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KNOWLEDGE AS A WAY TO ARCHITECTURE. DESIGNING WITH THE USE OF RESEARCH – *DESIGN BY RESEARCH*

WIEDZA DROGĄ DO ARCHITEKTURY. PROJEKTOWANIE Z WYKORZYSTANIEM BADAŃ – *DESIGN BY RESEARCH*

A b s t r a c t

This chapter discusses issues related to: theory of qualitative research, methodology of research, designing with the use of pre-design research and a model of architect-researcher. The knowledge presented is based on literature research, experience in the field of qualitative research, evaluations of several dozen objects, our own design practice with the use of qualitative research, and experience from research conducted as part of classes with architecture students. Fragments of selected publications from several dozen publications were used, including a monograph: Qualitative research in architectural design on selected examples [2012]. The author has been dealing with the issues of qualitative research for about 18 years presenting results in scientific publications and at national and international conferences: AHFE (Applied Human Factors and Ergonomics), HFSI (Human Factors and Sustainable Infrastructure), HCI (Human Computer Interaction), OKE (National Ergonomic Conference), Innovation in Architecture, ATZ (Architecture-Technique-Health), ULAR (Urban Landscape Renewal), BIWA (Interdisciplinary Studies in Architecture), Forum of Building and Engineering in Silesia, TUP and PAN meetings.

Keywords: rationalist approach, methodology of research

S t r e s z c z e n i e

Rozdział jest autorskim omówieniem zagadnień dotyczących: teorii badań jakościowych, metodologii wykonania badań, projektowania z wykorzystaniem badań przedprojektowych, modelu architekta-badacza. Zaprezentowaną wiedzę oparto na badaniach literaturowych, doświadczeniach badawczych w zakresie badań jakościowych, przeprowadzonych ocenach kilkudziesięciu obiektów, własnej praktyce projektowej z wykorzystaniem badań jakościowych, wynikach z badań obiektów w ramach zajęć ze studentami architektury. Wykorzystano fragmenty z kilkudziesięciu wybranych publikacji autora, w tym monografii: *Badania jakościowe w projektowaniu architektonicznym na wybranych przykładach* [2012]. Autor od około 18 lat zajmuje się problematyką badań jakościowych, prezentując wyniki w publikacjach naukowych oraz na krajowych i zagranicznych konferencjach międzynarodowych, m.in.: AHFE (Applied Human Factors and Ergonomics), HFSI (Human Factors and Sustainable Infrastructure), HCI (Human Computer Interaction), OKE (Ogólnopolska Konferencja Ergonomiczna), Nowoczesność w Architekturze, ATZ (Architektura-Technika-Zdrowie), ULAR (Urban Landscape Renewal), BIWA (Badania Interdyscyplinarne w Architekturze), Forum Budownictwa Śląskiego, a także na spotkaniach TUP i PAN.

Słowa kluczowe: podejście racjonalistyczne, metodologia badań

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1. Introduction

The subject of the conference provokes further reflections. The knowledge-based rationalist approach seems to be the right attitude for responsible design. On the other hand, an intuitive approach based solely on the creator's talent can give various results. In today's world, especially in investments, there is no space for experiments. An architect designs an object for someone's money. There is no room for trials or mistakes. The object is a packaging of the investor's goals, business activities, and it has to fulfill strictly defined tasks. Knowledge-based design, on the other hand, does not limit the freedom of creative expression in the area referred by Vitruvius as "beauty". Thus, the combination of a rational knowledge-based approach with the creative talent of an architect is certainly the way for success.

In the modern world it is difficult to think about success in any field without possession of professional knowledge. In contemporary investments we are dealing not only with the market, competitiveness, galloping technical progress, constantly changing expectations; but above all the final customer – the user. His success depends on the success of the investment.

Qualitative research is a necessary support in the contemporary preparation of investments at the planning, programming and designing stage, and then in the range of monitoring a facility during use.

The use of pre-designing studies simply pays off, because it guarantees a good investment of money and obtaining an object which meets established goals that ensure success. They provide security for the investor's targets. They allow the knowledge directly from the source – from users and facilities – to be usd. Designing with the use of research – Design by Research means avoiding mistakes.

2. Introduction to considerations

The chapter discusses issues related to: the theory of qualitative research, methodology of research, designing with the use of pre-designing research and a model of architect-researcher. The knowledge presented is based on literature research, experience in the field of qualitative research, evaluations of several dozen objects, our own design practice with the use of qualitative research, and experience from research conducted as part of classes with architecture students. Fragments of selected publications from several dozen publications were used, including a monograph: Qualitative research in architectural design on selected examples [2012]. The author has been dealing with the issues of qualitative research for about 18 years presenting results in scientific publications and at national and international conferences: AHFE (Applied Human Factors and Ergonomics), HFSI (Human Factors and Sustainable Infrastructure), HCI (Human Computer Interaction), OKE (National Ergonomic Conference), Innovation in Architecture, ATZ (Architecture-Technique-Health), ULAR (Urban Landscape Renewal), BIWA (Interdisciplinary Studies in Architecture), Forum of Building and Engineering in Silesia, TUP and PAN meetings.

Referring to the beginnings of the theory development in the field of qualitative research, it is necessary to emphasize the significant contribution of the authors of the following publications: Preiser W., Rabinowitz H., White E. [1988]: Post-Occupancy Evaluation; Preiser W. [1989]: Building Evaluation; Preiser W., Vischer J. C. (red.) [2005]: Assessing building performance, Nasar J. L., Preiser W., Fisher T. [2007]: Designing for Designers: Lessons

Learned from Schools of Architecture; Lang J. [1997]: Creating architectural architectural Theory. The role of the Behavioral Science in Environmental Design; Groat L., Wang D. [2002]: Architectural Research Methods; Zeisel J. [1990]: Inquiry by design, Tools for environment-behavior research; Johnson P. A. [1994]: The Theory of Architecture. Concepts, Themes & Practice; Anderzhon J., Fraley I. L., M. Green M. [2007]: Design for Aging Post-Occupancy Evaluations. Lessons learned from Senior Living Environments featured in the AIA's Design for Aging Review; Kernohan D., Gray J., Daish J., Joiner D. [1992]: User participation in building design and management. Architecture; Baird G., Gray J., Isaacs N., Kernohan D., McIndoe G. [1996]: Building Evaluation techniques; Duerk D. P. [1993]: Architectural programming. Information management for design; Foqué R. [2010]: Knowledge in architecture; van der Voordt T. J. M., van Wegen H. B. R. [2005]: Architecture in use. An introduction to the programming, design and evaluation of building; de Jong T. M. i van der Voordt D. J. M. [2005]: Ways to study and research. Urban, Architectural and Technical Design[1].

There are also important books in Polish describing qualitative research: Fross K. [2012, 2014 e-book]: Qualitative research in architectural designing on selected examples. The author discusses their own methods of pre-design studies "in 8 steps" and in the course of using "in 7 steps". It indicates the benefits of using research in acquiring knowledge for design on selected examples of projects and implementations. The next book is written by Niezabitowska E. [2014]: Research methods and techniques in architecture, Publishing Silesian University of Technology, Gliwice, 2014. A valuable publication that discusses the full range of available research methods and techniques for use in architecture[2]. The author's views were also presented in the following authored or co-authored publications: Fross K., Sempruch A. [2015]: The qualitative research for the architectural design and evaluation of completed buildings – part 1 – Basic principles and methodology; Fross K., Sempruch A. [2015]: The qualitative research for the architectural design and evaluation of completed buildings – part 2 – Examples of accomplished research; Fross K. [2015]: Ergonomics design with qualitative research; Fross K. [2015]: Qualitative research for the planning, programming, architectural design and evaluation of investment; Fross K., Winnicka-Jasłowska D., Gumińska A., Masły D., Sitek M. [2015]: Use of qualitative research in architectural design and evaluation of the built environment; Masły D., Sitek M., Fross K. [2015]: The impact of solar radiation on the quality of buildings: research methods; Fross K., Ujma-Wąsowicz K., Gumińska A. [2015]: Teaching of architectural design – first steps. Driving course design methodology. The Builder magazine also published an article on the revitalization of large-panel housing estates: K. Fross [2015]: Qualitative research – introduction for the revitalization.

Worth recommending are the current scientific publications of authors creating the Silesian School of Quality Research[3], including: E. Niezabitowska, A. Niezabitowski,

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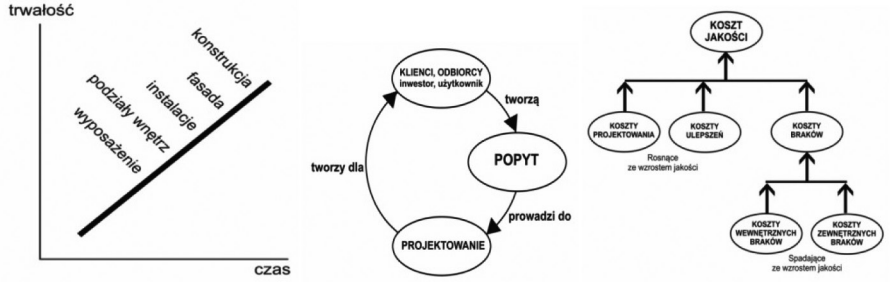
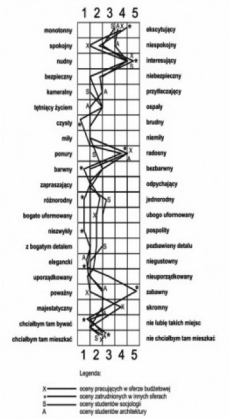
[1] Given in K. Fross, *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012. The monograph provides an extensive history of the development of qualitative research with a discussion of the state of research and literature.

[2] Given in K. Fross, *Qualitative research for the planning, programming, architectural design and evaluation of investment*, Builder, Business, Civil Engineering, Architecture, nr 6, PWB MEDIA, 2015, p. 14–17, 2015.

[3] 20 years of experience (1997–2017).



Ill. 1. Schemes: "6S" principle – different durability of building elements (author's elaboration, 2012), design aimed at manufacturing products that meet customer requirements and quality costs in architecture (author's elaboration according to D. Waters [2001], 2013)



Ill. 2. Semantic differentiation of the buildings characteristics that appeal to different groups of "social experts". Report from the research A. Bartoszek, poll by E. Niezabitowska [1996]. According to the documentation of the research project on the development of a functional and spatial program of the new city center of Ruda Śląska, using participative research of future users made under the direction of E. Niezabitowska [1996] (author's elaboration, 2012)

Ill. 3. A sketchy record of observational studies on the way how users behave at recreational facilities designed by the author in Marklowice and Rydułtowy (author's elaboration, 2012)

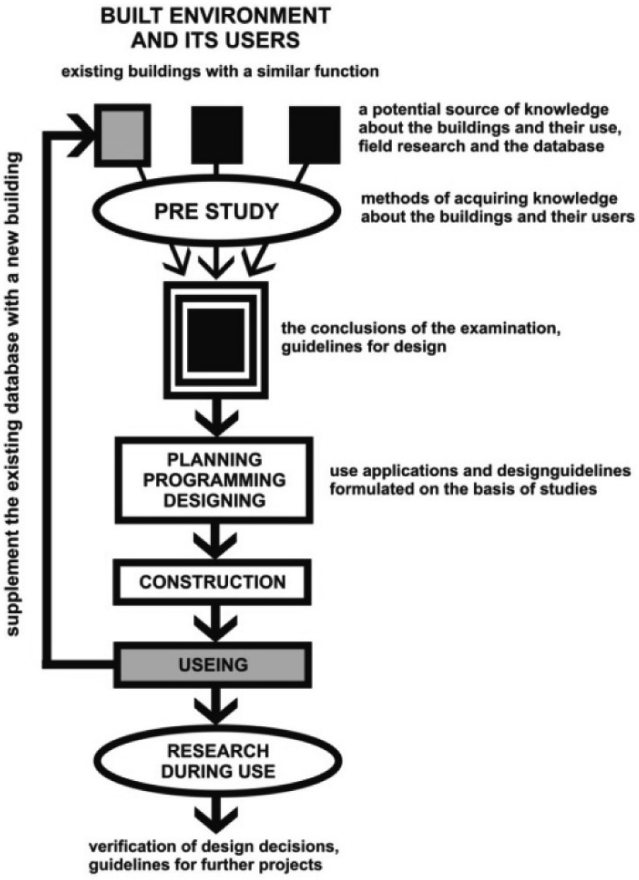
K. Fross, M. Bielak-Zasadzka, D. Winnicka-Jasłowska, J. Tymkiewicz, A. Bugno-Janik, D. Masły, M. Sitek and new propagators of the research approach to design A. Gumińska, A. Szewczenko, I. Benek, M. Tomanek, K. Ujma-Wąsowicz. Recently, there appeared important postdoctoral dissertations and presentations in the field of qualitative research at domestic and international conferences, seminars, and scientific meetings: AHFE, HCI, OKE, BIWA, TUP, PAN, INTERFACES, BUILDER, FORUM OF CIVIL ENGINEERING.

3. Knowledge or intuition?

The subject of the conference provokes it to be taken into consideration. The knowledge-based rationalist approach seems to be the right attitude for responsible design. On the other hand, an intuitive approach based solely on the creator's talent can give various results. In today's world, especially in investments, there is no space for experiments. An architect designs an object for someone's money. There is no room for trials or mistakes. The object is a packaging of the investor's goals and business activities, and it has to fulfill strictly defined tasks. Knowledge-based design, on the other hand, does not limit the freedom of creative expression in the area referred by Vitruvius as "beauty". Thus, the combination of a rational knowledge-based approach with the creative talent of an architect is certainly the way for success.

Vitruvius' triad formulates the essence of architecture that defines the core. However, contemporary beauty, function and design are surrounded by many circles of additional requirements, for example: strategic investment priorities, investor's business objectives, investment financing, return rate, users' needs, efficiency, economic solutions, operating costs, energy efficiency, ecology, versatility, flexibility, convertibility, adaptability, ergonomics, building regulations, provisions of the spatial development plan, conditions and context, location restrictions, and other rules, for example so-called "6S" (design including 6 building layers with different durability, time of wear and replacement). If all these elements are in balance and under control it's acceptable. But when there is a dominant artistic approach, intuitive, based on loose inspiration, or just a fashionable design, without controlling all the issues, there may be a danger of an ineffective, uneconomical building, although perhaps "nice".

In architecture, each line in the drawing has its expression in space and price. The following question can be asked: how much does a 10 cm line cost in the scale of 1:100 for a 4-storey building? Is architect thinking in this type of category while drawing the project? What is the awareness of how to invest money to influence design decisions? Apart from meeting the needs of users – which is an obligation, there are performing analyses of: operating costs, number of expected personnel, functional and economic efficiency, competitive facilities with a similar function, simulations of possible changes in the building over the next 10 years. You can also mention important issues such as: a building as a market product, quality costs in architecture, market rights, supply, demand, competitiveness, programming, optimization, business goals, investment priorities, user feedback. After all, these are extremely important issues, significant for the investor at the time of putting facility into the use, relevant for the success of the investment. The most important word in designing is – responsibility. All decisions taken at the idea, programming and design stages have visible effects during the use of the object.



Ill. 4. Diagram of the use of qualitative research (author's elaboration, 2012, 2017)

The following questions can be asked: Is an architect-artist allowed to do anything? Are there limits that cannot be exceeded? Where are the limits of efficiency and investment sense? Is everyone allowed to do the same thing? Are the "stars" of architecture allowed more? Can they exceed budgets and design non-economic buildings? Focus more on finding a form to get a work of art? After all, the goals of spectacular objects are often different than typical. The benefits are obvious – an attention, place advertisement (for example the Bilbao museum and the so-called Bilbao effect), thousands of visitors, demonstration of technical possibilities, etc. On the other hand, every day construction permits are issued for facilities with different functions, expectations and budgets that meet individual investors' goals.

Two approaches to architecture can also be noted: the first ignorant, with decisions according to subjective views ("I think so", "I know better"), with the main emphasis on the artistic side of the architectural work, using superficial inspirations, realizing the creator's

ego in terms of project creativity and the second: with the professional preparation of the pre-designing phase, the use of knowledge derived directly from the source of the assessments of the environment built and its users, with entire programming. Of course, the second approach does not exclude the creation of architectural works and creative self-realization of the designer[4]. The author's radical opinions lead to further reflection.

4. Knowledge for design

The built environment is created by man in the form of buildings and their complexes (agglomerations, cities, villages, housing estates, etc.), with all technical infrastructure and land development. The designed environment provides a framework for all human activities and relationships. It serves to satisfy various human needs, such as: living, work, services, recreation, etc. Architects give the built environment a form, which interacts and shapes users. The quality of the built environment as well as its relations with the natural environment are of great importance to the users themselves. Components of the built environment are designed, built and then used. They include admired, outstanding architectural works, ordinary, well-planned, meeting the needs and content-giving facilities, but there are also badly functioning, problematic buildings, often called "sick". An inefficient building can not only be old, in poor technical condition, which cannot meet modern expectations, but also a new, barely built modern facility[5]. As defined "sick building syndrome" (SBS) are problems associated with a decline in work efficiency, resulting in negative health phenomena among users of smart buildings.

In the modern world it is difficult to think about success in any field without possession of professional knowledge. In contemporary investments we are dealing not only with the market, competitiveness, galloping technical progress, constantly changing expectations; but above all the final customer – the user. His success depends on the success of the investment. It is he who at the end assesses the product (object, building), the work of the architects, but also assumption of the investor. Both investment and design decisions based on superficial reasons or intuition may not be accurate and are at risk of making numerous mistakes, as well as failure. Poorly prepared, erroneous in assumptions, the superficial functional and spatial program of the object may not achieve the expected effects, and as a result waste the funds allocated for this purpose[6]. Since users know so much about the objects they use, it is wise to use this knowledge directly from the source (from users of objects with similar functions). This is aptly recognized by S. Brand's statement [1995]:

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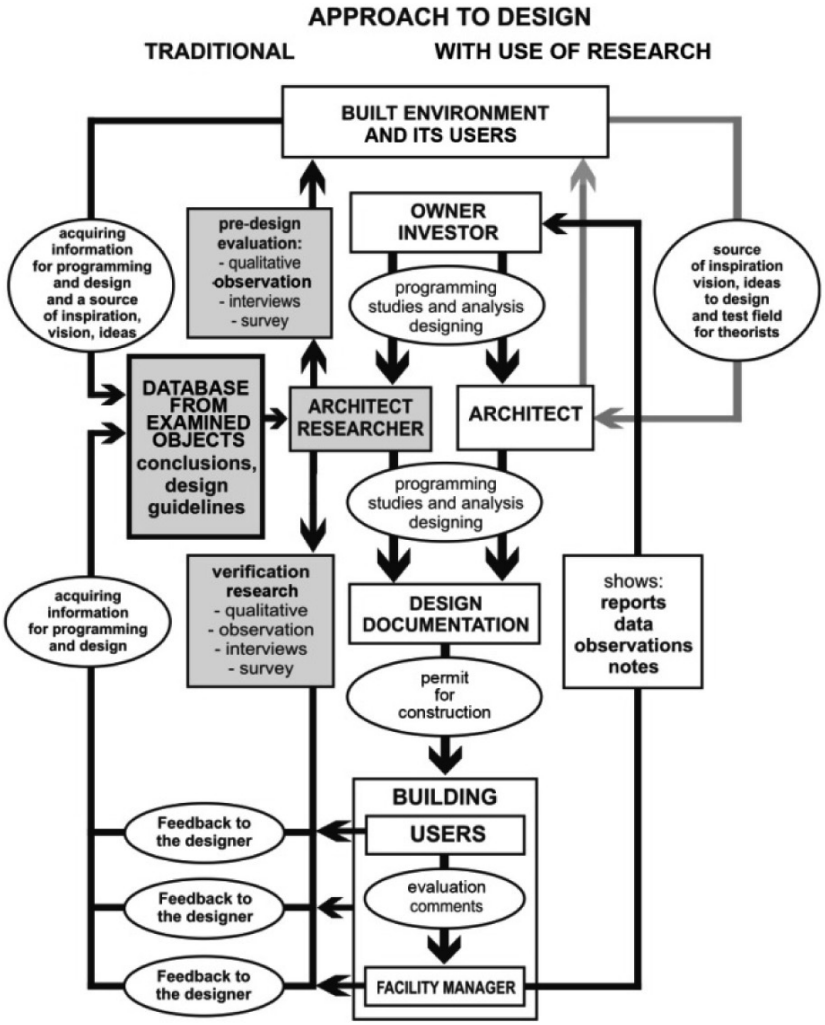
[4] According to K. Fross, *How many architects are allowed?* series: Design by Research, Builder, Business, Civil Engineering, Architecture, nr 6, PWB MEDIA, 2017 and K. Fross: *Architectural viruses. What is allowed to architects? I sit nice enough? Quality design based on knowledge, needs and priorities – standard and obligation*. in: BIWA 2. (CD-ROM) p. 7–18. t. 1, Faculty of Architecture of the Silesian University of Tech., Gliwice 2017.

[5] Quotation: K. Fross, *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012.

[6] Quotation: K. Fross, *Qualitative research for the planning, programming, architectural design and evaluation of investment, Builder, Biznes, Civil Engineering, Architecture*, nr 6, PWB MEDIA, 2015, p. 14–17, 2015.



Ill. 5. Author's diagram of the design process with the use of research (author's elaboration, 2012, 2017)

There seems to be nothing new in these ideas and that most of it is obvious. Of course, people know a lot about the buildings they use. Of course, it makes sense to learn from experience and provide information back to people who are building buildings so they can do it better next time[7].

[7] Given in: K. Fross, *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012., wg Niezabitowska E., Masły D. (red.): *Assessment of built environment quality and its importance for the development of concept of sustainable building*,

5. Qualitative research helpful in designing

Through qualitative research (universal methods and techniques of object evaluation), selected elements (zones, rooms), external environment and getting to know users' opinions, professional knowledge for programming and designing can be obtained. Traditional design based solely on intuition and artistic approach is always associated with increased risk. Therefore, qualitative design with the use of qualitative research is responsible design. It can initially be concluded that without professional knowledge it is not possible to talk about effective design.

There is a general lack of understanding of the need to perform research at the planning and programming stage of investments, in order to prevent future potential design errors or problems at the operational stage. Expert opinions and qualitative research are usually performed when a problem, defect, error, failure, signalled dissatisfaction, and high operating costs occur. Of course, it is better to prevent problems than to fix errors. It should be noted that not all building defects can be repaired at the stage of use. Historically, qualitative research emerged at the time when the problem arose when there was a need and it was noticed that the buildings designed by architects can cause many problems (for example health problems), have high maintenance costs, be troublesome in operation or reluctantly used (sick building syndrome).

Pre-designing qualitative research is about something completely different than in evaluating the search for the cause of the problem when it appears. Pre-designing research is about using knowledge and research methods to avoid mistakes made earlier in other buildings (for example facilities with a similar function), using good design practices. By this action, it is possible to create a better, more efficient, economical object, meeting the needs of users and the investor's goals, and to create a facility well-suited to expectations.

The use of pre-designing studies simply pays off, because it guarantees a good investment of money and obtaining an object which meets established goals, that ensures success. They provide security for the investor's targets. They allow the knowledge directly from the source – from users and facilities – to be used. Designing with the use of research – Design by Research means avoiding mistakes.

All investment and design activities must be based on knowledge, but not only on building regulations, notations in spatial plans, investor's guidelines, location analyses, etc. Currently, this resource of knowledge without extension to professional pre-designing research is insufficient.

This is evidenced by numerous implementations of ineffective, uneconomic, expensive to maintain buildings, reluctantly used or having problems with housing or renting. Then it is too late. Of course, you can implement recovery programs, try to modernise, transform and salvage the situation. But is it not possible to use the available knowledge and predict these elements? This is all about designing with the use of research to avoid mistakes, to predict problems at the planning and programming stages so that they do not appear during the design phase.

Publishing Silesian University of Technology, s. 100., Gliwice, 2007, and more [in:] Brand S., *How Buildings Learn. What Happens After They're Built.* Penguin Books, New York, NY 1995.

6. Objects and their users as a source of knowledge for design

Users evaluate the objects they use. They spend time, live, work, exploit and evaluate them. Therefore, both the built environment and users constitute a research field and a potential knowledge base, information about buildings, their advantages as well as defects and shortcomings. It is worth following this opinion using well-known research techniques[8]. After all, the essence of architecture is to create works for the user, and not only for the purpose of self-fulfillment, self-promotion or competition. A responsible architect makes self-esteem of created works and self-improvement by avoiding mistakes and applying proven design practices. Qualitative research is effective methods of obtaining information.

Qualitative assessments are used to obtain reliable information on the current state, potential of real estate or real user needs. Based on the results and conclusions from the research, in other words obtained knowledge, the right investment and design decisions can be made. Research results are the basis for making the right decisions. Each decision will be justified and the risk of error is reduced to a minimum. In the design practice (in programming and pre-designing phase), best practice standards can be used, and erroneous and faulty solutions can be avoided[9]. The important thing is that the acquired knowledge comes directly from the source – from the assessment of users' objects and opinions.

7. Architect-researcher as a necessity

As has been repeatedly demonstrated and found, qualitative research is an effective way of acquiring knowledge from the built environment and its users. These studies can become a valuable complement to the traditional approach to design, that is in line with the latest global design trends using Research by Design and Design by Research. For the implementation of *Quality Design*[10]*(using qualitative research) the author proposes an architect-researcher model that he designs using research. Def:* ***ARCHITECT-RESEARCHER***[11] *it is a model of*

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[8] See original methods and techniques of qualitative assessments described in the author's publications.

[9] Quotation, K. Fross, *Qualitative research for the planning, programming, architectural design and evaluation of investment, Builder, Biznes, Civil Engineering, Architecture*, nr 6, PWB MEDIA, 2015, p. 14–17, 2015.

[10] The utterance was used in 2012 for the purposes of postdoctoral dissertation: K. Fross: *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012.

[11] The utterance was used for the first time in 2012 in the postdoctoral dissertation: K. Fross: *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012. Then, it appeared in many publications, for example: K. Fross: *Modernity In architecture – Form or something more? – modern design with quality research*, nr. 6, tom 2, red: J. Witeczek, Publishing Silesian University of Tech., p. 65–81, Gliwice, 2012; K. Fross: *Architect-researcher as a model combination of research and design practice on examples*, [in:] *Advances in Human Factors and Sustainable Infrastructure*, editor: J. Charytonowicz, *Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics AHFE 2014*, Kraków, Poland 19–23 July 2014, Las Vegas, 2014; K. Fross: K. Fross, *Architectural viruses. What is allowed to architects? I sit nice enough? Quality design based on knowledge, needs and priorities – standard and*

a designer in which he personally or under his guidance performs the necessary pre-designing (qualitative, observational) research of objects with a similar function. On their basis, he draws conclusions and formulates guidelines for design. After completing the facility, he continues the assessments and observations in order to verify the design decisions and draw conclusions for new projects. This model prolongs the designer's interest for the use phase of the designed work (Fross K., 2012)[12].

It can be concluded that qualitative research is a necessary aid in the contemporary preparation of investments at the planning, programming and design stages, and then in the area of monitoring during the use of the facility.

References

[1] Brand S., *How Buildings Learn. What Happens After They're Built,* Penguin Books, New York, NY 1995.

[2] Fross K., *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012.

[3] Fross K., *Modernity In architecture – Form or something more? – modern design with quality research*, no. 6, vol 2, ed: J. Witeczek, Publishing Silesian University of Tech., p. 65–81, Gliwice, 2012.

[4] Fross K., *Architect-researcher as a model combination of research and design practice on examples*, [in:] *Advances in Human Factors and Sustainable Infrastructure*, editor: Charytonowicz J., Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics AHFE 2014, Kraków, Poland 19–23 July 2014, Las Vegas, 2014.

[5] Fross K., *Qualitative research for the planning, programming, architectural design and evaluation of investment*, Builder, Biznes, Civil Engineering, Architecture, no 6, PWB MEDIA, 2015, p. 14–17, 2015.

[6] Fross K., *Architectural viruses. What is allowed to architects? I sit nice enough? Quality design based on knowledge, needs and priorities – standard and obligation*, [in:] BIWA 2. (CD-ROM) p. 7–18, t. 1, Faculty of Architecture of the Silesian University of Tech., Gliwice 2017.

[7] Fross K., *How many architects are allowed?* edition: Design by Research, Builder, Business, Civil Engineering, Architecture, no 6, PWB MEDIA, 2017.

[8] Niezabitowska E., Masły D. (ed.), *Assessment of built environment quality and its importance for the development of concept of sustainable building*, Publishing Silesian University of Technology, p. 100, Gliwice, 2007.

obligation, [in:] BIWA 2. (CD-ROM) p. 7–18. t. 1, Faculty of Architecture of the Silesian University of Tech., Gliwice 2017.

[12] Quotation: K. Fross, *Qualitative research in architectural designing on selected examples*, Publishing Silesian University of Tech., Gliwice, Poland, 2012.