COMPUTER QUALITY MANAGEMENT SUPPORT
ON A FARM – CASE STUDY

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The article presents a computer-aided tool for quality management support, on the example of a farm involved in breeding cattle. The motivation for a tool to support farm management was the need to standardize the documentation including different types of records, discrepancies and to facilitate the archiving process. The project was developed in an Excel spreadsheet, with the principle of the most user-friendly interface between the user and the used support tool. The advantage of the project is the possibility to use it analogically in other farming industries, and the possibility of tool expansion, possible by adding modules depending on particular requirements of the farmer. The main reason to address the issue presented in the article is the lack of applicable IT solutions that would support farmers in farm management, and the willingness to show that a huge step may be done easily, as regards improvement in work, raising its quality and time-saving.

Keywords: management, system, quality, IT support, agriculture, documentation

1. Introduction

The accession of Poland to the European Union allowed Polish farming industry to successfully compete with the farming of the Western countries. Area subsidies to agricultural land, along with numerous funds, support the development of farming, providing opportunities for production increase, investment in modern machinery or increasing profitability. Along with these chances, however,

appropriate requirements occur for the farmers to keep proper documentation. Official controls cause a lot of trouble to farmers, which in turn makes them unwilling to keep proper records due to possible penalties or sanctions imposed for errors in the documents. The core of the problem may lie in the fact that in the past, on many farms, no detailed documentation was filled, therefore the present requirements are something new and unknown to the farmers. The solution in this area might be simple IT applications, elements of information systems. Enterprises functioning on the market have always had more or less developed information systems. Today, however, thanks to the development of information technology and in relation to the existing market situation, information systems are more complex. By providing selected and relevant information, they are crucial to the success of the organization. It is thanks to the technological development that one may observe the growing consolidation of information- and IT systems. Even if today the differences between them seem relatively noticeable, in future they are not going to be so obvious. However, one should remember that even most developed information systems are only tools in the hands of people, designed to gather information supposed to facilitate efficient management of a business entity.

2. Characteristics and analysis of documentation in the entity being the subject of the case study

The farm that is the subject of the analysis and the project is located in the Lodz region. Its size is about 40 ha of arable land of class 3, 4 and 5 and about 6 ha of meadows. The farm is run by two persons and involved in rearing cattle for meat and dairy, beef cattle, and the cultivation of plants that at a later stage serve for animal feed. The growth at the moment is 42 head of cattle of which 15 units are dairy cows, 12 bulls of above 1 year of age, 10 calves younger than 1 year of age and 5 heifers of less than 2 years of age. The plants cultivated are: wheat, triticale, oats, barley and corn, both in silage and grain.

The documentation of the farm is completed and archived in paper form. This causes certain difficulty with proper classification of documents, as well as problems with finding them easily later. Despite the fact that the documentation is stored in one place and marked appropriately, this manner of archiving is not the most lucky choice, as the documents may be permanently damaged or lost this way. Most of these documents has been designed by the Agency for Restructuring and Modernization of Agriculture (Agencja Rozwoju i Restrukturyzacji Rolnictwa, ARMiR), therefore it is important that the completed documents were aesthetic and with no errors. Due to the possibility of inspection, the records must be carried out systematically.

The basic inventory of the documentation on the farm includes:
- Cattle Herd Book of Registration,
- cattle passports,
- responses to the application to allocate a pool of numbers for cattle.

The main document on the farm, under special supervision, is the Cattle Herd Book of Registration (Polish acronym: KRSB), which was developed by ARMiR and contains data on all head of cattle currently in the herd.

The owner of the animal is obliged to complete the KRSB with information on the cattle owned, as well as update the data continuously (within 7 days from the event). KRSB is filled in block letters. Chronological order and sequence numbering must be maintained. One page is designed for 12 animals. The title page contains the name of the owner of the animal, the address and number of the farm, as well as the address and number of the place where the herd is housed. The following pages contain information on the animals, where in appropriately designed columns, one should provide:
- the ordinal number of the animal in the book,
- the full identification number of the animal,
- day, month and year of birth,
- day, month and year of inclusion in the herd (does not apply to animals born in the herd),
- the code of event that caused the animal's arrival to the herd, as well as data on the animal's origin (in case of purchase of the animal, one should enter the name, surname and address of the previous owner, or the number of the dwelling of the herd from which the animal came; if the animal was born in the herd for which KRSB is run, it is enough to enter the code "U", meaning birth (from Polish "urodzenie").
- 'XX" for females, "XY" for males; additionally, for cows, the date of their first calving, while for bulls – the castration date,
- the letter code of the breed,
- the identification number of the mother of the animal,
- date, month and year of the diminution from the herd,
- the code of the event that caused the diminution of the herd by this one animal,
- the data about the place where the animal was passed on, i.e. the name, surname or proper name, address and number of the dwelling of the herd, the number of the slaughterhouse or the rendering plant.

Additionally, in KRSB there are event codes and a list of letter codes to indicate the breed of cattle.

Apart from the documents mentioned above, the following forms are completed on a farm:
- application for registration of cattle,
- notification on cattle movement,
- notification of death,
- application for duplicates of tags,
- application to allocate a pool of numbers for cattle.

3. The project of computer support on a farm

3.1. Description of the tool

The analysis of the farm in question showed that it causes big problems to a farmer to fill in or archive the documentation. Therefore, an authoring tool was designed, with the use of a Microsoft Excel spreadsheet, containing the registry of the cattle on the farm. The registry is supposed to help the owner run documentation related to the animals. Besides, it allows the farmer to look at each animal individually. The advantage of the registry is its simplicity and clarity, thanks to which the tool may be used by a person with very basic computer skills. The tool consists of five tabs, including:
- Registration of Cattle,
- Animal Welfare,
- Rotation in the Herd,
- Animal Feed,
- Documentation.

In the "*Registration of Cattle*" sheet, there is a list of all animals on the farm. The columns of this list include:
- the location of the animal (the cowshed number),
- tag number,
- birth date,
- age,
- sex,
- breed,
- the number of mother's tag,
- technological group,
- insemination date,
- calving date.

The *"Location"* column in the register of cattle refers to the three buildings on the premises of the farm. It is Cowshed no 1, Cowshed no. 2 and Cowshed no.3. The owner has the possibility to choose given location for every item from the

dropdown list. *"Tag Number"* is the individual animal number, consisting of 14 characters. The first two positions are the country of the animal's origin, the next two characters are the numbers of the tag series, while the last character is the control number. The tag number for an animal is received from ARMiR after filing appropriate application for cattle ear tags. In the *"Birth Date"* column, the user puts the date of birth of a given item. The age of the animal is automatically calculated and returned in *the "Age (Month)"* column. The person working on the tool, enters the sex of the animal in the *"Sex"* column, using XX or XY. The *"Breed"* column refers to the breed of the animal. In the cells of this column, the name of the breed is assigned to a unique letter code of each breed of cattle. The letter codes for breed that are used in this tool, are accepted by ARMiR. In this case, the choice of the breed is made from the drop-down list. The letter codes of every breed, together with their explanations, are placed in a commentary placed in the *"Breed"* cell. To show the comment, one needs to click the *"Breed"* cell and move the cursor in the right top corner of the cell. Figure 1 presents the letter codes for the breed of cattle.

Figure 1. Letter codes for cattle breed, along with their full names,
in the commentary of the *"Breed"* cell

In the *"Number of Mother's Tag"*, the user provides the number of the tag of the mother to a given item of cattle. Despite the fact that currently the farm owners do not have the obligation to provide the number of the tag worn by the father of the animals that have been bred, works are being carried out at present to implement such requirement. Therefore, for easier use of the registry in the future,

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the created tool contains the column "*Father's Tag Number*" (currently hidden). Thanks to the use of particular Microsoft Excel functions, the cells in the column "*Technological Group*" are filled automatically, on the completion of the previous fields. The symbol of the technological group consists of a two-letter code. In the farm under discussion, there are five technological groups of animals. These are (with their respective acronyms in Polish):
- Dairy Cows - KM;
- Dry Cows – KZ;
- Beef Cattle – BO;
- Youths – M;
- Heifers – J.

Every technological group has a different composition of the feed ascribed to it, given to animals from a particular group. The list of letter codes of technological groups, together with the legend, is placed in a commentary for the "*Technological Group*" cell. Displaying the commentary is done in a way as in case of the commentary in the "*Breed*" cell. The "*Date of Insemination*" column refers only to the dairy cows, dry cows and heifers over 14 months of age, as this is the age when heifers are inseminated for the first time. The user, provides the insemination date in this column. The cells of the "*Calving Date*", the birth date is returned automatically, with consideration top the fact that pregnancy in cows lasts about 280 days. These cells refer to the same technological groups as the cells of "insemination date" column. After using particular functions, the tool automatically changes the technological group and the kind of feed taken by the cow, in the "*Technological Group*" cells from KM (dairy cow) to KZ (dry cow), two months before planned calving.

Another sheet in the Excel sheet: "Animal *Welfare*" contains a list with the history of animals' diseases, vet visits or any other possible remarks regarding any dealings with the animals during treatment. In the "*Tag Number*" column, the user selects from the number of the animal's tag from the drop-down list. The number of items in the drop-down list is dependent on the animals entered in the "*Registration of Cattle*". The cells in "*Age*" and "*Technological Group*" columns are filled automatically. The tool takes these data from "*Registration of Cattle*" and returns it in respective cells. In the cell of the "*Disease*" column and "*Vet Visit Date*", the user enters the name of the disease or condition diagnosed by the vet and the date of their visit on the farm. The "*Observations*" column contains information useful to the user. The information there may regard the way of dealing with a sick animal, medicines used, the date of subsequent visit of the vet, or the date of recovery of the given item of cattle.

The third Excel file sheet "*Herd Rotation*" contains all information concerning the rotation of the cattle herd on the farm. This information regards purchase, sales and diminution of animals. The headers of this list include:
- tag number,
- birth date,
- arrival/Leaving date,
- event,
- origin/destination.

The choice in the cells of the *"Tag Number"* column is done by means of a drop-down list form the *"Registration of Cattle"* sheet. The proceedings are analogical to those in the column of the same name in the *"Animal Welfare"* sheet. The cells in the *"Birth Date"* column are filled automatically, after picking a given number in the *"Tag Number"* column. Information on birth date is taken from *"Registration of Cattle"*. The dates in *"Arrival/Leaving Date"* are the dates when a given animal joined or left the herd. The cells in the *"Event"* column are filled with the choice of a given event from the drop-down list. The index of possible events accessible in the drop-down list includes purchase, sales, sales for slaughter, death. In the cells of the *"Origin/Destination"* column, the user provides information of the origin or destination of the animals, depending on what event took place in a given case. The origin of the animal, in case of a purchase of an item of cattle, is the number of the herd from which the animal came. In case of sales for slaughter or death of the animal, this field should include the number of herd to which the animal has been sold, the registration number of the slaughterhouse, or the establishment that received the carrion. This column includes a commentary making it easier for the user to choose particular origin or destination of the animal in the existing event.

The fourth sheet of the designed Excel file – *"Animal Nutrition"* contains two tables. One of them shows the daily portion of forage and roughage given to the animals from a particular technological group. Figure 2 shows the daily dose of feed for each technological group.

Rodzaj paszy	Dzienna dawka pasz treściwych (kg)		Dzienna dawka pasz objętościowych (kg)			
	Śruta zbożowa	Dodatki mineralno witaminowe	Kiszonka z kukurydzy	Sianokiszonka	Siano	Słoma
M (młodzież)	0,5	0,075	5	-	5	-
J (jałówki)	2	0,1	10	5	10	-
BO (bydło opasowe)	4	0,2	25	15	10	-
KM (krowy mleczne)	4	0,1	20	10	5	-
KZ (krowy zasuszone)	1	0,1	15	5	10	7,5

Figure 2. The table of daily feed dose, expressed in kilos, for a given group

The second table in *"Animal Nutrition"* is a pivot table. It shows, which particular items of cattle belong to a given technology group, along with their location and age. Thanks to the use of the sorting function, the table displays only

those tag numbers, which belong to a given technological group (KM, KZ, BO, J, M). Figure 3 shows an example of the use of the pivot table data sorting in *"Animal Nutrition"*.

Licznik z Nr kolczyka				Grupa technologiczna ▼
Nr kolczyka ▼	Lokalizacja ▼	Płeć ▼	Wiek (miesiąc) ▼	BO
PL005301225121	obora 3	XY	22	1
PL005301225138	obora 3	XY	22	1
PL005301225145	obora 3	XY	22	1
PL005301225176	obora 3	XY	19	1
PL005301225152	obora 3	XY	19	1
PL005301225169	obora 3	XY	19	1
PL005301225183	obora 3	XY	19	1
PL005301225234	obora 3	XY	16	1
PL005301225449	obora 3	XY	15	1
PL005301225481	obora 3	XY	14	1
PL005225315441	obora 3	XY	10	1
PL005225315458	obora 3	XY	10	1
Suma końcowa				12

Figure 3. Pivot table data sorting for the BO technological group

In the last file sheet, named *"Documentation"*, there are links to Microsoft Word files. At the moment, the section contains links to the instructions of milking and feeding, however the documentation may be extended at any time, by other helpful documents. To open a document of our choice, one should click the appropriate link. Figure 4 shows the list of documents of the *"Documentation"* sheet.

Lp.	Nazwa dokumentu	Odnośnik
1	Instrukcja udoju	INSTRUKCJA UDOJU.doc
2	Instrukcja żywienia	INSTRUKCJA ŻYWIENIA.doc

Figure 4. *"Documentation"*

The document "INSTRUCTION FOR MILKING" contains instructions on all activities performed during milking the cows. These activities are divided into three parts: Pre-Milking, Milking and Post-Milking activities. The "INSTRUCTION FOR FEEDING" document contains instructions regarding feeding the cattle on the farm under discussion. It contains a table with the feed doses, provided to each of the technological groups, along with the information on the sequence of feed distribution. These documents are particularly useful in situations when the owner needs to be replaced in their duties, e.g. due to illness, by the third party. Following these instructions will ensure the right milking and feeding of the animals, by giving the executed actions appropriate standard in these instructions, thus eliminating or minimizing any non-compliance that may arise.

3.2. Instructions of use for the tool

Entering the data into the registry may be done in two ways. The first one is entering data through a form. To open it, one should click on any cell in the list in *the "Register of Cattle"*, then choose *"Data"* and *"Form"* from the menu (Fig. 5).
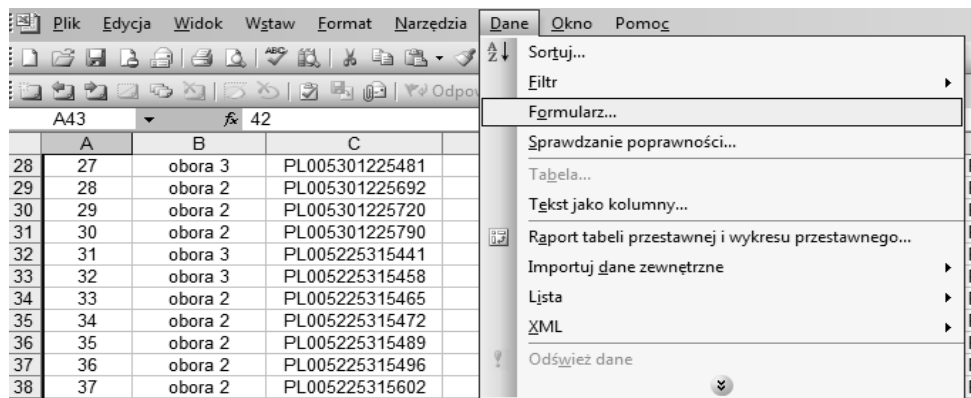

Figure 5. The choice of the form

After clicking on *Form*, a new dialog box will open. This form contains information on all records enlisted in the *"Registration of Cattle"* sheet.
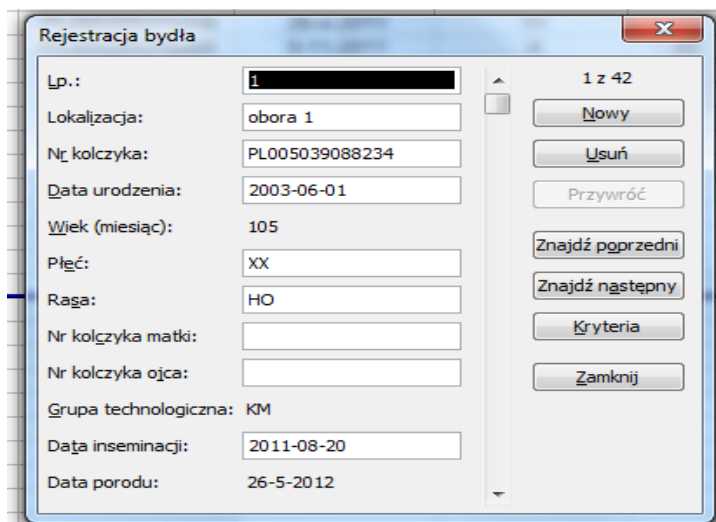

Figure 6. Form for "Registration of Cattle"

In order to add a new record, click *'New'* and fill in the appropriate fields (Fig. 7).

Figure 7. Filling a new record

After entering the data, click "*Close*", and the new record will be added to the list. The functions of the form also make it possible to delete the records from the list. In order to do that, one should choose the right record that is to be removed and click *"Delete"*.

The second way to enter data to the registry is by adding them directly to the list. To do this, choose the cell in the last record of the list and enter the data in respective cells. In "*Location*" and "*Breed*", the selection is done by choosing appropriate item from the drop-down list. Entering data in the "*Animal Welfare*" and "*Herd Rotation*" may also be done by these two ways and it is up to the tool user which method will be applied.

The designed tool also allows soring data in the registry. Thanks to this option, records corresponding to the user's current needs may be obtained easily. For example, in order to obtain only the records of female animals from the technological group M, in columns "*Sex*" and "*Technological Group*" one needs to click the button in the right bottom corner of the cell and choose appropriate sorting. Figure 8 presents a similar example.

Figure 8. Data sorted according to criteria: female sex, technological group M

Similarly, one may use sorting for other criteria. The list in the *"Animal Welfare"* and *"Herd Rotation"* sheets also contain the sorting option in each column.

4. Summary

The opportunity to use assistance provided by the European Community allows Polish agriculture farms to expand their production. This is also connected with keeping documentation, which, for many farm owners, is too big a challenge. So far, the documentation kept by the farmers was relatively narrow in scope, limited to collecting invoices and receipts, calculating gains and losses. After May 2004, every agricultural farm breeding animals has the obligation to run appropriate registries. In case of the farm under discussion, the most important document is the Book of Registration of Cattle Herds (Księga Rejestracji Stada Bydła). In most cases, farmers keep the documentation in paper form, which is a relatively obsolete method. Filling the documents in such way may lead to errors made while entering data. Archiving of paper documentation may be troublesome to a farmer, while bad storage may lead to its loss or damage. Also, it is cumbersome and time-consuming to search for information in paper documentation. Due to the above, it was decided to design a support tool for running the cattle herd registry on an agricultural farm. The application used for design of the above-mentioned tool was Microsoft Excel. The choice was motivated by high versatility of the program. Microsoft Excel is widely used in companies, institutions and by users at home. The biggest asset of this program is the ease of use and the possibility to store and process big amount of data. By applying respective mathematical, financial, statistical logical or information functions, as well as databases, working with the program is pleasant, while information obtained is easy to learn for almost every user. It's additional advantage is the popularity of Microsoft Office. Most computers, not only in company offices, but also private households, are equipped with this product. On the discussed farm, there is a computer with Microsoft Office, and so the designed tool supporting registration of cattle may be used by the owner without problems. The tool makes it easy to enter the data into the register, change them quickly if need be, and sort it without problems, according to the appointed criteria. The tool also performs information function for the persons who do not work permanently on the farm, and are employed only temporarily by the owner, to help in the periods where there is most work (e.g. harvest time). The user has the opportunity to trace the medical history or origins of every animal in the herd of cattle, and thus identify them. The application may be extended and changed depending on the needs in order to tailor the tool better to the actual conditions on the farm. It should be noted that the designed tool is applicable not only to the farm which was the

focus point during the design phase, as it may be very successfully used on other farms, after implementing appropriate changes. Also the problem of data archiving has been solved, as the applied tool takes little space on the hard drive of the computer, or portable disks (such as USB drive or CD), therefore one may also create several backup copies and no longer worry about the loss or damage of data, The user of the program also has the possibility to print either fragments or all needed information from the register.

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