INTERNET BASED SURVEY AS I/O SUPPORT IN PROCESS APPROACHED QMS OF FOOD/AGRO INDUSTRIES

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The ISO 9001:2000 standards encourage the adoption of the process approach for the management of organizations and their processes.
Using our quality audit experiences, several Internet questionnaires have been created to identify and support the most important I/O elements in a process approached QMS in different fields of the food/agro industries. Evaluating the Internet answers, we found some interesting properties of meat and fresh fruit/vegetable (FFV) consumption. In our Internet based QM research we have focused on these two special fields.

Keywords: quality management, meat and fresh fruit/vegetable consumption, internet CGI-forms

Introduction

Any activity that receives inputs and convert them to outputs can be considered as a process. The goal of a Quality Management System is to explore and to satisfy customers' requirements at the highest level, developing and using a policy that ensures the goal of real time satisfaction [1,3].

The new ISO 900X:2000 standard family uses the term "quality control" instead of the category "quality assurance" and a process approach of QMS (Quality Management System) whose most important input/output element is customer requirements and satisfaction.

In one of our earlier papers [4] we discussed Internet vs. paper-based replies to questionnaires surveying the rates of food consumption in different areas of food market. Comparing these types of replies we found an interesting, but – in view of the number of answers – insignificant difference between the two groups in FFV consumption and in meat consumption. This fact inspired our workgroup to create newer questionnaires on these topics, and to develop new software that makes it easy to evaluate both Internet based and Hardcopy answers.

The QM process model and the model of customers' habits

The ISO 9001:2000 standard helps on one hand the top management to be increasingly successful if they pay attention to their customers' requirements. On the other hand if the organisations use this standard they will come closer to the TQM, which is the last step in the quality control process [2].

In addition to the input/output elements there is another very important part of the process model: the product service. This can help customers in case they have any problems or questions regarding a product or service. And this information could help the consumers in their decisions. In the model on *Fig.1*, one can see the three factors, which influence consumers.

The *Fig.1* describes a decision process that consists of the following three factors:

- Property of food attributes – it contains physiological influences.
- Personal factors – biological, psychological and social impressions.
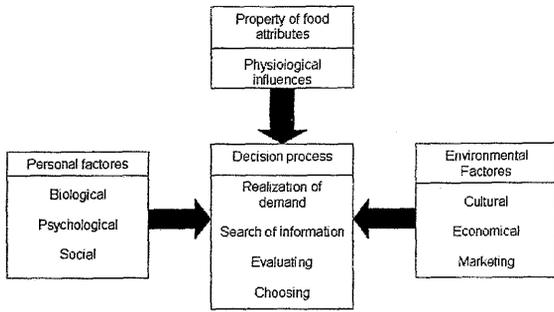
Fig.1 Customer habit's model

Fig.2 Internet data collection using email

Fig.3 The main steps of processing email answers

- Environmental factors – cultural, economical and marketing impressions.

All of these factors have impressions on all customers when they realize their demands. They collect information about the product or service and then – by their own opinion – they choose the best. That's why organisations should offer as much information as possible e.g. in forms of advertisements.

Using our quality auditing experiences, we have created several Internet based questionnaire forms to identify and to investigate customer requirements, satisfaction and preferences [7]. Evaluating the replies to the Web-forms and to the control group consisting of Hardcopy answers [4] we have found an interesting difference between the groups with respect to the meat and FFV consumption. Considering this fact we have decided to investigate deeper these fields, and we have created three new Internet-forms to be found at the following Web sites:

http://knight.kit.bme.hu/bea,
http://knight.kit.bme.hu/rita

On the first and second questionnaires we have investigated the FFV producers, market and consumption. The questions covered properties of fruits and vegetables grown in Hungary, which are influenced by postharvest activities and procedures. In the last ten years the number of hyper- and supermarkets in Hungary have been increasing. They offer goods at low prices, which are welcome to the customers, but their quality is not as good as the price. That's why we investigated price, quality and customer service of distribution centres.

On the third Internet form we attempted to get information about Hungarian meat consumption. Earlier surveys show that most of the Hungarians consume meat everyday. In the last years, however some problems have aroused (e.g. BSE, foot and mouth disease) and healthy nutrition has also become more and more important in our lives. For this we wanted to gather more details of the "new" Hungarian meat consumption habits.
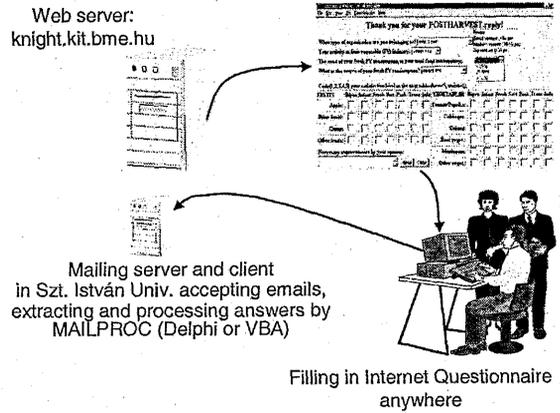
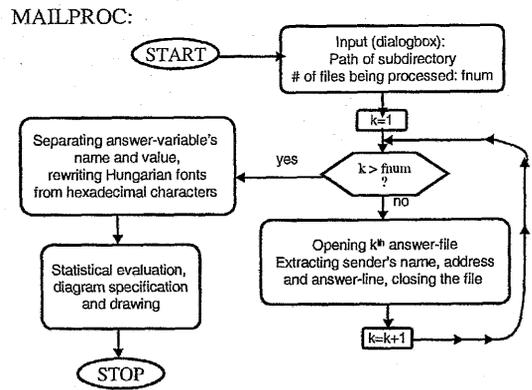## The structure of Internet data collection and evaluation

In our first Internet questionnaires we used forms posting the answers in email. Although the evaluation of emailed answers is more complicated than the evaluation of forms sending answers to a CGI program, at first we decided to use email answers. The plain reason for this being that it is not easy to get farmers and housewives to use the Internet (or a PC questionnaire at all). In several cases they do not have full Internet connections, at most they are familiar with emailing. They usually have only email connections to the Internet. The html files of the Web-forms generating email replies can be sent to users via email, then it is possible for the users to fill out the forms offline. The completed questionnaire is then saved in the outbox folder, to be automatically sent back at the next dialup connection to the Internet.

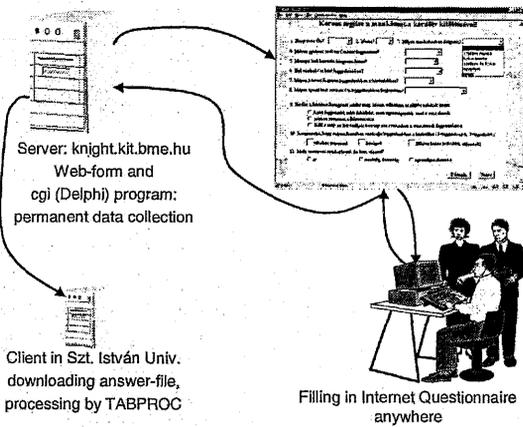The process flow of this kind of data collection and email processing is shown on *Figs.2* and *3*:

Fig.4 Internet data collection using CGI program

Fig.6 QD file generated from a Web-Form

Fig.5 Steps of processing CGI program-collected answers

Fig.7 Source of FFV consumption

Fig.8 Qualification of information system in distribution centres

We tried to find the food customers, who could use this type-1 questionnaire, but in several fields the number of answers was not enough for proper statistical evaluation. At this point we decided to create a CGI program on our server. Type-2 questionnaires were created to utilise the CGI script.

The process flow of this type of data collection and evaluation is shown on *Figs.4 and 5*.

As one can see on *Figs.2* and *4* or on *Figs.3* and *5*, there are no big theoretical differences between type-1 and type-2 questionnaires and their processing programs. The difficulty in type-1 is the collection and separation of email messages; in type-2 on the other hand we have to generate a questionnaire description (QD) file before running the processing software. Some parts of this QD description file is shown on *Fig.6* comparing with the corresponding parts of the HTML file.

When the QD file is generated from the HTML source, we have the possibility not only to collect Internet answers, but also to collect the Hardcopy answers in a separated, but very similar file.
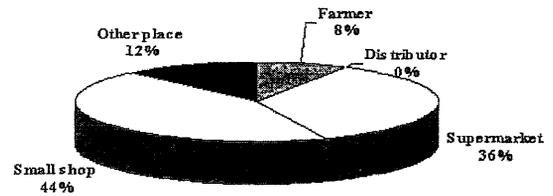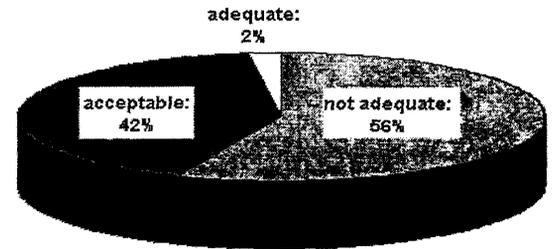
Evaluation of FFV consumption data

From our FFV project we show here the evaluation-graphs of extreme qualifications, as well as the answers about the most important Hungarian FFV areas with respect to produced quantities in Hungary or Hungarian customers' habits.

On *Figs.7-9* we show some results of our first Web-based questionnaires. 44 % of responders said they had bought FFV in small shops and 36 % of them in hypermarkets/supermarkets.

Fig.8 gives information about the preferred distribution centres – in this question we wanted to know if the participants were satisfied with the information system of the chosen distribution centre or not.

Unfortunately most responders said that the amount and quality of the information had not been adequate (56 %) and only 2 % of them said that it had been
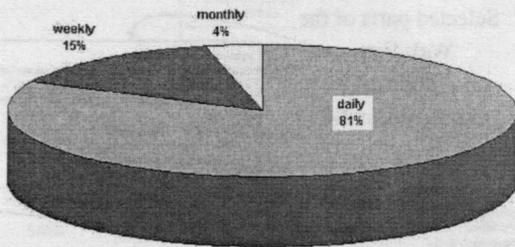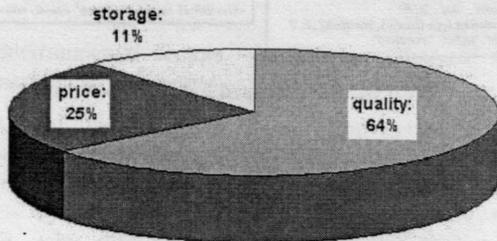
Fig.9 Frequency of FFV consumption
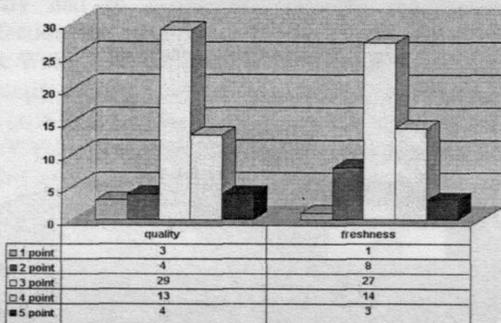

Fig.10 Most important factor at buying

	quality	freshness
1 point	3	1
2 point	4	8
3 point	29	27
4 point	13	14
5 point	4	3

Fig.11 Qualification of FV freshness and quality at distribution centres

	1 point	2 point	3 point	4 point	5 point
ripeness	0	0	10	33	15
wholeness	0	6	23	21	8
freshness	0	1	22	23	12
selected	0	13	25	12	8
packing	7	19	21	7	4
information	17	13	18	7	3

Fig.12 Qualification of apple

	1 point	2 point	3 point	4 point	5 point
ripeness	2	3	19	23	10
wholeness	0	0	15	32	10
freshness	0	3	19	29	6
selected	0	6	19	22	10
packing	2	10	14	21	10
information	10	17	16	14	0

Fig.13 Qualification of citrus

adequate. These participants do their shopping in market places where they can get references about FV from the farmers.

Fig.9 shows that most Hungarian people eat FFV daily. This is a very good rate as this means that we try to live healthier, but we have seen many of them do not have enough information about usage of these products.

Lack of usage instructions is the first problem but as we can see in the Fig.10, most responders answered to the question concerning the purchase influencing factors, that the price was less important than quality.

It's well known, that Hungarian people demand quality but as Fig.11 shows, the qualification of freshness and quality is not enough to satisfy the customers.

Fig.12 summarizes the qualification of apple. Apple is one of the most popular fruits in Hungary. Customers can buy it in every season, and Hungarian apple production is considerable in Europe, too.

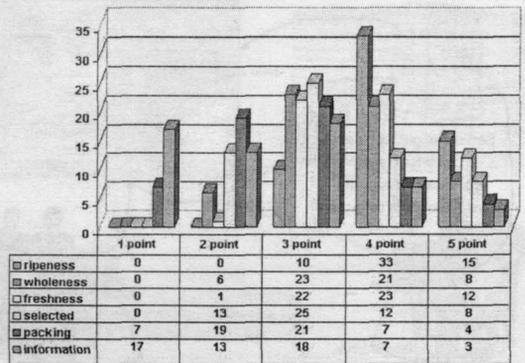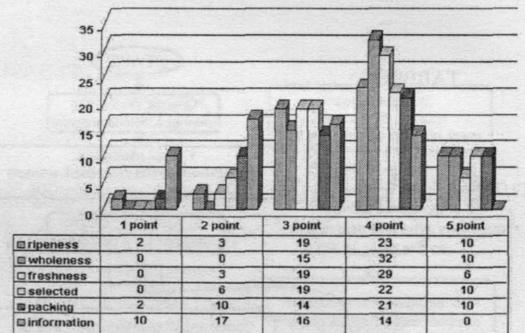Figs.11-12 show the many problems among the preferred and qualified properties of FFV very well. We have investigated the same problems – with similar results – for other fruits and vegetables: stone fruits, citrus, tomato, paprika, cabbage, onion, root vegetables and mushrooms. From the FFV investigation we will now discuss the results concerning the citrus group (Fig.13).

As our climate is not appropriate to grow citrus fruits, the properties of the imported citrus are satisfactory quite on every level. The lack of customers' information is the only problem in this field.

Evaluation of meat consumption data

Meat consumption patterns vary widely with the economic conditions and cultural or religious backgrounds of different regions. Increasing fraction of the younger generation cannot cook, so they need the semi prepared products. Among others, this is the reason for the increasing demand for the deep frozen products and the sliced cold meat in Hungary. Another factor is, that customers prefer white meat to red one, because of health considerations [5,6].

Since the first signs of the BSE crisis turkey consumption has grown especially: experiments in Germany have shown an increase of 8,6 %. In the first part of year 2001 it has reached 16 %. This increase is also valid for the fresh and deep-frozen products. The prices have also been growing, because the supply was
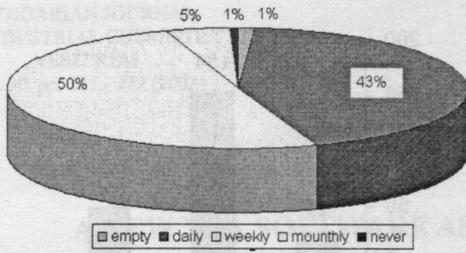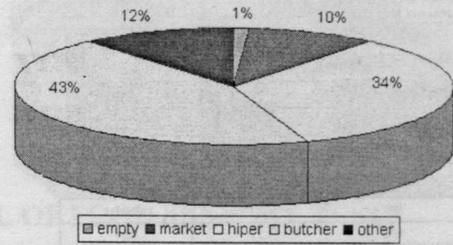
Fig.14 The meat consumption patterns in Hungary

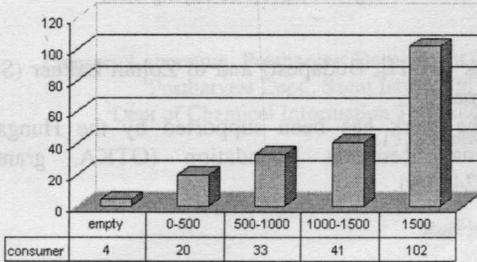Fig.16 Meat production purchase in Hungary

Fig.15 Form of bought meat

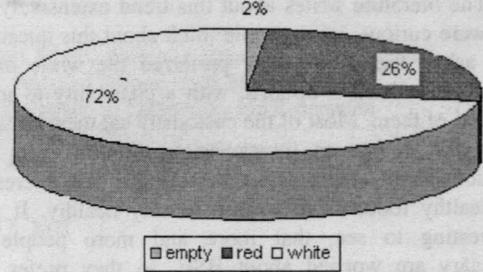|	empty	0-500	500-1000	1000-1500	1500
consumer	4	20	33	41	102

Fig.17 The meat consumption patterns in Hungary

not able to keep pace with the demand. Even after expanding the livestock the prices seem to stay at this higher level. In July of 2001 turkey costed 17 % higher, than in the previous year. Furthermore in the last few years there were some epidemics (BSE, foot and mouth disease) in Western Europe. Customers are frightened, because the meat could be infected, so they prefer the product from their own country. The most important aspect for them is the safety.

To understand the structure of the meat consumption patterns in Hungary, a type-2 Internet based survey was applied. The online forms consisted of simple, multiple-choice questions and text fields. The first part of the questionnaire included questions regarding to the demographic backgrounds of the subject, for example gender, age etc... In the second part we asked the consumers about their meat consumption habits. In the following section we summarise the statistical evaluation of over 200 replies to this survey.

Fig.14 shows, that amongst the people replied, only a small percentage (1 %) is vegetarian. 50 percent consumes meat every week, and also a big fraction (43 %) of them has meat daily. The reason for these is that in Hungary the healthy way of living is not yet usual. The other reason could be, that meat consumption belongs to the traditional Hungarian lifestyle.

The next question was, how much money would be spent monthly for meat (Fig.15). More than half of the returned answers suggested, that over 1500 HUF were spent for meat products. It was an interesting experience to see, that mostly the retired have spent below 500 HUF. This is in connection with their lower incomes.

Fig.16 shows, where the meat products are purchased. 43 % get the meat from the butcher, which is possibly the best way, because you can always get meat of highest quality.

In Hungary the hypermarkets and supermarkets are also gaining ground. That is why 34 % goes to hypermarkets, when they need these products. The growing needs and the increasing work time require faster shopping. These hypermarkets have the sale strategy to sell as much as possible, so they have long opening hours, or they are open 24 hours a day, seven days a week (sometimes non-stop). They keep the largest product variety, and because of the huge amounts, the prices can be lower. They can afford regular sales, which is also preferable for the customers. It is a weekend family program, too, you can find there something interesting, no matter, how old you are. Market is also a beloved place to get meat products. Especially retired people and housewives go there, where they have time to look for the highest quality at the lowest price. They are those people, who would travel across the city, to save some coins on a pound of meat. 12 % belongs to the other group, who shop at small shops, or they raise their animals.

Fig.17 shows a clear trend in the ratio of red and white meat consumption, in favour of the latter. This can be the result of both the recent health crisis (foot and mouth, BSE, etc.), and the growing number of health conscious consumers.

The BSE, or Bovine Spongiforme Encephalopathie is an infection of the cattle. The whole nerve-system is destroyed, and the animal dies. It takes about 5 years from the infection to the first visible sign. Cattle catch this disease with the feed, which contains flour made from animal meat or bones. The first BSE crisis started in year 2000. At that time the price of beef fell. But afterwards the prices were raised again, because in the Netherlands there was foot and mouth disease, so there was a shortage of beef.
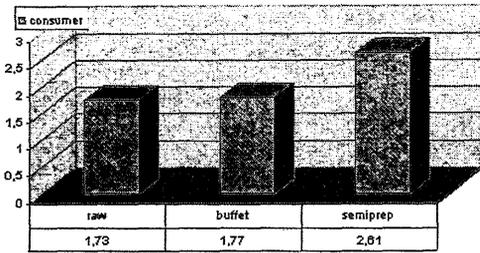
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Fig.18 Form of bought meat

Fig.19 Aspects of buying meat

The literature writes about this trend extensively, so we were curious, what people think about this question. We asked them, why they preferred the white meat. They were listed 3 options, with a possibility to mark several of them. Most of the customers eat meat because they like it, but an increasing fraction of them are cautious about what they eat, because they are interested in healthy food, as they want to stay healthy. It was interesting to see, that more and more people in Hungary are worried about BSE, so they prefer the white meat.

The next question was, in which form they eat the meat. They had to mark, whether they eat it row, semi prepared or buffet *(Fig.18)*. We can see a trend, because earlier the raw meat was very popular, and now it is at third place. The people work a lot, they have less time for cooking, so they prefer the semi prepared meat, because it is much easier to prepare, this way they can save time.

The last question was, about the most important aspect of buying meat. This was also a multiple-choice. It was very interesting to see, that the quality is much more important, than price *(Fig.19)*. Because of the diseases in the last few years, everybody is looking for safe food.

Conclusions

Using our audit experiences in food/agro industries and the literature data, we developed effective Internet questionnaires to identify the FFV and meat consumption patterns and customers' requirements in Hungary. Two types of Web Forms were created to collect the replies; both types contain several questionnaires each having its special application area. For the statistical analysis of the replies we developed the corresponding software in Delphi and in VBA. Applying our different Web Forms the number of replies was between 50 and 300.

Acknowledgements

SYMBOLS

BSE   Bovine Spongiforme Enzephalopathie
CGI   Common Gateway Interface
FFV   Fresh Fruit and Vegetable
ICA   Internet Collected Answers
I/O   Input/Output
QM   Quality Management
QMS   Quality Management System
SC   Shopping Centre
QD   Questionnaire Description
VBA   Visual Basic for Application

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