

December 2002

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Recommended Citation

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AMCIS 2002 Proceedings. 268.

<http://aisel.aisnet.org/amcis2002/268>

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SUPPORTING CUSTOMER COOPERATION TO PROMOTE SUSTAINABLE DEVELOPMENT

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Abstract

To support sustainable development especially in rural regions, often customer cooperation is needed, because small ecological businesses often have inadequate distribution systems. In this paper we describe a research project that improves regional development by an application which supports a community in ordering, supplying and distributing organic food and other ecologically friendly products. As an extension we look into building up a virtual, decentralized eco-village. Several hundred people understand themselves as inhabitants of the village, which is spread in a limited region with a diameter of about 20-30 miles, because otherwise material flows are too extensive and maintaining social bindings is more difficult.

Introduction

One important step towards sustainable development is the support of purchasing and delivering regional produced goods like organic food or materials for clean construction (World Commission on Environment and Development 1987). In case of organic food one possibility of ordering and purchasing is to organise oneself in a food cooperative (food-coop, Bundesarbeitsgemeinschaft 2000), to buy directly from regional farms and also be able to order products from a wholesaler. For the latter, acting jointly is necessary, because complete wholesale bundles are seldom needed by a single person or family. A food-coop is a good example for customer cooperation, because every step must be organised by the members.

Other goods can jointly be ordered, too, and additionally the delivering of the articles within purchasing community should be supported.

But cooperating and the coordination of these activities require communication means and special arrangements and are not easy to set up, especially in rural regions. So an obvious solution is to put in new information technologies.

Project Context

A new approach to a regionally limited community is a virtual, decentralized eco-village (Naumann 2001). Our research refers to a community that is advancing from a food-coop to such an eco-village. The community will share common interests (e.g. culture events), will jointly procure organic food and other ecologically friendly products and will be connected via internet and a special application.

The motivation of this group is brought about by the goals of sustainable development. They want to act ecologically, economically and cooperatively. The food-coop approach and its extension is able to meet all these demands:

- Ecology: The traded products are organic, traffic is limited and so air pollution because of the bounded region
- Economy: Regional companies are supported and the common procurement saves cost

- Cooperation: The common procurement makes it necessary to work together, to find arrangements etc. So social contacts are enforced.

We expect that acting ecologically by cooperation has benefits for sustainable development and can enforce regional activities to solve existing environmental and social problems. Food-Coops are an appropriate candidate for introducing electronic cooperation, because the business model is known, and food is a low cost good one needs regularly in his household.

Food-Coop Transaction Phases

To realize an electronic solution we developed at first a Java-Application to support the joint procurement of organic food by wholesale. The main problem is here to bring into line the customers requests with the bundles offered by the wholesaler. So an information system has been developed to meet these requirements, which can be divided in four parts:

- Information Collecting Phase
- Customer Ordering
- Wholesale Ordering
- Delivery and Distribution

Each step is supported by our information system 'e-Food-Coop'. Especially the community member interactions and cooperations are considered. The concept can be understood as an instance of a self-organised participatory electronic product catalogue (PEP Schubert 2000, p. 154) with an ecological focus (Hummel 2000).

Procurement Without the Support of an Information System

In the pre-software phase the procurement of wholesale food was done by handing round a printed catalogue of organic food. There was no real ordering deadline, because it was not foreseeable when handing round of the catalogue would be finished. That phase took a lot of time (for 20 persons in a rural region about 2-4 weeks) and was not helpful to cooperate, because the consumers only saw the requests so far and after the circulation of the catalogue was finished, they had no possibility to look at their requests. Furthermore the first person had no chance to complete bundles (but therefore to open some), and the last participants could only fill up previously requested bundles or order whole ones.

After that phase the ordering coordinator put together the bundles manually and sent the order to the supplier. After the delivery the products had to be split up and sometimes (if the delivery differ from to the ordering) re-grouped between the participants.

The e-Food-Coop Application

The main point of effort in our current project is to support communication and information-sharing to improve ordering and delivering. With this application time can be saved, and more consumers have the possibility to participate. Furthermore the orderings are optimized, because the users can cooperate during the whole procurement process.

Information Collecting Phase

In the first step the customers (therefore the members of the community) have to receive information about products. After the electronic product catalogue from the suppliers are read in into the database several data about the offered articles are available. For example the manufactures names and locations, and also the country where the article comes from (e.g. Quinoa, a cereal from Boliva). This information is also important to calculate the impact of the products on the environment.

In addition to these basic product data the community members can add comments to the products, for example with positive or negative (tasting) experiences, recipes or other information about the products.

The screenshot shows a window titled "All Supplier Deadlines" with a table containing the following data:

| Lieferant | Deadline | Products | Comment |
|------------------|------------|-----------------------|----------------------------|
| Robinienhof | 15.04.2002 | Meat, sausage | Special arrangement |
| Bannmühle | 22.04.2002 | Juice, fruits | |
| Gebr. Franz | 01.06.2002 | Organic food | Delivery to Robinienhof |
| Naturbauladen | 20.06.2002 | Clean construction | |
| Robinienhof | 15.07.2002 | Meat, sausage | Special arrangement |
| Öko-Textil Themm | 31.07.2002 | Clothes, eco-textiles | |
| Gebr. Franz | 01.09.2002 | Organic food | Delivery to Robinienhof |
| Zettelwirtschaft | 25.09.2002 | Office equipment | Delivery to Umweltwerks... |
| Bannmühle | 01.10.2002 | Juice, fruits | |
| Gebr. Franz | 01.12.2002 | Organic food | Delivery to Robinienhof |

Below the table are two buttons: "Details" and "Close".

Figure 1. General Survey over the Next Supplier Deadlines (Translated)

Another important bit of information is provided via an extra frame (figure 1): The deadlines for ordering. Because every supplier can have different dates, it is necessary to present this information to the users. Non-fresh is food less often ordered than fresh food like vegetables etc. Other products like building materials or eco-textiles are only ordered sporadically by the group.

Customer Ordering

After the information phase the community members start to order. Here they also have the possibility to add notes to the special article they want to order. But furthermore, if two customers for example request a different sort of noodles, and no bundle will be completed, they have the chance to agree on the same article. To support this decision, the software computes and indicates for every ordered article whether one or more bundles are complete. If not, the users have the chance to change their requests.

In figure 2 the column 'Supply?' indicates whether the bundle is complete. 'Exact' means that the order meets the request exactly, 'modified' that the number of parts would have to be modified (at this moment) by the coordinator and 'no' that the request can't be met.

If a participant does not own a computer to order electronically, he can contact by phone or fax another person which owns one, and can adopt the request. Another possibility is to use one computer with several participants. The software allows several users by separated data storing.

Wholesale Ordering

After the deadline is met the requests from all customers must be summed up. The ordering coordinator, also member of the community, has a special frame with an overview of all requests. In case of doubt he/she has to decide, whether the request has to be changed. To support this decision a simple system is established: In addition to the request the users say if they want the parts of the bundle 'at least' or 'at most'. If the bundle for example consists of 12 parts of 500g, 'at least 6 parts' means that the customer wants 6, but would also take 12 if no other user is interested to purchase. On the other hand if he wants 'at most 6' parts and the bundle is not completed by other purchasers, he will get nothing. But as said in 3.2, in this case it is reasonable to use the comment system or direct contacts to negotiate before the deadline to find other purchasers.

| Supplier | Art-Nr. | Description | Gebinde | requestet | ordered | delivered | Price | Supply? |
|--------------|---------|---------------------------------------|----------|-----------|---------|-----------|----------|----------|
| Gebr. Fra... | 45060 | Lavasan,10l,Flüssigwaschmittel | 1x10 l | 2 + | 2 | 1 | ≈56.12 € | exact |
| Gebr. Fra... | 05135 | KAMUT-Spaghetti | 12x500 g | 12 + | 12 | 15 | ≈23.16 € | modified |
| Gebr. Fra... | 05113 | Dinkel-Spirelli,100%Dinkel | 12x500 g | 12 + | 17 | 17 | ≈22.03 € | modified |
| Gebr. Fra... | 05160 | Dinkel-Vollkorn-Bandnudeln | 10x500 g | 10 + | 10 | 10 | ≈18.48 € | exact |
| Gebr. Fra... | 09228 | Rosinen,geölt,250g,Türkei | 10x250 g | 10 + | 10 | 10 | ≈12.36 € | exact |
| Gebr. Fra... | 10570 | Crisp,Schoko-Waffelriegel | 35x20 g | 70 + | 70 | 70 | ≈28.01 € | exact |
| Gebr. Fra... | 17005 | Herbamare-Nachfüllbeutel,500g,Biol... | 6x500 g | 6 - | 6 | 6 | ≈24.65 € | exact |
| Gebr. Fra... | 17093 | Kräuter-Senf | 6x125 g | 2 - | 2 | 2 | ≈2.10 € | exact |
| Gebr. Fra... | 17928 | Zarte-Heringsfilets-in-Tomatencreme | 6x200 g | 6 + | 6 | 6 | ≈12.36 € | exact |
| Gebr. Fra... | 20185 | Passata,pürierte-Tomaten | 6x680 g | 6 + | 6 | 6 | ≈7.56 € | exact |
| Gebr. Fra... | 20180 | Tomatenmark,200g | 6x200 g | 12 + | 12 | 12 | ≈10.17 € | modified |
| Gebr. Fra... | 23100 | Sesamöl,0,5l,Ecocert | 6x0,5 l | 6 + | 6 | 0 | ≈20.97 € | exact |
| Gebr. Fra... | 24202 | Delikatess-Mayonaise,80%Fett,mit.EI | 6x250 ml | 6 + | 6 | 6 | ≈11.02 € | exact |
| Gebr. Fra... | 25052 | Dinkelstangen | 9x125 g | 9 + | 9 | 9 | ≈12.08 € | exact |
| Gebr. Fra... | 25100 | Kartoffel-Chips,mit-Salz,natur | 8x125 g | 8 + | 8 | 8 | ≈14.03 € | exact |
| Gebr. Fra... | 27156 | Mini-Schoko-Kekse | 6x125 g | 6 + | 6 | 6 | ≈8.83 € | exact |
| Gebr. Fra... | 37032 | Ananassaft | 6x0,7 l | 12 + | 12 | 12 | ≈32.91 € | exact |
| Gebr. Fra... | 37120 | Traubensaft,rot,0,7l | 6x0,7 l | 6 + | 6 | 6 | ≈12.29 € | exact |
| Gebr. Fra... | 37307 | Apfel-Mango-Saft | 6x0,7 l | 6 + | 6 | 12 | ≈11.16 € | exact |
| Gebr. Fra... | 37417 | Guave-Aloe-Vera-Drink | 6x0,7 l | 6 + | 6 | 6 | ≈12.43 € | exact |
| Gebr. Fra... | 37380 | Tropen-Reigen(Multi) | 6x0,75 l | 6 + | 6 | 6 | ≈12.43 € | exact |
| Gebr. Fra... | 28027 | Bourbon-Vanillepulver,10g | 6x10 g | 2 - | 2 | 0 | ≈7.27 € | exact |
| Gebr. Fra... | 20095 | Demeter-Zuckermais | 6x370 ml | 3 - | 2 | 2 | ≈5.37 € | modified |
| Gebr. Fra... | 27625 | Nuss-Nougat-Waffel | 24x1 St | 10 - | 10 | 10 | ≈5.06 € | no |
| Gebr. Fra... | 37230 | Pfand Voelker PET | 6x0,7 l | 24 - | 24 | 36 | ≈12.25 € | exact |

Total amount ≈591.63 €

Figure 2. Example for the Ordering of a User with the Additional Information Whether the Bundle is Completed or Not at this Moment (Translated)

For the ordering coordinator the first step is to consider the order as if all requests could be met. Then an algorithm computes which bundles are not completed. In this case the additional request information ‘at least’ and ‘at most’ has to be considered. Afterwards the coordinator can fit the requests of incomplete bundles and modify the ordering of the users.

Figure 3 shows the worksheet for the coordinator. Incomplete bundles are marked with ‘**?’**’ which means the user requests have to be modified.

When all bundles are completed, the order can be extracted and sent to the wholesaler.

Delivery and Distribution

When the products have been delivered by the supplier to a central point, they have to be distributed. The application prints out a list of every article and how they have to be divided among the users. To avoid unnecessary transportation the users locations and their requested articles can be grouped by the software. The community members can also use the comment system to exchange information about the distribution and, for example, to arrange car-sharing.

Also if something has to be cleared up after delivery, the information system can be used. If for example one user realizes that the ordered yogi-tea is not to his taste, he can search another purchaser in the community.

The screenshot shows a software window titled 'Komplettbestellung' with a 'Details' tab selected. It features a control panel with 'Product Groups' (set to 'Bestellte Artikel'), 'Supplier' (Gebr. Franz GmbH), and 'Deadline' (01.03.2002). Action buttons include 'Copy Requests', 'Compute bundles', and 'Send Data'. The main area is a table with the following columns: Art.-Nr., Art-Bezeichnung, Gebin..., Bestel..., AS soll, AS ist, AW soll, AW ist, BB soll, BB ist, CEV s..., CEV ist, ES soll, ES ist, GP. The table lists 182 items, including products like Marzipaneier, Zuckerrübensirup, and various herbs. A status bar at the bottom indicates '182 Artikel bearbeitet, 177 Bestellungen eingetragen, 5 Bestellungen noch offen'.

| Art.-Nr. | Art-Bezeichnung | Gebin... | Bestel... | AS soll | AS ist | AW soll | AW ist | BB soll | BB ist | CEV s... | CEV ist | ES soll | ES ist | GP |
|----------|------------------------------------|-----------|-----------|---------|--------|---------|--------|---------|--------|----------|---------|---------|--------|----|
| 11850 | Marzipaneier,verpackt-in-Goldfolie | 16x40 g | 1 | | | | | | | | | | | |
| 11862 | Teighasen-Zartbitter,milchfrei!! | 8x1 St | 1 | | | | | | | | | | | |
| 12115 | Zuckerrübensirup,450g | 12x45... | 0 | | | | | | | | | 4 - | 0 | |
| 14182 | Frucht-Pur,?Aprikose? | 6x250 g | 1 | | | | | | | | | 6 - | 6 | |
| 14196 | Frucht-Pur?Mango? | 6x250 g | 0 | | | | | | | | | | | |
| 14280 | Carob-Creme,EKO | 12x35... | 0 | | | | | | | | | | | |
| 14415 | Samba(Jumbo),750g,Schoko-Has... | 6x750 g | 2 | | | | | 3 + | 3 | | | 3 - | 3 | |
| 15040 | Scharfe-Schote | 12x12... | 1 | 2 - | 2 | | | | | | | | | |
| 15050 | Hausmacher | 12x12... | 0 | | | | | | | | | | | |
| 15096 | Nusspaprika,250g | 6x250 g | 1 | | | | | 2 + | 2 | | | | | |
| 15592 | Nuss-Paprika-Aufstrich,125g | 6x125 g | 1 | 2 - | 2 | | | 0 + | 0 | | | 6 - | 4 | |
| 15605 | Curry-Ananas,mit-Tofu,200g,GRO... | 6x200 g | 1 | 6 - | 6 | | | | | | | | | |
| 16220 | Basilikum,gerebelt,AIAB | 5x20 g | 1 | | | | | | | 2 - | 2 | | | |
| 16330 | Majoran,gereb.Biocultura | 5x20 g | 0 | | | | | | | | | | | |
| 16360 | Oregano,gerebelt | 5x20 g | 0 | | | | | | | | | | | |
| 16370 | Paprika,edelsüß | 5x50 g | 0 | | | | | | | | | | | |
| 16400 | Pfeffer,schwarz,ganz | 5x50 g | ***?? | | | | | 3 + | 4 | | | 2 - | 2 | |
| 16440 | Thymian,kbA | 5x30 g | 1 | | | | | | | 5 - | 4 | | | |
| 16520 | Curry-Pulver,extra,Nachfüllbeutel | 5x50 g | 0 | | | | | | | | | | | |
| 17005 | Herbamare-Nachfüllbeutel,500g,B... | 6x500 g | 1 | | | | | | | | | | | |
| 17014 | Kelpamare,85ml,flüssige-Pflanze... | 12x85 ... | 0 | | | | | | | | | 4 - | 0 | |
| 17015 | Kelpamare,500ml,flüssige-Pflanz... | 6x500 ... | 0 | | | | | | | 1 - | 0 | | | |
| 17093 | Kräuter-Senf | 6x125 g | 1 | | | | | | | | | | | |
| 17099 | Feuer-Senf | 6x125 g | 1 | | | | | | | | | | | |
| 17134 | Kalamata-Oliven,in-Lake | 6x330 g | 1 | | | | | | | 3 + | 3 | 3 - | 3 | |
| 17136 | Maraki-Oliven(grün),Kräutern... | 6x220 g | 1 | | | | | 2 | 2 | | | | | |

Figure 3. Worksheet for the Coordinator. It Gives an Overview of All Requests (Translated)

Technical Implementation

The whole distributed application is implemented in Java and uses a relational database to store the data. In order to give the client computers more flexibility, we decided to set up a stand-alone application, supported by Java-Servlets on the server side. In addition, it is possible to store data on the clients locally: We use the serialized Java-Classes to store all data, so the requests can be made offline. After that only a short connection to the internet is necessary to upload the information. The additional advantage here is to reduce net loads, which is of increasing importance with regard to environmental impacts, especially in power consumption (Bartel et al. 2001; Hilty and Gilgen 2001).

Conclusions and Outlook

The implemented system has been working since 2001 with a group of about 20 users. Since the ordering is now much easier than with the printed catalogue, the number of people from the region interested in purchasing organic food within the community is increasing. But we made also the experience that it is useful when the participants know each other face-to-face. For example comments on products are more freely then. Another interesting possibility is the use of the e-Food-Coop application in small health food stores, which don't have a complete ERP-System.

Since the PEP mentioned in section 2.1 bases on three parts (an electronic catalogue, a (virtual) community and a customized interface for the users) we have especially in the customizing part possibilities to improve the information system. Taste

preferences and family specific needs can be saved. Also advanced tools to communicate beyond comments (e.g. BBS, Chat) are useful and can be integrated.

Our current research focuses on two topics:

First we want to upgrade the application to support a green box scheme with weekly delivered food. This logistic system then can be extended to help community members to exchange or loan member-owned goods (e.g. hand workshop tools) with the aim of a local exchange trading system (LETS, see for example Hoffmann 1998).

Second topic is the question of regional mobility. As one central goal of the decentralized eco-village group is to save and to share resources, also transport resources should be economised. Here we need an information system that combines public transport like rail and bus with informal possibilities offered by the community members. Again, customer cooperation is necessary, because points of time and meeting places have to be coordinated.

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