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APPLICATION OF THE CAWI METHOD FOR THE HOLISTIC SUPPORT OF INNOVATION TRANSFER TO BUSINESS PRACTICE

Key words

Innovation transfer, surveys, marketing research, poll, CAWI.

Abstract

The article presents a method for the support of the transfer of innovative technologies to industry in which ICT systems for the realisation of remote interviews CAWI are used. The author discusses the formal aspects of the functioning of the CAWI method and presents an original survey system, which constitutes a part of the IT Platform designed at the Institute for Sustainable Technologies – National Research Institute (ITeE – PIB) in Radom, whose aim is to facilitate the operations of intermediary organisations in the knowledge transformation and technology transfer process. The structure of the solution, together with its functional properties and areas of application are shown. The author also compares and contrasts selected questionnaire methods in terms of their advantages and drawbacks so as to indicate the solution that would most effectively support the process of practical innovation dissemination. Additionally, the research and application problems identified in the course of author's investigations are discussed and the cutting-edge properties of the solution designed are indicated.

Introduction

Introducing new values and quality, innovations are of great importance to the civilizational progress. They are the results of human creativity and their application depends on many human factors as well (i.e. character of buyers or end users) [1]. According to P. Drucker, every idea, action or item that is new, i.e., distinct from any other already existing thing in terms of quality, is considered to be an innovation [2]. The transformation of knowledge into end products and market actions are characterised by a high level of risk and uncertainty [2]. An important role in the creation and practical implementation of innovations is thus played by R&D processes and the development of the information society, which together with the growing number and the improved innovativeness of enterprises, facilitate competitive growth of the national economy. Innovative enterprises are those enterprises in which innovative products were designed or implemented at the time of investigations [3]. On the other hand, a company cannot be called innovative when it is in the possession of a “high” technology and sells it to others but does not develop at the same time. The innovativeness of a venture can be boosted in such areas as products (manufactured material goods and services offered), technologies, business processes (internal and external), and marketing strategies and methods. Expectations of the entrepreneurs towards innovations vary and depend on the sector in which the venture operates in, company size, and the character of its activity. According to business people, innovations play the most important role in such areas as quality improvement, expansion to new markets, expansion of the offer, reduction in manufacture costs, and improvement of the production process, the reduction of the material usage, environment protection, the introduction of new products, the reduction of energy consumption, and compliance with legal regulations and standards [4]. The main source of industrial innovations are, *inter alia*, in-house scientific investigations and research conducted at research organisations, and patents. Therefore, the transfer of innovations is a very important factor. It embraces all tasks connected with the practical implementation of research results and the circulation of patents and licences [5]. These tasks form the foundation for the technological progress and have a great influence on the competitive growth of the enterprise. There are numerous channels for innovation transfer. The three main channels for the transfer of innovative technologies from research centres to industry include the following: the exchange of the result of jointly realised research, licensing, and start-up ventures. The methods and tools for the support of the transfer process are also of key importance. Depending on the stage of the transfer process, the following methods and tools can be used: brainstorming, the Delphi method, the analysis of scenarios, analysis of market alliances, analysis of technological capacity, etc. Methods used in the innovation transfer

process include surveys and questionnaires, which most commonly are of help at the time of the generation of ideas [4]. The CAWI method, which is one of such methods, is currently gaining in popularity, particularly because of the ease of the distribution of interview questionnaires among the respondents and the possibility of a quick access to partial results of the investigation conducted.

1. Characteristics of the CAWI method against selected survey methods

The survey consists in the measurement of the opinion poll and the distribution of specially formulated and prepared questionnaires with grouped questions and instructions to be followed by the respondents when answering them. The survey can be organised as follows:

- An interviewer has direct participation and plays the role of the auditor disturbing questionnaires among respondents and, once they are filled in, collects them for further analysis.
- An interviewer has indirect participation, and his or her role is to place questionnaires where they can be easily accessed (e.g. fairs, exhibitions) or popularise them using different forms of mass media.
- An interviewer has no participation, and in this case, the respondents are surveyed via the Internet, mails, or the questionnaires that are distributed together with the press or the packaging of purchased products, etc.

The interviews are composed of the following stages:

- The determination of the objective and the scope of investigation;
- The design of questionnaires containing:
 - title,
 - information concerning the objective and the scope of the investigation,
 - a set of questions, and
 - information about the respondent;
- The distribution of questionnaires among the respondents;
- The collection of data from the questionnaires;
- The calculation of results;
- The interpretation and presentation of results;
- Drawing conclusions.

Computer Assisted Website Interview (CAWI) is one of the survey methods in which questionnaires are filled in by respondents in the on-line mode with the use of the communication medium in form of the Internet network [6]. The method is considered a quantitative method in which numeric parameters are determined in given units so the subject of the investigations can be characterised. Investigations of this type can be supplemented by qualitative elements so that more information about the topic of the investigation (respondent's opinion) can be gathered. The CAWI method is currently the most

quickly developing survey method. It enables the data to be collected much cheaper and quicker in comparison to traditional methods.

The main advantages of the CAWI method include the following:

- The possibility to include in the questionnaire information in textual, graphic, or multimedia form;
- The low costs of investigations (no need to employ interviewers);
- Quick access to partial data and the possibility of the quick analysis of data recorded in the electronic form;
- No risk that the respondent will make a mistake while filling in the questionnaire form (electronic questionnaires prevent submission of incorrect information);
- Access to numerous respondents around the world; and,
- The possibility for respondents to remain anonymous.

The disadvantages of the CAWI method are as follows:

- Only respondents with the access to the Internet can be surveyed, and
- A lack of certainty of who is actually answering the questions.

Computer Assisted Telephone Interview (CATI) is a method in which surveys are conducted via the telephone and assisted by computer techniques [7]. Interviews are conducted by a trained interviewer who records the respondents' answers in a specially designed database. This method is particularly applied in the situation when respondents do not have a lot of time to spare for the survey. A list of the main advantages of the CATI method includes the following:

- Quick access to partial data and the possibility for their quick analysis stemming from the fact that they are recorded in an electronic form;
- The possibility to supplement questions with sound materials;
- The possibility to support respondents with interactive hints in the case of particularly difficult questions, which significantly improves the reliability of the given answers; and,
- Access to respondents in various geographical locations.

As for the drawbacks of the CATI method, these are as follows:

- Only respondents with access to the telephone can take part in the interview.
- The surveys must be short and compact, because respondents may get tired of the prolonged dialogue with the interviewer.
- The interviewers need to be employed and trained.
- Using the telephone system is costly.
- There is no possibility to supplement the interview with visual materials.
- It is difficult to interview anonymous respondents.

Paper and Pencil Interview (PAPI) is a survey method in which the interviewer personally and directly interviews the respondent. In this type of interview a specially prepared questionnaire form is used in which questions

are grouped according to the issues or problem discussed [8]. This method is the oldest survey method, and it is now considered to be classic. PAPI interviews take place in offices or respondents' homes. The answers they give are written down on the paper questionnaire forms, and then they may be added to the database so that further analyses can be conducted. This type of a survey is usually applied for complex research topics in which active participation and the interaction of the interviewer are necessary. The main advantages of the PAPI method include the following:

- The high reliability of data gathered,
- The possibility to conduct complex interviews while assisting respondents in answering the questions,
- The possibility to interview respondents who are not computer literate or are unable to use the telephone.

The disadvantages of this method include the following:

- The high costs connected with the need to employ and train interviewers and their journey to the respondent's location,
- The need for questionnaires to be prepared in paper form, and
- The need to transmit data from paper questionnaires to the computer system so as they can be then subject to more complex analyses.

2. CAWI based model for the support of innovation transfer

The model that supports practical dissemination of innovations employing the CAWI method was developed at the Institute for Sustainable Technologies – National Research Institute in Radom as a part of the IT Platform designed to assist network organisations in effective knowledge transformation and technology transfer (Fig. 1). Supporting the processes of knowledge transformation and technology transfer with computer tools, the Platform enables the flow of information, the fusion and sharing of digital resources in virtual organisations.

The application layer of the platform is composed of the original computer implementations of technology transfer aiding methods, such as the CAWI method, which is implemented in the I-Survey remote interview subsystem. The developed model for the application of the CAWI method in the transfer of innovative products considers several stages, which are presented in Fig. 2.

In the model presented, the legal entity stands for enterprises, whereas the scientific centre stands for universities, research institutions, and corporate R&D centres. Market research is the process of acquiring information concerning the market trends (e.g. consumer behaviour and preferences, competition, product distribution systems, etc.). Based on the results of market research, new ideas for the development of new or modified existing solutions are generated. The development of innovations is a multistage process whose

objective is to create a cutting-edge solution in a given area of application. The usage of surveys at this stage facilitates effectiveness of tasks concerning the selection of the concept of the solution, which is likely to meet market requirements in the future. The innovation needs to be implemented both in the enterprise it originates from as well as another company that is selected with the use of the questionnaire. A crucial element of innovation implementation is the collection of opinions concerning the developed solution. The analysis of opinions may lead to the generation of new ideas connected with the product or ideas for totally new products.

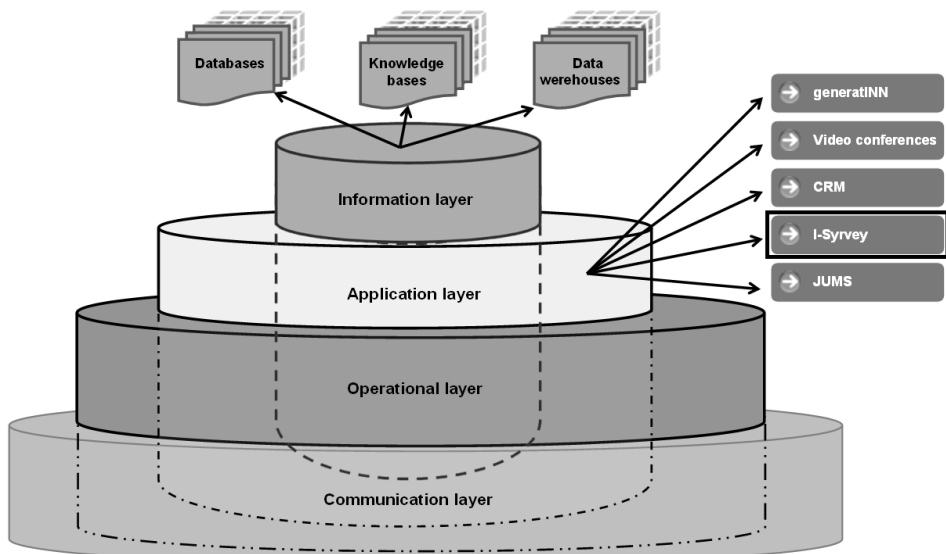


Fig. 1. Multilayer structure of the IT platform supporting the functioning of network organisation facilitating effective knowledge transformation and transfer of research results to business practice

Source: Multipurpose computer platform supporting the transfer of innovations to business practice [9].

The model is composed of the following types of questions that can be incorporated into the questionnaire:

- alternative (“yes” or “no” type),
- disjunctive (the selection of one answer from the list of more than two variants),
- multiple-choice (selection of many answers from the list of possible variants),
- numeric (answers expressed in a numerical values),
- open (descriptive answer),

- semi-open (selection of one or more answers with the possibility for other variants defined by the respondent to be added),
- filtration (the answer decides on whether or which question from the defined ones is to be presented to the respondent in the next step),
- control (once the answer is provided, its correctness is checked), and
- rating (the sequence in which the answers are provided by the respondent plays a decisive role).

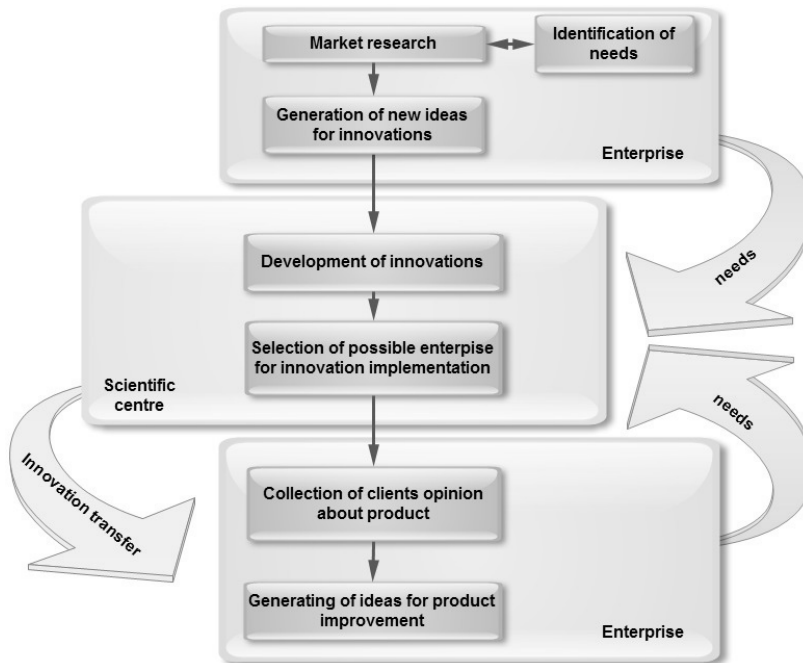


Fig. 2. Model for the application of the CAWI method in the innovation transfer process
Source: Author.

Questions can be obligatory (the respondent is obliged to answer the question in order to proceed) or voluntary (there is no need for the respondent to answer questions given in order to proceed). In the case of expanded surveys, questions can be grouped into thematically connected blocks, which is of great convenience to the respondent.

3. Implementation of the CAWI method in the I-Survey system

The reason behind the creation of the I-Survey system was the development of the computer application for the support of innovation transfer processes via the original IT platform developed at the Institute for Sustainable Technologies

– National Research Institute in Radom aimed at boosting the effectiveness of knowledge transformation and technology transfer processes. The system is composed of eight basic modules presented in Fig. 3 below.

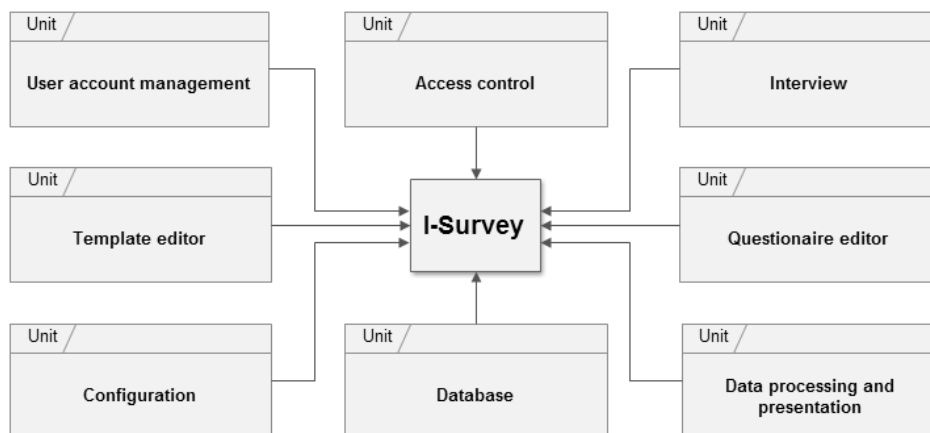




Fig. 3. I-Survey modules
Source: Author

Tasks are realised by particular modules that complement each other and create the system that complies with the requirements of the CAWI method. The user account management module defines access accounts and determines whether the users are authorised to access the remaining modules of the system. The users authorised to edit the questionnaires can create their own forms and define parameters of the interview process. Access control modules, on the other hand, supervise logging processes and switch the users from one module to another. The system can be used by users with already created accounts as well as unregistered users who only fill in the questionnaires publicly or anonymously. The interview module is intended for the rendering of questionnaires in the on-line mode and to gather data filled in by the respondents. A part of such a questionnaire is presented in Fig. 4.


The template editor is intended for the design of graphic templates based on questionnaires that are rendered at the time of the survey. The system is unlimited when it comes to the number of templates to be designed. Graphic templates can be exchanged between questionnaires the related surveys. The questionnaire editor (Fig. 5) is a module intended for the preparation of question sets that are to be presented to the respondent at the time of the interview.



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PROGRAM Innowacyjne systemy wspomaganie technicznego
STRATEGICZNY zrównoważonego rozwoju gospodarki

Koncepcje zmian w konstrukcji prototypu

0% 100%

Proponowane udoskonalenia konstrukcji penetrometru PL-12DC

Czy Twoim zdaniem ostatnie zmiany konstrukcyjne zostaną odebrane pozytywnie przez nabywców urządzenia?

	Tak	Nie
Nowa obudowa głowicy pomiarowej	<input type="radio"/>	<input type="radio"/>
Umieszczona poziomo w stoliku	<input type="radio"/>	<input type="radio"/>
Wolniejszy ruch głowicy w kierunku próbki	<input type="radio"/>	<input type="radio"/>
Czarny kolor obudowy	<input type="radio"/>	<input type="radio"/>

Co Twoim zdaniem należy zmienić w następnej wersji urządzenia?
Wybierz jedną z następujących odpowiedzi

- Zwiększyć dokładność pomiarową
- Powiększyć podstawę
- Wprowadzić różne prędkości przesuwu głowicy
- Zbudować oprogramowanie dla systemu Android
- Wymienić uchwyt na bardziej uniwersalny

Wprowadź komentarz:

Fig. 4. Part of the questionnaire designed based on the I-Survey enabling the selection of the concept of solutions for the PL-12DC laser penetrometer with alternative and semi-open questions

Source: Author.

The configuration module enables system parameters to be adjusted and adapted to the requirements of individual users. Both server configuration parameters and parts of the user interface can be changed. The main task of the database is to store information gathered from the surveys and data representing questionnaires built into the system. All the data, both partial and complex, can be presented in tables or graphically, which is possible due to the application of the module for data processing and presentation. The system ensures data export in most popular formats of data exchange; therefore, more complex analyses can be conducted in other independent computer applications.

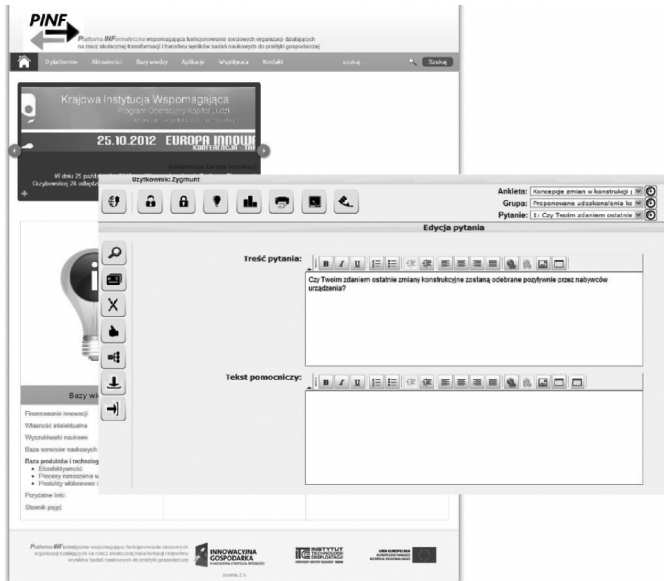


Fig. 5. Questionnaire editor for I-Survey system

Source: Author.

Conclusions

The model and the original computer solution employing CAWI methods presented in the article comply with the assumptions and conditions for the support of tasks undertaken with view of facilitating the practical implementation of research results, and they significantly improve the transfer of innovations to industrial practice. The solution proposed is characterised by low costs stemming from the fact that no interviewers need to be employed and trained for this type of surveys, quick access to partial data, the possibility for the quick conduction of complex analyses since the data are in the electronic form, the elimination of mistakes in the survey and the transfer processes, access to respondents in various geographical locations, and the possibility to ensure respondents' anonymity. Because the method can be used at different stages of innovation development (no matter if in a company or research institution), it significantly boosts the effectiveness of the transfer process. The application of new technologies enables enterprises to flexibly adapt to economic changes, while the flow and exchange of information and experience may lead to better cooperation between the R&D sector and industry. The computer solution developed, which is the computer software functioning on the IT platform for the support of the activity of networks for effective knowledge transformation and technology transfer, complies with and includes the requirements of the CAWI method. The computer application implemented is

characterised by great flexibility concerning its structure and operation. Therefore, it can be used for the transfer process and in other areas of the activity of network organisations.

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Reviewer:

Waldemar FURMANEK

Zastosowanie metody CAWI do holistycznego wspomaganie transferu innowacji do praktyki gospodarczej

Słowa kluczowe

Transfer innowacji, badania ankietowe, badania marketingowe, sondaż, CAWI.

Streszczenie

W artykule przedstawiono metodykę wspomaganie procesów transferu innowacyjnych technologii do praktyki gospodarczej z wykorzystaniem teleinformatycznych systemów dedykowanych do realizacji zdalnych badań ankietowych typu CAWI. Omówiono podstawy formalne funkcjonowania metody CAWI oraz zaprezentowano opracowany oryginalny system ankietowy, wchodzący w skład zaprojektowanej w Instytucie Technologii Eksploatacji – Państwowym Instytucie Badawczym (ITeE – PIB) Platformy Informatycznej wspierającej funkcjonowanie organizacji działających na rzecz skutecznej transformacji i transferu wyników badań naukowych do praktyki gospodarczej. Przedstawiono architekturę rozwiązania, jego cechy funkcjonalne oraz obszary zastosowań. Dokonano porównania wybranych metod ankietowych pod względem wad i zalet w celu wyłonienia rozwiązania skutecznie wspomagającego transfer innowacyjnych technologii do praktyki gospodarczej. Omówiono zidentyfikowane problemy badawcze i aplikacyjne, które należało rozwiązać podczas projektowania i implementacji systemu. Wskazano innowacyjne cechy opracowanego rozwiązania.