produced, stocked, and then sold through either mediation or auctioning. This case focuses on the buyers' and auctioneers' positions when flowers are traded through auctions. This case deals with the application of personalized agents as part of a Decision Support System which empowers the decision maker. The decision makers discussed in this case are the auctioneers who control the auction process, and the buyers who bid at the clock auction. Agents are defined as software programs that sense their environment and react autonomously on their environment in order to maximize a certain outcome. The agents, as envisioned in this case, are able to determine users' preferences and based on these preferences agents can proactively make recommendations. Agents as applied to the auction process could empower the auctioneers in their decisions. Another type of agent could empower the buyer, since buyers have the high-pressure task of buying at the clock auction.

The auctioneers' case

The auctioneers at the DFA control the Dutch auction, i.e. clock auction process. Each of the 39 clocks is regulated by one auctioneer. Auctioneers are employees of the DFA whose task it is to optimize the price at which goods are sold, at the same time making sure the auction process is fast so that large quantities can be sold in a short period of time. Experienced auctioneers have very good judgment in order to successfully govern this process. However, their intuition has not resulted in full optimization of the process. Furthermore, the DFA has observed that behavior amongst the various auctioneers differs slightly. As a consequence, the DFA is also looking for a way to encourage more uniform behavior between auctioneers, while also optimizing the auction process.

The buyers' case

Mr. Buyer commonly purchases flowers at the DFA. He is under the impression that many of his buying decisions at the flower auction do not live up to his expectations. Every time his company has bought flowers they felt that they could have done better especially since there has been an overwhelming increase in the available assortment of flowers and qualities at the auction in the past decade. Even though Mr. Buyer feels that his company could have traded better at the auction in the past, he realizes that assessing all of the options available at the auction is too arduous and costly. In addition, with the added possibility of remote buying, buyers are able to buy at different auctions and find the auction that offers the right products in the closest proximity to where they have to be delivered. Looking for ways to optimize the proximity means even more factors, such as transportation cost and time, are to be taken into consideration when making a buying decision.

2. Background

The Dutch flower industry

The Netherlands is the very center of the international floriculture sector. The Dutch flower industry consists of a network of companies, each devoted to different aspects of the industry. These companies include breeders, growers, auctions, wholesalers, retailers, and transportation firms who import and export the flowers.

Not only growers from within the Netherlands bring their goods to Dutch auctions, growers from all over the planet ship their goods to the Netherlands. Flowers and plants from many countries, mostly warmer countries, such as Israel, Kenya, Zimbabwe, Spain and Ecuador are flown into the Netherlands, where they are stocked and sold the next day. Most of the flowers and plants sold in the Netherlands are exported to other countries. The main export countries are Germany, United Kingdom and France. Within Europe, the main mode of transportation is by truck. Products meant for export to countries outside Europe is brought to Amsterdam Airport and flown to destinations all over the world, where they can be sold within one day.

Flowers, as a product, are offered by many suppliers, called growers. For buyers there are few risks for delivery, since there are many growers offering products. Dutch growers are mostly geographically concentrated around the different auctions, because the price of transportation is relatively high and flowers are highly perishable. It is estimated that there is an 8 percent decrease in value after ca. 24 hours. Therefore, realizing short lead-times is of utmost importance to the flower supply chain. Most flowers make it from the growers to the retail shops within 48 hours. As a consequence of the necessity to realize short lead-times, a *push strategy* and a *pull strategy* are used in the flower supply chain. In the push strategy (supply driven), the growers, who are the initiators of the supply chain, push their products through the supply chain by selling them through clock auctions. They do so in order to keep their inventories low. The other strategy, a pull strategy (demand driven) is used by the retailers who would like to buy their products in advance. Once buyers order the products needed through the use of mediation by the DFA, the growers directly ship the recently harvested flowers to the buyers.

The Dutch Flower Auctions

The Dutch Flower Auctions (DFA), company name FloraHolland, operate within a flower supply network consisting of thousands of companies (see Figure 2.1. and additionally appendix I). The DFA comprises six individual auction locations which are spread throughout the Netherlands. In the 1960s the auctions in the Netherlands began merging with each other to become known as the Dutch Flower Auction. The individual auctions are marketplaces operating in a similar manner and are interlinked in a logistical network.

The DFA, being the largest flower auction in the world, is also the market leader, accounting for 60 percent of the global flower trade. The DFA is an association because it is a collective initiative of united flower growers and therefore represents the growers' interests. As an association, the DFA's primary mission is to provide services. The reason for growers to set up an auction was that auctions allowed growers to increase the total sales and the margins per unit sold (Kambil and van Heck, 2002).

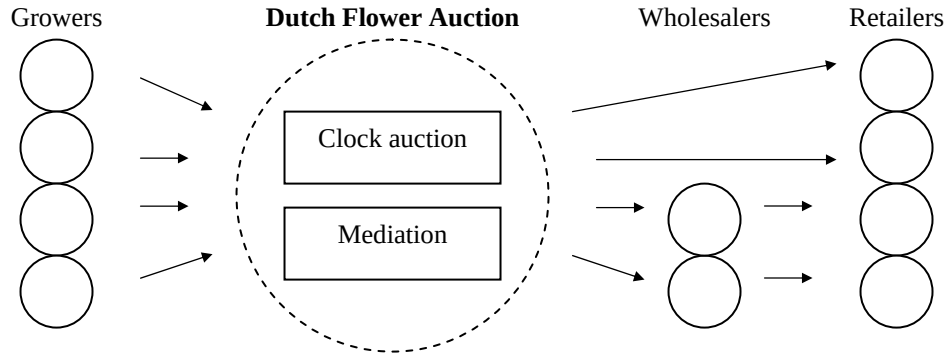

Figure 2.1. *Simplified Flower network, every line denotes transportation.*

There are two general buying scenarios (see Figure 2.2.). The first scenario is when the DFA directly sells to the retailers, in other words the flower shops (retailers) can engage in trade at the auction themselves. The second is the scenario in which the DFA sells to wholesalers who buy on behalf of their clients (retailers). The wholesalers then resell the goods to retailers. An example of such conduct is the wholesaler who supplies a supermarket with a steady stream of flowers. About two-thirds of the auctioned flowers are sold to wholesalers.

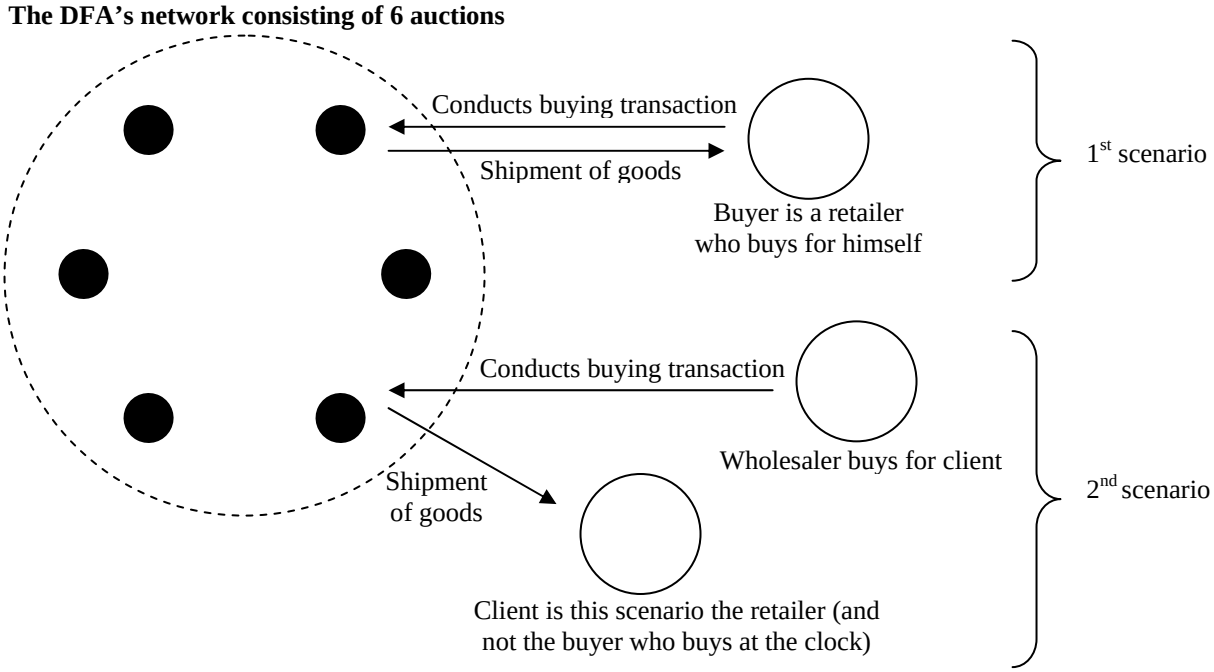

Figure 2.2. *The DFA's network depicting two buying scenarios. One in which the buyer is a retailer who buys for himself. In the second scenario the wholesaler buys for the client.*

At the DFA they auction flowers and potted plants. In this case we solely focus on the auctioneering of flowers, of which 43.2 million flower stems are sold everyday at the DFA. Because flowers are highly perishable goods, timely delivery is an important issue in the flower supply network.

At the Dutch Flower Auctions there are two sorts of trade mechanisms: *mediated trade* and *clock trade.*

Mediated trade (demand-driven network configuration)

Mediated trade refers to the trading between growers and buyers through the mediated services facilitated by the Dutch Flower Auction. In mediated trade buyers are the supply chain initiator. Therefore, mediated trade is a demand chain, which produces flowers on order and distributes them directly to customers (wholesalers, retailers) (Pozzebon and van Heck, 2006). The products bought through the intermediary services of the DFA are shipped during the day to the auction.

Clock trade (supply-driven network configuration)

The main difference between mediated trade and clock trade is that mediated trade is demand driven, while clock trade is supply driven. Additionally, clock trade as an auction method offers transparency, while mediated trade does not (Pozzebon and van Heck, 2006). Clock trade represents 70% of the flowers traded, and is the focal point of this case. At the Dutch Flower Auctions the goods sold on the clock trade market are shipped every night before 4:30AM, allowing the goods to be auctioned during the day, which takes until around 10:00AM. When a shipment is auctioned through a clock auction, the auctioneer will determine the beginning price and the size of the minimum units for sale. The auction starts at 6.00AM and makes use of 39 clocks (for potted plants and flowers) at six different auction locations. Different products are sold at each clock, and sale continues until all of the products are sold. On average there are approximately 125,000 transactions per day.

Clock trade was invented in the Netherlands in 1870s, because quick delivery is essential to floriculture. In this way products could be sold quickly to the first buyer indicating an interest in the product (Kambil and van Heck, 1998). Clock trade takes place using a clock, and it is known as a Dutch auction or open descending price auction. Such an auction start with a high asking price which is lowered until a buyer accepts the asking price. Accepting the last announced price means being awarded with the goods auctioned. In this type of auction the participants know the previous winning bids, since these are visible. Therefore this method is quite transparent.

Figure 2.3. *The clock with trolleys carrying the flowers to be auctioned.*

Clock auctions are governed by auctioneers, and work as follows. A clock pointer indicating the price, points to quickly descending values. The price decreases very quickly, on average a transaction is made every four seconds. Buyers bid by pressing a button denoting the portion of the shipment they would like the buy. Because buyers only buy a smaller portion of the shipment being auctioned, the

shipment is auctioned until it is fully sold in smaller batches called “commercial transactions” or “sub lots”. By making commercial transactions (sub lots) buyers have the ability to buy at the price they would like as indicated by the clock, and buy the amount of their preference by choosing the size of their commercial transaction. See Figure 2.3 of the clock auction hall, and appendix II for detailed design of the clock.

Table 2.1 below depicts an example of a transaction logbook entry of the auctioning of a lot with the size of 25 units. These lots are divided into five commercial transactions or sub lots.

Units for sale	Price	Quantity	Buyer
25	15 cts	5	H. De Jager
20	14 cts	6	T.H. Pietersen
14	18 cts	4	P.J. De Vries
10	13 cts	5	A. Jansen
5	12 cts	5	A. B. De Groot

Table 2.1. *A hypothetical logbook entry of how one lot is divided into five commercial transactions or sub lots.*

When buying through a clock auction, buyers aim to buy at the lowest possible price. Thus, they try to show their interest at the very latest possible moment. Caution needs to be exercised in doing so, because reacting too late means forgoing the ability to buy the auctioned product while other buyers have jumped on the opportunity. As a consequence, buying through clock auctions is not an easy job.

Remote buying

Nowadays buyers can also buy through clock auctions even though they are not physically present at the auction themselves. Through a computer interface buyers anywhere in the world are able to buy at the DFA (see Figure 2.4). This application spreads historical to the buyers regarding the previous weeks, months and years.

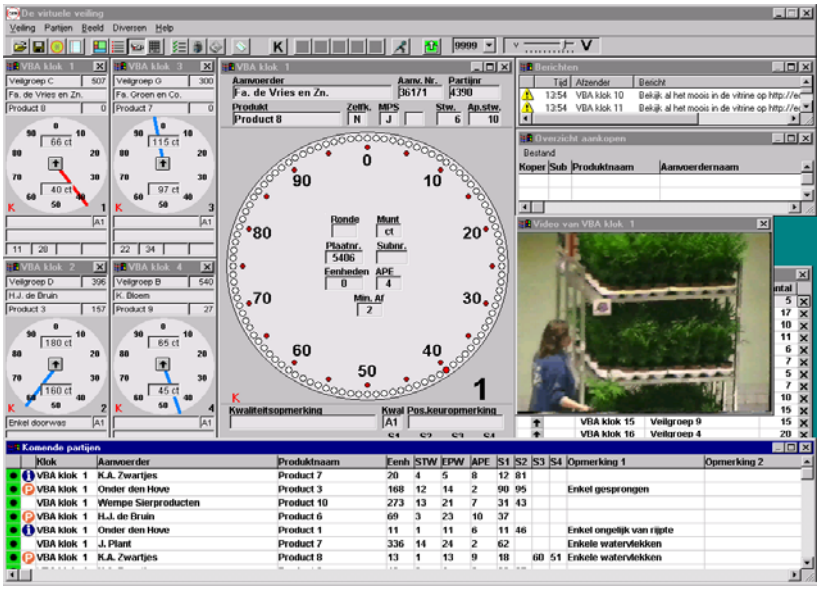

Figure 2.4 *The remote buying application’s interface.*

Buyers who use the remote buying application are also informed about what will be auctioned during the day. Just before the auction day starts, the supply of flowers to be sold from each seller becomes known and shared in the "auction scheme". The DFA offers the auction scheme online the buyers. The buyers can use this information to search for a specific grower or type of flower. Some buyers use this information to make proxy biddings. With proxy bidding the buyer sets a maximum price they are willing to bid for a particular upcoming lot. If there are no other participants who bid higher than this set maximum by the proxy bidder, the goods will be awarded to the buyer who used the proxy bid.

Remote buying opens up a world of opportunities, since many buyers procure for their customers who are located at different locations. There are six different auctions of the DFA in the Netherlands, which means that when remotely buying, buyers could optimize the transportation cost and transportation time by making sure they buy products from an auction that is in close proximity to the location where they need to ship the goods.

Competition at the clock.
Generally per auction hall there are 10 to 150 people paying attention to a single clock, and approximately a maximum of 30 of them will be interested in a particular lot of goods being sold. When a buyer sees a lot that he is interested in and is the first to buy it by it by pressing the buy button with the amount of units to purchase, he will be awarded with the goods. In the split-second directly after the winner pressed the button there will be roughly five other buyers who pressed just a split-second too late. The buyers who pressed just a little too late are all buyers who compete for the same lot.

Nowadays, an increasing number of buyers use the remote buying application to make purchases. This means that less people are present at the clocks. Especially wholesalers, who historically had a procurement team that was spread out between the different auction locations in the Netherlands, now trade remotely. This allows the procurement team to be collocated, enabling good communication with the other members of the procurement team as well as the sales department.

The auctioneers

The auctioneers are the persons regulating the competition by controlling the speed of the clock, the initial price, and the minimum purchase quantity. By controlling these variables, auctioneers are able to influence the dynamics of the auction. The DFA has two objectives: high prices, and a quick selling process. Their main objective is to auction goods at the highest price possible since they represent the growers, while as the time passes in the morning from 6:00AM to around 10:00AM when the auction process starts to wind down, they would like to speed up the auction process. Therefore, the auctioneer starts in the beginning of the auction process at 6:00 attempting to increase competition by auctioning smaller lots, having low minimum purchase quantities. Auctioning smaller lots, means small buyers as well as big buyers are able to buy the goods, which leads to high competition that drives the price up. As time passes, auctioneers want to speed up the process so they will start auctioning bigger lots, setting a higher minimum purchase quantity. This results in less competition, as only big buyers are interested, leading to lower prices and because the lot size is bigger the auction process is speeded up.

Auctioneer profile

Currently, the DFA hosts 39 clocks. Each clock is governed by an auctioneer. Auctioneers try to sell the products for the highest price, while simultaneously trying to have an expedient auction process.

During the actual auction process, the auctioneer controls three important auctioneering variables: (1) the speed, (2) the initial standing price, and (3) the lot size. As is the case with buyers, auctioneers must consider many parameters when making their decisions. Auctioneers need to take the following decision parameters into consideration when managing the auction process: (1) historical prices; (2) quality measures; (3) upcoming auctions; (4) market conditions; (5) and internal conditions, such as the warehousing process at the DFA.

Auctioneers have a complex job, since for each lot to be auctioned they must decide on the value of three variables, i.e. speed, initial standing price, and lot size. Even though the auctioneers have many years of experience, their behavior is neither optimal nor standardized. The DFA would like to see a more uniform trading process at the different clocks. An intelligent agent as embedded in a Decision Support System could assist the auctioneer in making higher quality decisions and allows for more uniformity in the behavior between auctioneers. Examples of agent-based auctioneer decision support can be found in (Collins et al. 2002, Gupta et al. 2009), and (Ketter et al. 2009).

Buyers

Buyers do not only base their decisions on amount and price. There are also quality indicators. Quality indicators are set by quality inspectors employed by the auction. In this case the quality indication A1 (highest quality), A2, B1, B2 (lowest quality) is used. Because buying is such a high pressure task, buyers need to make their decisions within 3-5 seconds; they rely on the information as given by the quality metrics. However, since 80% of the flowers sold are A1 quality this group of A1 flowers is too large. Therefore, the quality metrics do not offer enough information to base a decision on. Buyers have no method of knowing from which seller they can get the needed quality. As a consequence, they rely on reputation. Most buyers purchase from a group of known sellers and continue to do so until the quality of the flowers falls short of the anticipated quality. When this happens buyers will reconsider from which seller they will buy.

Buyer profiles

Buyers are defined as all parties that buy products from the growers. These could be retailers, and wholesalers who re-sell to their clients. Some buyers depend on transporters to deliver the products, which add an extra link to the supply chain. There are many different kinds of buyers active on the auctions. Four different kinds of buyers are listed below in detail. The four listed below are not meant as a list of archetypical buyers. Their profiles are meant to be used to explore how different companies, with different strategies, are trading on the DFA.

General wholesaler (cost driven exporter)

PowerFlower is a cut flower wholesaler consisting of a group of subsidiaries. Part of their business is the supplying of large stores and supermarkets. They aim to deliver large quantities at very competitive prices in order to bring affordable products to consumers. Therefore, they focus on having large volumes and speed in their business processes. Their main business is seasonal flowers, and Christmas and valentine products. PowerFlower has recently entered into a strategic alliance with Walt Disney. In this alliance they place Disney characters on its products. Meaning that flowers and potted plants are marketed with Disney's special label. In order to supply these products to the customers, PowerFlower is in need of a very large stream of low cost flowers that can be sold under Disney's label.

Specialist wholesaler (differentiator on quality)

Xolec Flower is an export company that has 55 employees. It is part of the General Flowers Holland, which is a group of subsidiary companies that together comprise the biggest global export company in cut flower with a group revenue of 500 million Euro. Xolec Flower exports to

the USA, Canada, and Japan. Their main specialty is the selling of high quality tulips, in which they are highly specialized. They mainly sell to wholesalers abroad and supermarkets who sell Xolec Flower's prepackaged tulips to US customers. In order to maintain such a strong international position in export they have specialized in airfreight packaging and have built a strong position in air transportation.

Large retailer (medium quality retailer)
An example of a large retailer who sells cut flowers to a broad audience is *The Greener Thumb*. The Greener Thumb is a garden center which sells all kinds of general garden equipment and potted plants. They are also known to sell large quantities of flowers. The Greener Thumb has huge stores, on average 7.000 m^2. They have 55 stores in the Netherlands, 3 in Belgium, and 1 in Russia. Their main target group is women between the 30 and 45 year. Since this is such a general target group they aim to sell medium quality seasonal cut flowers. When selling flowers they do not differentiate or craft bouquets on request, they try to look for the currents trends in order to reach their target group with flowers that are "in fashion".

Small retailer (flower shop with specific client wishes)
As a small retailer *Van der Weert Dutch Flowers* is a family business based in Vlodrop in the province of Limburg. The company is owned by a couple who run the company together with their son and four employees. They have a small headquarter and a shop located near the German border. On the Saturdays they also have an outlet on the local market in a nearby village. Generally, Van der Weert specializes in cut flowers for weddings, funeral flower arrangements and bouquets for special occasions where they create bouquets based on their clients wishes. Being a family company they value good service, and high quality products. They are known for selling beautiful roses, which has always been a large part of their business. The last couple of years they also specialized in organic flowers. They are now successfully selling and promoting organically grown Dutch tulips among their customers.

Each of these buyers are competing in a different environment and have a different information need. These buyers need to consider many kinds of information when making their decisions.

First, buyers need to consider *product information,* such as price and quality measures, which are shown at the clock or though the remote buying interface. The second is *transportation information*. The Dutch Flower Auctions consist of six auctions throughout the Netherlands. Buyers can remotely buy at different auctions. This allows them to save transportation time and cost by being able to look for purchases at auctions which are in close proximity to the clients to whom the flowers at to be delivered. The third is *auction information*. When buyers buy on the clock auction their decisions are influenced by the amount of available products still to be traded. Scarcity drives price. Therefore, the traders need to know what will be traded in the upcoming auctions. The last is *market condition information*. The market has many conditions that could influence buying decisions such as, such as the trading history on the auction, price and product availability forecast, seasonal trends, news etc.

Combining the information above leads to the assertion that there are six main decision parameters to be considered with every buy: (1) *price*; (2) *quality measures*; (3) *transportation costs*; (4) *transportation time*; (5) *upcoming auctions*; and the (6) *market conditions*. However, humans can not calculate optimums with these decision parameters, especially not that quickly. There is a need to find a method to optimize analysis speed regarding these parameters. A Decision Support System equipped with intelligent agents which serve as personal assistants for the buyers could offer a solution. The tasks of these agents are to empower buyers, thereby enabling higher quality decision making.

3. Intelligent personalized buying agents at the Dutch Flower Auction

The way a market functions is determined by the human actors on the markets, therefore it is humans who are the core of the market functioning (Kambil and Van Heck, 2002). Humans are known to have bounded rationality, which refers to human's inability to come to optimal decisions due to their inability to process large amounts of information (Simon, 1979). Instead of processing large amounts of information and reaching optimal solutions, humans use simple rules called heuristics to guide their decision making. As a consequence, humans are 'satisficers' who search for a non-optimal solution that fits their needs, instead of 'maximizers' who scrutinized all the options available. Additionally, humans experience something that is defined as the notion of the ´tyranny of choice´. This refers to the fact that having many options to choose from, leads people to experience negative emotions (Schwartz, 2004). Findings conclude that having some options is beneficial to human well-being, however being overwhelmed with options decreases human well-being.

An agent is defined as anything that can perceive its environment through sensors and is able to autonomously act upon that environment (Russell and Norvig, 1995). Intelligent agents are able to monitor the environment, do internal calculations and make recommendations. Ideally, agents are able to maximize its performance measure by observing the environment and act on this by using built-in knowledge. In this case we use the notion of intelligent agents as software that is used when automating repetitive tasks. Agents are given a particular task, to carry out autonomously, reporting back to the user afterwards. Using a combined view, in which the abilities of agents are considered together with the complexity of market trading, a new perspective emerges (Maes et al., 1999). Personalized intelligent agents that support human decision making can offer tremendous value, leading humans engaged in market trade to make higher quality decisions.

Humans being equipped with personalized agents as part of a Decision Support System have the ability to reach higher quality decisions by having the agents deal with huge amounts of information. The agents reduces the large number of options, so humans can choose from several sound options (Meas, 1994; Ketter et al., 2008). Therefore they are able to help humans cope with information overload and target the abundance of choices available by recommending personalized results that guide humans in making higher quality decisions. Through the use of performance dashboards users can quickly see what the current status of key decision variables are, and can make decisions based on the shown information (Eckerson, 2005). Performance dashboards visualize the deviation between target and actual performance. They propose decisions and indicate the effect of proposed decisions.

Before Decision Support Systems are able to make recommendations to users, agents have to determine the user's preferences through preference elicitation and modeling. Preference modeling means that the agents need to be trained with data in order for them to determine preferences to base their recommendations on. The training of the agent can be done through feedback mechanisms. For instance, users can insert their preferences manually by means of questionnaires, or give explicit feedback when voting on suggestions provided. Implicit feedback is also possible; agents can actively monitor the user's behavior. Over time, through providing feedback the agents become more aware of the user's preferences, and the human user becomes more familiar with the agent. This means that over time the agent can be awarded with more autonomy in the decision making process. Therefore, the agent is to be equipped with a threshold called an "adjustable autonomy". This threshold indicates the level of autonomy the agent has. Users start by giving the agent little autonomy when it is still learning the preference of the users but after a while more autonomy could be awarded to the agent.

Agents are able to handle information overload for humans by dealing with information sensed in the perceived environment. There is however a social dimension that agents forgo. As indicated by research on auctions, there are many attributes on which buyers base their trading; some are not easily transferred digitally, e.g. body languages or gossiping (Kambil and van Heck, 2002).

Auctioneers' case problem

Currently, auctioneers use their intuition when auctioning goods. Their vast experience allows them to judge very carefully what the suitable variables are when selling goods. However, this intuition is not optimal. Auctioneers are not able to calculate the optimal initial standing price, the optimal speed, and the optimal lot size since small changes in these variables influence the auction price buyers pay. Calculating or analyzing data within the 3-5 seconds between transactions is nearly impossible. Therefore, humans use heuristics instead of truly calculating optimums. For the Dutch Flower Auctions it would be very beneficial to have auctions in which the speed vs. price trade-off is engineered to be optimal.

Conclusion auctioneers' case

In a gather between the representatives from the Dutch Flower Auction and the case writers, there was a discussion regarding *how to utilize personalized agents to empower the auctioneers during the clock auction process*. These agents could be used by all of the auctioneers in order to optimize and standardize performance.

Buyers' case problem

In Figure 3.1. Mr. Buyer is engaged in trading. His laptop enables him to monitor other auctions and retrieve additional information.

Figure 3.1. *Mr. Buyer engaged in trading behind his terminal at the clock auction.*

Mr. Buyer and other buyers who trade through the clock auction at the DFA have to make high pressure decisions, but there are too many factors to consider when making a buying decision. The traders experience negative emotions after they conducted a transaction since many times the products bought are believed not to be the best choice available. However, scrutinizing all of the products offered at the auctions and finding the perfect product to buy consumes too many resources. Applying personalized intelligent agents in such a scenario could offer benefits. However, not all factors can be understood by the agent, social factors as rumors or atmosphere cannot be grasped by

agents. The Dutch Flower Auctions would like to support the buyers in their trading and has opened up their infrastructure. The infrastructure of the Dutch Flower Auctions allows software to be connected to the central clock of the auction. The flower auction is open to the idea of a personalized intelligent agent if this leads to more satisfied buyers, since in the DFA reasons that the more successful the buyers are in finding the right products, the more trading will take place.

Conclusion buyer's case

Mr. Buyer discussed with the case writers how to implement the idea of personalized intelligent agents at the Dutch Flower Auctions to empower the buyers. The implementation of these personalized intelligent agents could be used by many buyers at the flower auctions. Mr. Buyer and his team need to identify *how personalized intelligent agents can be utilized on clock trade at the Dutch Flower Auctions to enable higher quality business decisions for the buyers*. A guiding business question here to be asked is: *will the application of these personalized intelligent agents only lower the transaction costs, or will they bring a competitive advantage*?

4. Case organization

As explained in the case, the auctioneers and the buyers have different information needs. Furthermore, between the buyers, each of the four different buyers profiles also have different information needs. This results in different rationales for strategies in successfully trading and auctioneering at the auction. For instance, when considering the buyers some buyers have a cost saving strategy, while others might have a differentiation strategy. In this case every team of students will design a Decision Support System for either the auctioneer or one of the four buyer profile types. The scope of the system supporting these differences for buyers is only explored to a certain extent in this case. As a consequence, students need to augment these dimensional variables themselves through studying the business needs and possibly elicit requirements from the different actors involved when building their systems.

System

In artificial economic environments interesting features of the real world are abstracted, and others features, such as taxes and personalities trading on the markets, which offer little interest for the topic at hand are ignored (Collins et al., 2008). In this case students will be working in such an artificially created environment. The students are provided with access to an online environment in which a simple simulation auction prototype is already created. The simulation prototype of a Dutch auction is already available for them to use and can be augmented to fit their gained insights.

The task of the students in the case is to create personalized assistance in the form of an intelligent agent that communicates with the auction already in place. Students will design a bi-directional interface of this personalized agent displaying information to the buyer so as to empower him to make higher quality decisions. In order to do so, students need to define simple rules for the agent to act on. The example rule below could represent one of these preferences made explicit.
Buyer example: IF season = spring AND flower = Tulip AND price < 76 THEN buy 50.
Auctioneer example: IF season = summer AND flower = Rose set initial_price at 80.

Stakeholders

This case deals with different stakeholders, meaning that different methods in the requirements elicitation process are to be used, depending on the availability of the different actors. In order to elicit the requirements, further information is to be discovered from disparate sources, being the internet, questionnaires and interviews.

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Glossary

Auctioneer
An auctioneer manages the clock auction process. Each of the 39 clocks at the DFA is managed by a different auctioneer.

Buyer
A buyer is a company that buys flowers. Buyers can buy through the mediation services of the DFA, or at the clock auction. At the clock auction, which is the focus of this case, a buyer can either buy by being physically present in the auction hall, or via a remote buying application.

At the DFA there are two types of buyers, namely retailers and wholesalers. When the buyers are retailers, they buy goods that they themselves sell to their customers. Wholesalers also buy at the auction, however they buy goods for their clients, who are retailers. See also Figure 2.2 at page 5 for the two scenarios.

Commercial transaction (sub lot)
Commercial transactions refer to the portions of goods sold from one lot to different buyers. When a buyer indicates his interest in the auctioned goods he specifies the amount of units to be bought.
See also: Lot

Dutch Flower Auctions (DFA)
The network of 6 auction locations operates under the name FloraHolland. At the Dutch Flower Auctions potted plants and cut-flowers are traded. The trading process takes place through either mediation services or clock auction. This case focuses on buying cut flowers through the clock auction.

Lot
Individual growers sell groups of units at the auction which are referred to as lots. Buyers are able to buy smaller portions of this lot. The smaller portions are called commercial transactions or sub lots.
See also: *Commercial transaction*

Quality indicators
The goods sold at the clock auction are inspected by quality inspectors employed by the auction. They award A1 (being the highest quality), A2, B1, B2 (being the lowest quality).

Retailer
Retailers are the closest link to the end-customers in the flower network. Some retailers buy their goods from wholesalers, while other retailers buy directly at the Dutch Flower Auctions.

Seller (grower)
A seller at the DFA is a grower who brings his goods to the DFA in order to be sold.

Wholesalers
A type of buyer at the Dutch Flower Auctions that buys goods for clients. Wholesalers buy at the auction in order to resell to their own clients.

Appendix I: The Dutch Flower Network

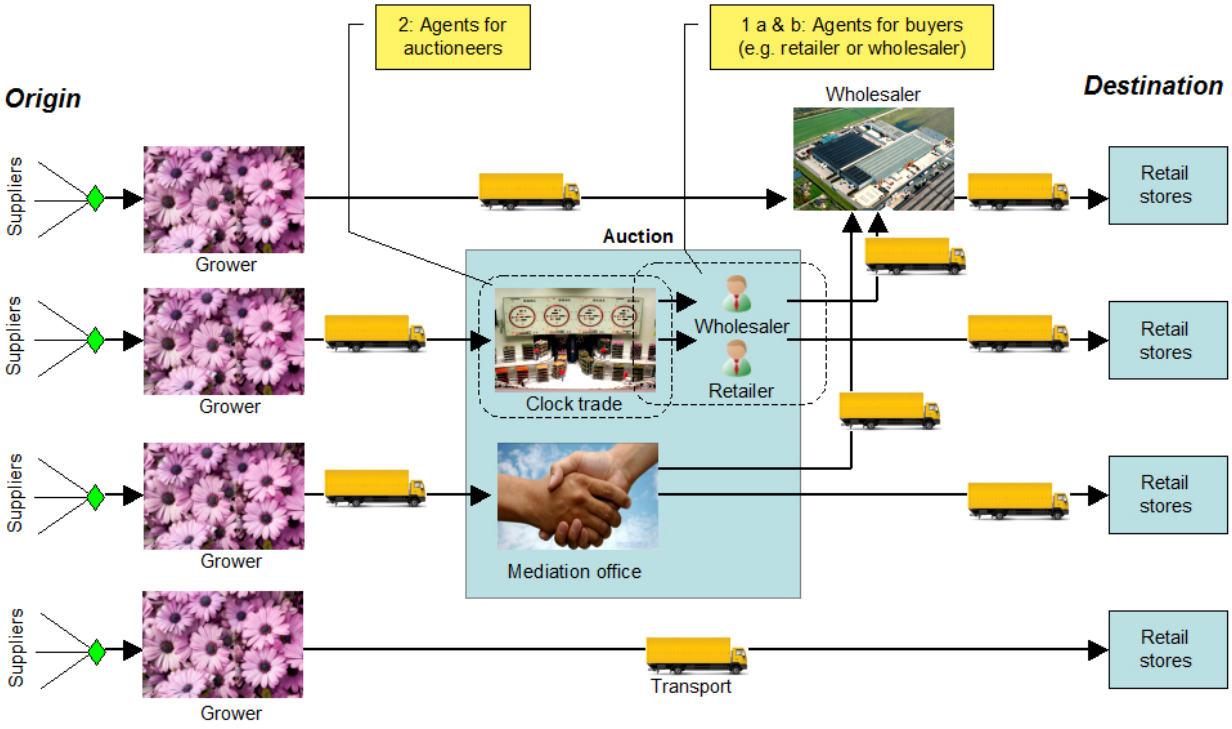
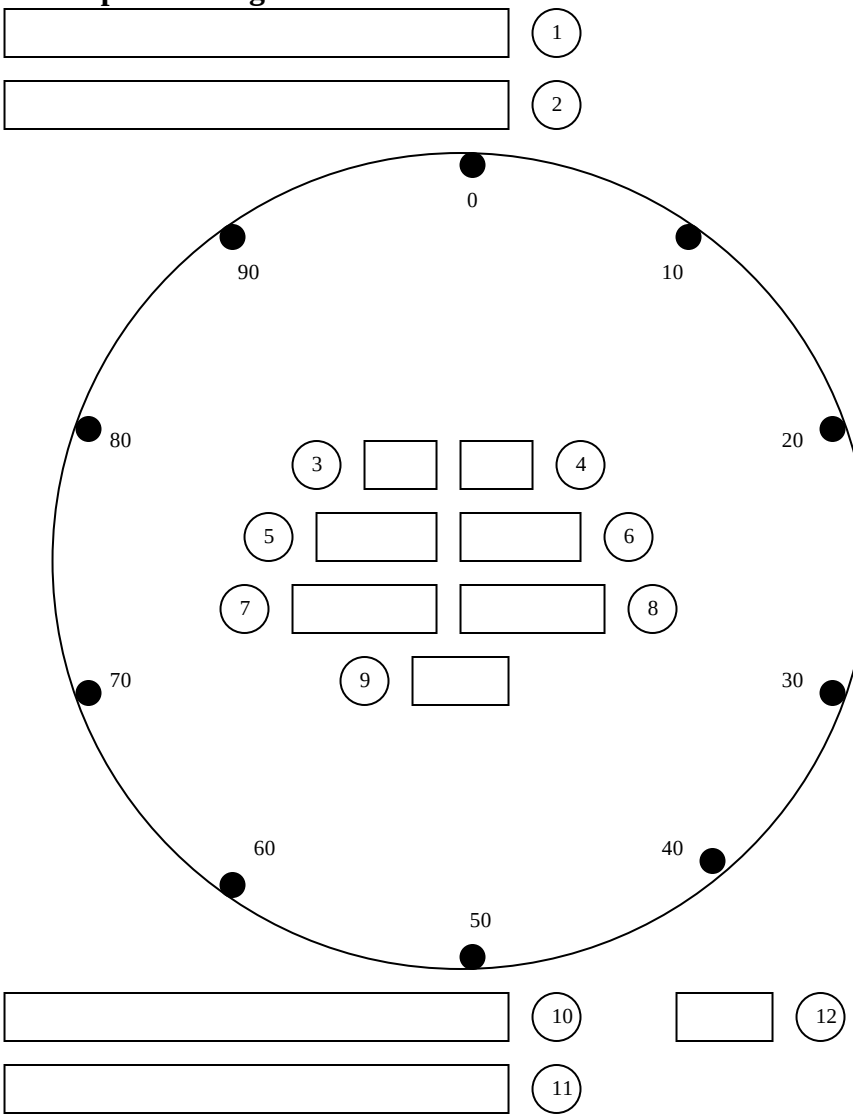


Figure I. *The Dutch Flower Network*

Appendix II: A simplified design of the clock



	Name	Example values
1.	Seller	Name of the seller
2.	Product	Product name
3.	Round	Auction round
4.	Unit of currency	e.g. “1 cent”, “5 cents”, “10 cents”, “1 Euro” etc.
5.	Buyer ID	Identification number referring to the buyer
6.	Sub nr.	Sub number
7.	Units	e.g. “10”
8.	Stems per unit	Amount of stems per unit, e.g. “10”.
9.	Minimum purchase quantity	e.g. “2”
10.	Negative comment on quality	e.g. “Small water stains”
11.	Positive comment on quality	e.g. “Nice leaves”
12.	Quality indication	e.g. “A1” (highest quality), “A2”, “B1”, “B2” (lowest quality)

Table II. *Legend of displayed information on the clock.*

Appendix III: DFA information systems

Currently the DFA has many systems in place, each system offering a different kind of information service. The diagram below depicts some of the systems already in place. More information on these systems can be found at the DFA´s website (www.floraholland.com).

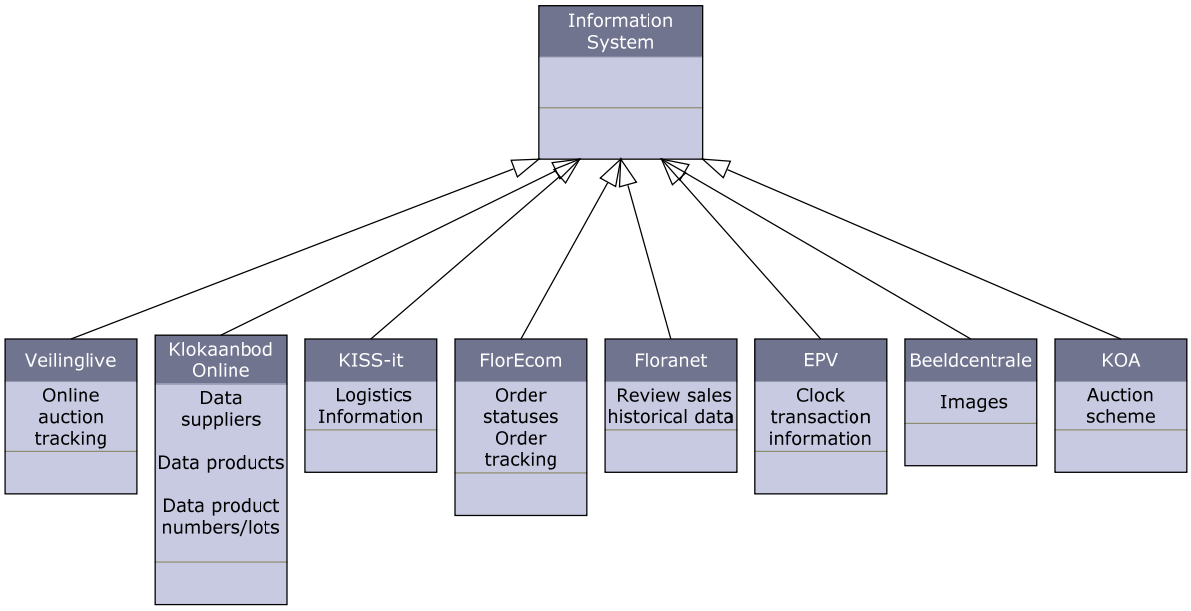


Figure III. *Currently available information systems at the DFA.*

About the Authors

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