

Selected theoretical and practical aspects of statistical methodology of qualitative research in information systems

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ABSTRACT

Information technology (IT) is one of the fields of science (including computer hardware and software used to create, transmit, display and secure information), combining telecommunications, utilities, and other technology-related information. It provides to the users the tools by which they can obtain information, select it, analyze, process, manage and communicate to other people.

Information technology media may support very well the qualitative research, which is often essential and special in developing economies and transition circumstances. Special conditions and activities are needed to identify the situation, market, individual analysis and diagnosis. Simple structured surveys and questionnaires give not always full and accurate answers. Users may find good theoretical approach in information systems (IS) concerning qualitative research and tools helpful in research interpreting.

In the presented below article there appears a review of qualitative methods with respect to informative, statistical and philosophical aspects. One can find here the idea of qualitative research, including consideration over some methods of its application, evaluation and verification with the use of classic statistics and statistical optimization methods. Thus, on one side, the article serves as a review but on the other it is a proposal of how to utilize statistical methods (if its considered a matter of its own merits) in a qualitative research. The question – ‘Can one apply quantitative methods and statistics in qualitative research?’ is a subject matter in various discourses concerning methodology and ethics of qualitative research at different conferences as well as in literature. Ethics of qualitative research is connected with methodological, psychological (in reference to respecting the rights of research participants) and other aspects linked to use of the results in a social circulation.

KEYWORDS:

Information systems (IS), qualitative research, methodology of qualitative research

REVIEW AND CLASSIFICATION OF SCIENTIFIC METHODS.

Qualitative methods developed in social science during analyses of socio-cultural phenomena. The examples of qualitative methods could be among many: action research, case study research or ethnographic research. The sources of qualitative data are among many: observation or participant observation, surveys and questionnaires, documents, texts, opinions – participants monologues or impressions and reactions of a researcher.

From the beginning of the seventies of the previous century qualitative methods did not belong to the mainstream of examinations, nevertheless they were more often applied in social or pedagogical research or in the examinations over human resources management, informatics, medicine or in other fields. There were also other, alternative qualitative methods designed which put emphasis on the issues of reliability and analysis of data as essential factors in exploratory studies (Myers, Avison 2002, Stake 1994).

Scientific methods are classified in different ways but one of the most general is a division into qualitative and quantitative research (Myers, Avison 2002, Stake 1994).

Quantitative methods began to be used in life sciences – in physical phenomena analysis. At present quantitative methods are applied in socio – economical and psychological sciences e.g. in survey measures, experiments carried out in laboratory environment in so called formal methods (among many including also econometrics) or in methods of mathematical modeling (Straub et al. 2004).

The idea of creation and division of qualitative methods as opposed to quantitative ones emerged as a result of a statement that man as a human being is different to the rest of the world taking into consideration his capability to express himself not only in a verbal way but also e.g. through body language. According to some scientists, especially in the field of psychology, experimental manipulation (which can be treated as quantitative method) is not ethical because it trespasses the privacy of participants, undermines their self respect or jeopardizes health. Moreover, reduction of nature of human actions to measurements, numbers and physiology is ‘a distortion of the things experienced by people’ and experiments do not take into consideration such subjective factors as individual life history of participants (Paluchowski, 2000). Others believe that the authenticity of explanation in experimental model results from objective – statistical and practical – criterion.

Qualitative methods are designed to enable researchers to understand attitudes, behaviors, way of thinking and emotions in a social, cultural and economical context of life. Many

scientists believe that if the aim of the research is to understand certain phenomena and to put it in a socio-institutional or cultural context, then carrying out the analysis only on the basis of questionnaires, in which there appear fixed, already quantified textual answers, may lead to loss of valuable information or even may render the research meaningless (Kaplan, Maxwell 1994).

In humane sciences there is room for considerations over qualitative model whose sense lies in interpretation of content. Such model of cognition in science studies is defined as understanding. In psychology the qualitative research is justified with thesis acknowledging variety and irreducibility of psychological phenomena which can be divided into facts of nature and facts of culture. The subject of the qualitative research are first of all the facts of culture (material and spiritual reality created by a man), specific problems of unitary character which result from individual experience of a person and relate to experience of consciousness, world of personal meanings, expression, organization and intentional acts connected to reflection, will and conscience of an individual (Stras-Romanowska 2000).

A matter of argument in qualitative research is generalization of results, problem of authenticity and credibility of results. One can verify the authenticity of qualitative research e.g. interpretive (semantic) on the basis of mutual understanding (between researcher and participant or recipient of text and its author), feeling of palpability of researcher and his certainty of interpretation accuracy (Stras-Romanowska 2000), thus, it is an objective criterion. One of the methods of objectification is help of competent judges (competent interpreters) who can reach consensus in the matter of interpretive findings (Straś-Romanowska 2000). In statistical meaning the results can be objectively generalized to population only under certain conditions, enabling for instance application of statistical inference and statistical optimization (Kowal 2000, Kowal 2003 - see: 'Algorithm of elimination of ambiguous objects', examples 1-2 in chapter entitled 'Possibility of application of chosen methods of classical statistics and optimal experiments planning in qualitative research' in a current monograph) or some elements of mathematical theory of fuzzy sets if the shape of distribution of variables is difficult to define which can happen in case of small samples in qualitative research, with bigger dispersal and ambiguity of statements.

Majority of researchers decides to choose only one sort of method: qualitative or quantitative research. There is also a group advocating use of both at the same time during the same examination (Gable 1994).

Apart from diversification of the research into qualitative and quantitative one, among many, the division can be also made into:

- objective and subjective (Burrell, Morgan et al. 1979),
- connected with discoveries of general laws (nomothetic) and concerning uniqueness of individual situations (idiographic research),
- research oriented towards explaining and understanding phenomena which lead to prognostic (predictive) studies whose aim is description, forecast and modification;
- research considering external perspective (etic, outsider and researcher's perspective and taken from this perspective theory – for instance – in psychology – case study, psychographic method, psychological model) and internal perspective (emic, participant's perspective and his system of subjective meanings, for instance in psychology hermeneutical dialogue, autobiographical method – Bartosz 2000, Stras-Romanowska 1997).

NOTION OF QUALITATIVE RESEARCH IN THE FRAMES OF INFORMATION SYSTEM

Qualitative methods are more often used in socio-economical studies (in marketing, human resources or while examining of organization culture, Kuraś 2006)¹. In the presented paper the problems connected with 'qualitative research' are considered in the frames of information systems, in reference to applied methods, techniques and examination tools.

TECHNIQUES AND METHODS OF RESEARCH

Scientific research refers to studies and analysis which aim at proposing objective answers and formulate laws and regularities. Scientific research starts from formulating a scientific problem which can be understood as a question or a set of questions to which an answer is brought as a consequence of carried out research. The questions refer to objects, phenomena or processes which lie in the field of interest of researcher (Nowak 1970). In the process of scientific research the choice of methods, techniques and research tools are of crucial importance. First of all, it is crucial to define the subject matter, for what reason the examinations will be conducted, the method in which the research will be carried out in order to obtain solution to posed problems and check the authenticity of connected to them hypothesis.

¹ The class of SI system is defined as a human activity system, thus a social system constituted not only by people but also by artificial (data, technical means) and abstract components (methods, organization, cf. Kowal 2006)

Scientific method can be understood as a strategy to obtain results, starting from philosophical theories, through scientific projects (defining primarily object of research, aims, assumptions, questions and hypothesis or target population) to methods of collecting and analysis of data. Most commonly, a chosen method requires specific abilities, conditions and measurements connected with examinations. The definition 'method' itself (often used interchangeably with such notions as 'cognition model' or 'research methodology') refers to a set of general assumptions having influence on the way of examinations, adjusted to its object and aim (Straś-Romanowska 2000). According to Kotarbiński a method can be defined as a strategy used systematically with intention to be repeated in a similar case (Kotarbiński 1957). Scientific technique (always connected to specific method) is often characterized as a way of realization of planned tasks as practical activities, regulated with a thoroughly created instructions allowing to obtain optimally verifiable information, opinions, facts (Kamieński 1974). Methods and techniques do not exclude each other but stay in a close relation and complement each other, whereas research tools (e.g. questionnaires, surveys, interviews, observations, statistical data, publications, personal documents) are instruments used in order to realize chosen scientific technique (Pilch 1977).

UNDERSTANDING OF QUALITATIVE RESEARCH

In psychological and sociological science some scientists consider qualitative research among many only as a verbal example and psychological analysis of patients, narrative research including analysis of content and finding hidden meaning or forecasting methods without taking into consideration quantitative aspect.

Many scientists define 'qualitative' as research of 'qualitative phenomena' e.g. such phenomena which in mathematical sense cannot be measured or weight but can be described verbally (for instance sex, color, type of mind or temper, kind of advertisement, reactions of recipients to promotional materials). However, separate objects can be ascribed to certain categories, the latter can be given numbers in an arbitral way and one can apply adequate quantitative methods. Research objects according to Stevens (1930) can be characterized with three kinds of properties (features): qualitative (e.g. sex or color), ordinal (level of education, number in ranking) and quantitative (weight, age, height). Properties can be 'measured' in proper scales – qualitative (nominal), ordinal, interval and ratio one. In many scientific works 'qualitative' is understood as research concerning qualitative properties of objects measured in categorical scales (Zajac 1988).

DIFFERENT PHILOSOPHICAL APPROACHES TO QUALITATIVE RESEARCH

Independently from the chosen kind of research its basics should always derive from universal philosophical assumptions. Among many, crucial importance is ascribed to epistemological foundations concerning knowledge and ways of acquiring it.

Science philosophers define scientific paradigms and categories that should build theoretical foundations for research. The most preferred in qualitative research is epistemological three-category approach: positivist, interpretive and critical. In literature concerning the subject matter there often appears discourse whether taken scientific paradigms or epistemological assumptions must be opposed or they can be used parallel.

Sometimes scientists identify qualitative research with interpretive one, however it is not always the truth, but it might result from taken theoretical assumptions. Character of the research results as well from the taken theoretical assumptions (e.g. case study and can be independent from philosophical foundations. For instance a case study might be of a positivist, interpretive or critical character, whereas in research of activities one can apply a positivist, interpretive or critical approach (Kowal 2005, Orlikowski 2002, Richard and Boland 2002, Walsham 1993).

Positivist approach. In positivist approach the determinant of scientific knowledge is a method allowing for objective and unambiguous description and explanation of reality (Straś-Romanowska 2000). In this approach the assumption is that the reality is objective and can be described with use of measurable properties which are independent not only from the scientist or observer but also from the used research tools. In this approach the research is a trial of test or verification of theory, a trial of understanding the phenomena which allows for predictions. According to theory of information systems a positivist research is characterized with formal proposals (scientific and research hypothesis were formulated), analyzed variables were measurable, taken hypotheses were verified and results drawn on the basis of empirical data can be generalized. This kind of research differs from quantitative research with small number of populations and with not always complied condition concerning randomness of sample. If the above mentioned conditions are satisfied the research can be considered as positivist one including case study.

In order to obtain results in positivist approach there is a number of statistical methods used from statistical description, through point or interval estimation to verification of statistical hypothesis, as variables are measurable and hypothesis are formulated. A researcher can generalize the results on general population for instance through verification of statistical hypotheses and application of tests of differences significance, tests of concordance or

independency. Many scientists believe that such sort of qualitative research is more objective in the meaning of reliability and accuracy of the results.

Interpretive approach. In interpretive approach there always appears assumption that access to reality (given, functioning or constructed by some community) can be done only through some social constructions such as language, consciousness or common for some community way of thinking. Philosophical foundations for interpretive approach are hermeneutics and phenomenology. During interpretive analysis the researcher tries to understand certain phenomena through meanings given to them by people. Methods of interpretive research are directed to:

- creation and understanding of information system context, as well as
- description of a process according to which information process has influence on context and in reverse – the context has influence on the system.

In interpretive research there is no predefinition of dependent variable. In this type of research the most crucial thing is concentration on complexity of meanings which man gives to happening situations (Orlikowski 1991).

Critical approach. One variety of interpretive approach is a critical approach. Representatives of critical approach assume that socio – economical reality was constituted historically and results from activities of men. Reality is created and reconstructed by societies.

Authenticity of interpretive, semantic research is verified on the basis of agreement (between the researcher and researched, text recipient and its author) or feeling of obviousness of researcher towards defined relationship of sense, conviction of interpretation accuracy drawn from epistemological experience, knowledge, intuition, insight, authority (subjective criterion). Relationship of sense can be explained on the example of analytical therapy. Let us assume that motive of a black dog appears in dreams of a patient. The patient and his therapist together should find the meaning of the symbol appearing in dreams of the examined for instance whether a black dog symbolizes fears connected to certain kind of real situations. The method of objectification is help from the side of competent judges (competent interpreters) who should reach consensus in the field of interpretive establishments. The results can be generalized objectively to population only under certain conditions enabling application of methods of statistical inference and statistical optimization (Kowal 2006, por. Wawrzynek1977).

Utilization of statistical methods can sometimes help in clarification of a problem, despite the fact that in majority of qualitative approaches bigger importance is given to the fact of appearance of certain fact rather than frequency of its appearance. Qualitative analysis on the basis of substantial assumptions should bring the answer to the question whether there appears a logical relationship between considered features. Quantitative methods for instance correlation or regression analysis cannot only describe the correlation between variable X and variable Y due to mathematical model but also characterize tightness of this relationship. Essential analysis (in fact, in the sense of philosophy of science, deductive one), often called qualitative or qualitative analysis, based on induction should give the answer to the question whether co-variableness or other cause/effect correlation can take place between the variables. There may appear some symptomatic relations between variables, which can serve as a base to forecast certain phenomena, nevertheless cause and effect correlation does not exist between them.

For instance, symptomatic correlation appears between the way people dress and snow melting. Most commonly, when spring comes, people wear lighter clothes, the snow melts, however, it does not mean that the kind of clothes is the cause of snow-melting. Nevertheless, we can forecast this process when we see people dressed in spring clothes. What causes the snow to melt is undeniably high temperature which appears during certain seasons of the year. It is a fact that we know from experience and it has its grounds in knowledge connected to physics or climatology. The forecast whether the cause and effect correlation exists can be done on the basis of experiments and substantive knowledge from literature on the subject matter. The results of statistical procedures cannot show unambiguously if a given relationship is of a cause/effect character. They only include information if data 'fit' tested model or whether certain variables can ground the base to forecast certain phenomena. On the other hand, an experiment, supported by substantive knowledge, can indicate a cause and effect correlation. For instance, we can conclude that certain method of memory training improves students' perception if after a monthly training the results of memory tests in experimental group will be better than in control group which did not participate in trainings. The justification of the results must be, nevertheless, of substantive, qualitative and deductive character.

QUALITATIVE RESEARCH IN INFORMATION SYSTEMS IN METHODOLOGICAL AND PHILOSOPHICAL ASPECTS OF SCIENCE.

In many information systems (IS) qualitative research is presented in the frames of philosophical assumptions, however most commonly, it appears as studies in which qualitative data (such as interviews, surveys, documents, results of observations or case study) are analyzed in a substantive way

In such a perspective the aim of qualitative research is to gather understanding and explain socio-economical or psychological phenomena. In qualitative psychological research in hermeneutical version understanding is perceived as a form of explanation called explanatory, deductive or instrumental understanding (Straś-Romanowska 2000). Qualitative research allows us to give answers to such questions as ‘why’, ‘for what reason’, ‘which are’, ‘what are’, after the analysis of individual, free statements of respondents, analysis of behavior, gestures or creations. Such analysis is an arduous and time-consuming procedure, thus qualitative research is often carried out on a small scale, but can serve as grounds to formulate hypotheses which then can be verified in quantitative research realized on big populations (see table 1). In socio-economical examinations the most frequently used qualitative research is focus group interview (FGI) or in-depth interview (IDI). They are usually used to characterize some community (target group of for instance some market segment), not only in reference to inner motivations or emotional sensitivity threshold but also to attitudes, assessment of some phenomena or higher-order needs.

Table 1. Comparison of quantitative and qualitative research

Qualitative research	Quantitative research
<p>Aims of the research: Theoretical aims: They result from substantive assumptions of researched problem concerning studied field, expressed in the language of words or pictures: 1) understanding, agreement, explanation (understanding, deductive, instrumental) and phenomena interpretation; 2) defining the object of research; 3) defining cognitive and practical aim; 4) posing cognitive questions concerning: a) features (properties) of examined phenomena (objects) b) kinds of relationships between features of phenomena c) correlations between examined phenomena d) formulating complementary questions of creative character (beginning with such expressions as ‘what’, ‘with what reason’, ‘what are’, ‘which’, etc., with structures which do not include information about researcher’s thesis, nevertheless requiring elaborate answers (Straś-Romanowska 2000, Pilch i Bauman 1988, Such 1972, Ajdukiewicz 1928).</p> <p>Practical aims:</p>	<p>Aims of the research: Theoretical aims: The main aim of scientific cognizance is to gain the most compact, reliable, general, simple and containing maximum information knowledge (Such, 1972). On the basis of such cognizance it is possible to prove certain regularities and laws that govern them (Pilch, 1998). The aims of quantitative research result from the aims defined earlier on the basis of qualitative research and proper substantive assumptions expressed in language of logics and mathematics: 1) Description of object population, phenomena, their features and dependencies between them with use of mathematical, statistical functions, numbers; generalization of results to general population 2) Explaining and forecasting Formulation of directional ‘wh-questions’ (also starting with auxiliary verbs – do, does, etc., and ‘whether’, ‘why’, ‘how’) whose aim is to confirm or deny given thesis</p> <p>Practical aims: Control, interference in the course of events, forecasting</p>

Expansion of consciousness, improvement in quality of life	
Subject matter: The world of human spirit, thoughts, facts of culture (Stras-Romanowska 2000)	Subject matter: The world of nature, facts of nature, natural, physical and socio-economical phenomena
Method of formulating scientific hypothesis. This method gives answers to complementary questions; 'what', 'for what reason', 'why', 'in what way', 'what are', 'which', etc., but first of all they deal with 'why-questions' (cf. Ajdukiewicz 1928) but in understanding and interpretive approach, without references to numbers	Method of formulating scientific hypothesis. This method gives answers to directional 'wh-questions' (also starting with auxiliary verbs – do, does, etc., and 'whether', 'why', 'how') in reference to numbers, in the language of logics and mathematics: - which mathematical or statistical functions characterize objects, phenomena, their properties and dependencies between the features or groups of phenomena, - whether representative for general population data, gathered in quantitative research confirm hypothesis posed on the basis of qualitative research, - how we can interpret the obtained quantitative result
Character of cognition: Contextual, historical (ascribing sense) cognition (Stras-Romanowska 2000)	Character of cognition: Linear, sequential (describing causes) cognition
Size of examined population Usually small population, rarely random, chosen in purposeful manner	Size of examined population Usually statistically big object samples, chosen randomly, according to defined scheme
Connection type: Sense (semantic association: part – whole)	Connection type: Cause and effect, correlation, symptomatic
Criterion of truth: Phenomenological, semantic	Criterion of truth: Empirical, statistical
Generalizing of results to general population: In interpretive approach the results are usually not generalized to population. Whether the interpretive, semantic cognition is authentic can be decided on the basis of mutual understanding (between the researcher and the participant, the text recipient and its author) or the feeling of conviction of interpretation accuracy towards defined sense relationship drawn from epistemological experience, knowledge, intuition, insight, authority (subjective criterion). The method of subjectivization is help of competent judges (competent interpreters) who must reach consensus in interpretations (Straś-Romanowska 2000). The results can be objectively generalized to population only under certain conditions which enable application of methods of statistical inference or statistical optimization(Kowal 2000).	Generalizing of results to general population: Numerical results can be generalized to the general population with previously assumed probability, on the basis of methods of statistical inference (point estimation, confidence intervals, verification of statistical hypothesis)
Research scenario: Flexible scenario, dependent not only on research method but also on situation, mood or instant idea of researcher or examined person.	Research scenario: Most commonly based on secondary sources, physical measures or structured questionnaire in which respondents tick the answers on scales e.g. Likert, Thurstone, Stampil scale, etc.
Influence of researcher on course of research – quite big	Influence of researcher on course of research – substantially smaller, as the research should take the course defined by created phases of the project, in the realization process there are at least a few thoroughly qualified persons employed
Character of interpretation of results - Big objectivism not only of the researcher but also of participants (especially in hermeneutical approach)	Character of interpretation of results – the interpretation is more objective, usually based on methods of statistical inference.

Source: own work and on the basis of literature: (Paluchowski 2000, Brzeziński 1996, Straś-Romanowska 2000, Pilch and Bauman1988, Such 1972, Ajdukiewicz 1928) and own research

SUMMARY

Qualitative researches are more and more often carried out in socio-economical, humanities sciences and in practice, in different theoretical approaches (positivist, interpretive or critical) and with use of miscellaneous methods and techniques (most frequently in focus group interview, brain storming, individual in-depth interviews, copy tests, experiments or observations).

This process can be seen in information systems on the Internet where at www pages we can encounter advertisements of firms - public opinion research centers which offer carrying out of qualitative marketing research, creation of new look for companies, products or forecasting of changes in management and organization (e.g. analysis of managers' consciousness and sensitivity to changes in management, identification of examined problems or projections of results utilization in counseling concerning planning of operating strategy (Ragin, 2007). In western culture a dominant politics of globalization of economy and culture takes into account national and cultural diversity which can be better understood due to help of qualitative rather than quantitative research (Paluchowski 2000). This is why many research projects within the frames of the European Union applies, at least in some part, a qualitative paradigm. Qualitative and quantitative methods can co-exist and be mutually completing. The choice of proper procedure is made, in majority of cases, with help of researcher's paradigm and his ontological and epistemological assumptions. If we assume only different methods, for instance in-depth interview, observations and questionnaires carried out in a parallel way, then opposing qualitative and quantitative method is unjustified as the methods used in them are empirical, based on data acquired from respondents.

On the other hand if we assume different research paradigms (with different ontological and epistemological assumptions) then the two approaches can be treated as opposed.

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