The Way of Improvement of Quality of Life of Older Persons as Users and Maintainers of Technical Means

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INTRODUCTION

In human life there are needs, which may be high quality of life. These needs can be met using specific technical means and their surroundings for this purpose. It may be possible if some activities on the particular stages of needs meeting process will be undertaken (containing recognition of need, designing, constructing, production and exploitation of technical mean), what makes possible to achieve this purpose. But it is necessary to perform analyses of exploitation data and information and creation of solutions to improve quality of life.

Therefore in the article the conception of way of improvement of quality of life of older persons as users and maintainers of technical means has been presented. This conception is applied for exploitation improvement.

QUALITY OF LIFE – THE SELECTED PROBLEMS

Quality of life problem is multidisciplinary, because it is an object of considerations of specialists representing various fields of knowledge. It is an object of interests of persons representing medical sciences and social ones (the examples of elaborations describing these problem is (Czapiński, 1994), (Czerw, 2017), (Fredrickson, 2017), but also technical sciences, whose example is (Midor and Wieczorek, 2016), (Wieczorek, 2016), (Wieczorek, 2017), (Wieczorek, 2020). Quality contributes to many differerent elements including but not limited to (Kusterka-Jefmańska, 2010):

- The state of the natural environment;
- Wealth perceived both in the material sense, as goods in our possession, and in the non-material sense, as access to education and culture;
- Health and safety both in terms of health (threat to life) and in terms of loss of property (crime and natural disasters) and in the economic sense (necessary financial resources);

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- Sense of being rooted in the local environment, interpersonal relations and participation in the life of a given community and influence on decisions concerning its collective and individual life.

The first two mentioned elements indicate a good owned by a person, which may be a technical mean. Its exploitation influences the natural environment. Taking into account the first mentioned element growth of quality of life level collides with the problem of growth of technical means amount. The attention to it is paid in (Wieczorek, 1997), (Wieczorek, 1997), (Wieczorek, 1998). Therefore, the concept of sustainable development has emerged, which ensures the improvement of the condition of the natural environment while ensuring a high quality of life for societies. More and more societies are interested in problems of ecology, including older persons. Due to the necessity to guarantee an adequate quality of life for their grandchildren in the future, these people undertake activities aimed at improving the condition of the natural environment. Contemporary scientific problems in the field of environmental protection include the topic of the consequences of using technical means. This topic is also discussed in the literature on the use of technical means. An example that draws attention to the link between environmental protection and the exploitation of technical systems is (Kowal et al., 2013) (it focuses on the legitimacy of using the TPM policy for the purposes of environmental protection). Therefore, there is an urgent need to provide seniors with a high quality of life, taking into account the needs resulting from ensuring sustainable development. The idea for solving the discussed problem is the proposed 4R philosophy, this one and activities connected with it are described in (Dengler et al., 1996), (Dröscher, 1996), (Flapper, 1995), (Flapper, 1995), (Hernández, 2019). The “4R” abbreviation comes from the terms: Reduce – Reuse – Recycle – Recover. The “Reduce” term may be understood as all activities, which cause to reduce generation of waste (Lost Spaces, 2021). The “Reuse” term means that technical mean is used repeatedly. The field of knowledge, which is the operation of technical means, involves taking actions such as repair by regeneration of technical means or their components. The recovering may be applied in the following situations:

- Material recovering;
- Energy recovering;
- Re-using them in whole or in part for specific purposes.

This concept has evolved and now the “6R” abbreviation appears, which is the previously mentioned approach to environmental protection supplemented by the terms (Lost Spaces, 2021):

- Rethink – this concept covers critical thinking consisting in analyzing one's everyday consumer habits;
- Refuse – means consciously limiting your purchases.

Quality of life problem (taking into account presented ecological problems) concerns acquisition and exploitation of owned technical means. However,

these stages of the life cycle of a technical means should also be of interest to the designer, constructor or manufacturer. Therefore, it is advisable to look for solutions at all stages of the cycle in question.

Ergonomic design, described in (Shorrock, 2016), but also exploitation should be carried out with the use of analyzes taking into account the following aspects: technical, economic, organizational and environmental, as well as social aspects. In the last-mentioned case, it may be advisable to use the social assessment of technology, which involves collecting and analyzing data/information on opinions expressed by users/maintainers of technical means. The need to assess the quality of life may require data, e.g. on the emotions and feelings of users and maintainers, appearing during the exploitation of a technical means. (Łosiak, 2007) presents the theme of feelings and emotions.

The exploitation of technical means aimed at improving the quality of life of their users and maintainers requires the determination of factors influencing this quality. Figure 1 shows the areas of activity that affect it. Due to its innovative nature, the development of models for assessing the impact of exploitation strategies or the technical condition of a technical measure on the quality of life of older people may be of particular importance for the discussed subject.

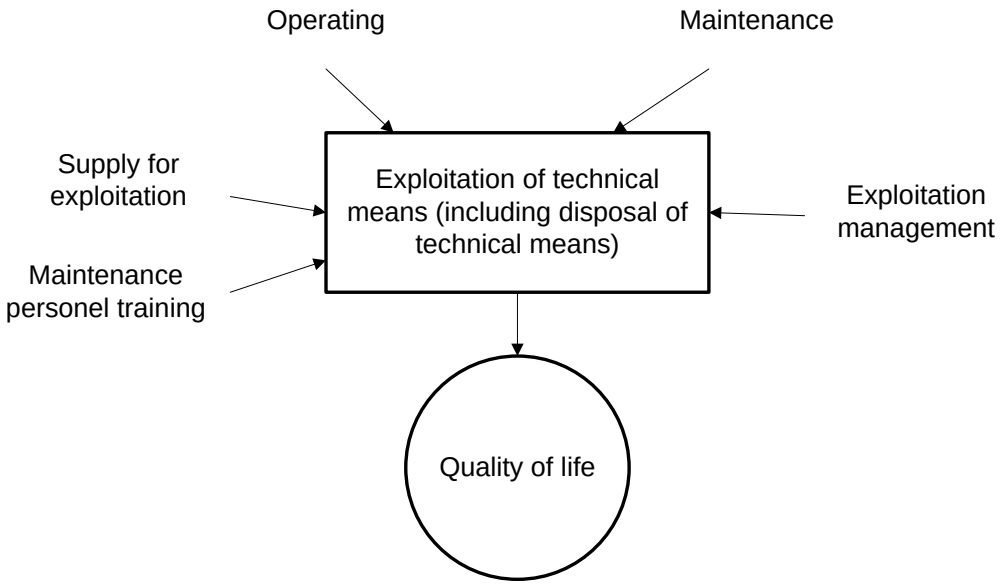

Fig. 1 Areas of exploitation activities influencing quality of life of older persons

Conducting proper exploitation, as well as undertaking design works, requires the use of appropriate solutions; Therefore, it is necessary to search for appropriate methods and techniques supporting individual stages of the technical product life cycle. The multifaceted nature of the presented issues requires building models consisting of a large number of variables (this is indicated by (Wieczorek, 2014), which will most often be random, which justifies the use of simulation tools described in (Banks, 1998), (Rubinstein and Kroese, 2016). In addition, the necessity to make decisions will require a lot of knowledge

on the basis of the collected data, therefore it is suggested to use the knowledge engineering methods described in (Nikolopoulos, 1997).

THE WAY OF IMPROVEMENT OF QUALITY OF LIFE OF OLDER PERSONS

The answer to the requirement to meet the above-mentioned needs by people of different ages (including the elderly) as users and operators of technical means may be the process represented by the scheme of process of satisfying the needs according to J. Dietrych (Fig. 2), described in (Dietrych, 1978). The last stage of the mentioned process is exploitation, including also disposal of technical means. Satisfying the needs related to the exploitation of technical means may take place through:

- Taking actions at the exploitation stage aimed at its improvement (including improvement of the quality of human life – user and/or maintain of technical means);
- Taking actions at other stages in the process of meeting the needs – for this purpose, information feedbacks should be used, obtained as a result of the use of technical means and transferred for re-design (there is information feedback between the exploitation stage and the design stage).

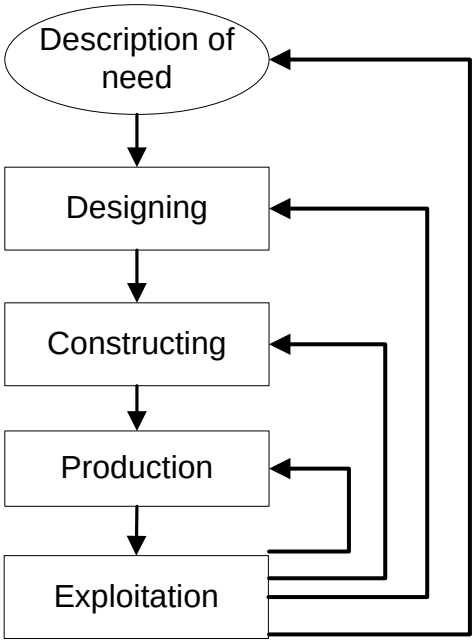

Fig. 2 Scheme of process of satisfying the needs according to J. Dietrych, with existing information feedbacks

The research will be aimed at elaboration of multidisciplinary model supporting growth of quality of life level of older persons with taking into consideration the need of environment protection by decision making in accordance with original elaborated strategy including selected elements of commonly applied another exploitation strategy and policies (RCM, TPM, BCM, TPM) and makes assumptions of 6R method. In the proposed model the following aspects are taken into consideration:

- Technical aspects;
- Economical aspects;
- Organisational aspects;
- Environmental aspects;
- Social aspects.

The proposed model will be applied in both above mentioned cases. With its use the establishment of exploitation activities, which may be undertaken to ensure the desired quality of life of older persons being users of technical means will be possible. This establishment will be achieved by execution of calculations and simulations of exploitation measures values and values of technology assessment characteristics and making decisions on activities established basing on them. The procedure with the use of the proposed model will contain the following steps:

- Selection of technical mean/its selected component;
- Selection of the feature/phenomenon which will be assessed (feature of technical mean/its component, exploitation event, exploitation or supporting process (material supply process or exploitation personnel training process), exploitation or supporting system, technical state of technical mean);
- Calculation or simulation of values of indicator of feature/phenomenon assessment;
- Calculation or simulation of values of indicator/characteristics of total estimation of quality of life; for this purpose, a model will be developed using the quality of life assessment matrix presented in Fig. 3, in which there will be values of persons quantity identifying with specific emotion/feeling being answer to specific feature/phenomenon; this quantity is estimated basing on surveys, the questions in the survey will be formulated for the previously estimated value of the indicator/evaluation characteristic of the phenomenon);
- Indicating activities to realise basing on optimization performed with the use of 6R method.

The researches conducted with the use of proposed methodology will include the following technical means:

- Buses (city – buses, intercity bus, tourist bus);
- Cars and trucks;
- Mopeds;
- Bicycles;
- Walkers (for seniors);
- Wheelchairs;
- Trains;
- Supply (water supply, sewage supply, another ones);
- Another machines and devices in service and production companies.

	Emotions/feelings				
Construction feature	Sadness	Feeling ackward	Joy	Shame	Fear
Element 1	0	0	0	0	0
Feature 1	100	0	0	0	0
Feature 2	60	0	40	0	0
Feature 3	100	0	0	0	0
Feature 4	0	0	50	0	0

Fig. 3 Matrix of quality of life assessment

In the conducted researches the following features of technical means will be taken into consideration:

- Construction features;
- Exploitation features;
- Technical State features;
- Human engineering features.

There are the following construction features of technical means:

- Geometric features;
- Materials;
- Dynamic features.

The operational features of the technical means that are the subject of the research should include their properties. Among the properties of these funds, the following can be distinguished (Lewitowicz and Kustroń, 2003)

- Functions;
- Dimensions;
- Weight;
- Resilience;
- Stability;
- Operational potential;
- Operational potential for maintenance;
- Controllability;
- Recoverability;
- Functionality (utility, maintenance, airworthiness maintenance);
- Value;
- Storageability;
- Readiness (technical, operational);
- Economic durability;
- Reliability;
- Security;
- Economy;
- Lifetime;
- Durability – service life (hourly, calendar, inter-renovation);
- Operational susceptibility;
- Suitability;

- Efficiency;
- Testability;
- Resistance to environmental conditions;
- Damage, wear, corrosion, material fatigue;
- Resilience.

To the researched human engineering features it is necessary to include antropometrical ones.

With the application of methodology presented in the article the following topics of researches may be undertaken:

- An improvement of quality of human life with the use of 6R philosophy and reliability methods;
- Multiaspect exploitation planning of technical means for using them by older persons;
- The assessment of influence of exploitation events on older persons' quality of life,
- The assessment of influence of material supply systems on older persons' quality of life;
- The assessment of influence of technical states (condition) on quality of life of older persons;
- The role of technology assessment method in decision making in accordance with 6R method.

CONCLUSIONS

Increasing the level of the quality of life in various spheres of human life is becoming a significant problem of humanity. This applies to people of all ages, including the elderly. It becomes necessary for engineers to search for engineering, but also non-engineering methods and techniques that will guarantee the implementation of pro-quality activities throughout the life cycle of a technical means. Therefore, in the research conducted, the author looks for solutions in various fields of knowledge that help improve the quality of life. They include methods and techniques supporting the social evaluation of technology, but also ergonomic design. The simulation of exploitation processes suggested in the paper may allow to indicate the optimal solutions of the designed (with the use of ergonomic design) technical means. It is important that the technical measure is adapted to people of different ages.

REFERENCES

4R Principle Reduce, Reuse, Recycle and Recover. Waste management. Available at: https://dreamcivil.com/4r-principle/ [Accessed 15 Sep. 2021].

Banks, J. (1998). Handbook of simulation. New York: John Wiley & Sons, Inc,

Dengler, T., Hollingshead, A. and Shermetta, S.(1996). Scrap tyre burning at Lafarge. World Cement, 27 (4), pp. 4.

Dietrych, J. (1978). System i konstrukcja (System and construction), Warszawa: WNT.

Dröscher, M. (1996). Recovery of used plastics in Germany: ecological and economical aspect. Polymer Recycling, 1(2), pp. 43-48.

Flapper, S. D. P. (1995). One – way or reusable distribution items ? Research Report TUE/BDK/LBS/95 – 04.
Flapper, S. D. P. (1995). On the operational logistic aspects of reuse. In: the International Symposium on Logistic, Nottingam (UK), pp. 343-348.
Czapiński, J. (1994). Psychologia szczęścia (Psychology of happiness). Warszawa: PWN.
Czerw, A. (2017). Psychologiczny model dobrostanu w pracy (Psychological model of well-being in work). Warszawa: PWN.
Fredrickson, B. L. (2017). Pozytywność (Positivity). Warszawa: Zysk i S-ka.
Hernández, A. E. B., Luc T., Beno, T., Fredrisson, C., Jawahir, I. S. (2019). Process sustainability evaluation for manufacturing of a component with the 6R application. In: 16th Global Conference on Sustainable Manufacturing – Sustainable Manufacturing for Global Circular Economy. Procedia Manufacturing, 33 (2019), pp. 546-553.
Kowal, E., Kucińska-Landwójtowicz, A., Misiołek, A. (2013): Zarządzanie środowiskowe (Environmental management). Warszawa: Polskie Wydawnictwo Ekonomiczne.
Łosiak, W. (2007). Psychologia emocji (Psychology of emotions). Wydawnictwa Akademickie i Profesjonalne.
Kusterka-Jefmańska, M. (2010). Wysoka jakość życia jako cel nadrzędny lokalnych strategii zrównoważonego rozwoju (High quality of life as the overarching goal of local sustainable development strategies). Zarządzanie publiczne, 4(12).
Lewitowicz, J., Kustroń, K. (2003): Podstawy eksploatacji statków powietrznych, Part 2., Warszawa: WITWL.
Midor K., Wieczorek A. (2016). Kształtowanie jakości życia pracowników w środowisku przemysłowym – studium literaturowe (Shaping the quality of life of employees in the industrial environment – a literature study). In: Ryszard Knosala, ed., Innowacje w zarządzaniu i inżynierii produkcji. Part 2. Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, pp. 431-438.
Nikolopoulos, C. (1997). Expert systems. New York – Basel – Honk Kong: Marcel Dekker, Inc.
Rubinstein, R. Y. and Kroese D. P. (2016). Simulation and the Monte Carlo Method. Wiley.
Shorrock, S. (2016). Human factors and ergonomics in practice: improving system performance and human well-being in the real world. Taylor & Francis Ltd.
Wieczorek, A. (2014). Klasyfikacja i charakterystyka cech modelu układu człowiek – środek techniczny – otoczenie dla potrzeb zarządzania eksploatacją środków i systemów technicznych (Classification and characteristics of features of unit: man – technical mean – surroundings for exploitation management of technical means). In: Ryszard Knosala, ed., Innowacje w zarządzaniu i inżynierii produkcji. Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, pp. 105-118.
Wieczorek, A. (2016). Gerontechnologia w rozwiązywaniu problemów osób starszych (Gerontechnology in solving problems of older persons). Systemy Wspomagania w Inżynierii Produkcji, vol. 2, pp. 358-370.
Wieczorek, A. (1997). Powtórne użytkowanie środków technicznych. Analiza zagadnienia na przykładzie autobusów komunikacji miejskiej (Reusing of technical means. Problem analysis on an example of city – buses). Praca dyplomowa magisterska. Politechnika Śląska, Gliwice 1997 (not published).
Wieczorek, A. (1998). Problem wzrastającej liczby środków technicznych – metody rozwiązania problemów skutków zjawiska (The problem of increasing amount of technical means – methods of solving problems of phenomenon effects). Zeszyty Naukowe Politechniki Śląskiej, series: Organizacja i Zarządzanie, 3(1387), Gliwice.
Wieczorek, A. (1997). Reusing processes in a case of exploitation of city – buses. In: 7th European ISTVS Conference, pp. 295-302.

Wieczorek, A. (2017). Wybrane problemy społecznej oceny systemów technicznych wspomagających funkcjonowanie osób starszych w transporcie oraz sposoby ich rozwiązywania (Selected problems of social assessment of technical systems supporting the functioning of elderly people in transport and ways of solving them). Systemy Wspomagania w Inżynierii Produkcji, 6/5, pp. 44-54.

Wieczorek, A. (2020). Koncepcja metody oceny jakości życia użytkowników środków technicznych (The conception of method of the assessment of quality of life of technical mean users). In: R. Knosala, ed., Inżynieria Zarządzania. Cyfryzacja produkcji. Aktualności badawcze. 2. Part. 2, Warszawa: Polskie Wydawnictwo Ekonomiczne.

Abstract: In the article the way of improvement quality of life as users and maintainers of technical means is presented. It is assumed that it is necessary to keep the fundamental of sustainable development. Therefore the application of the scheme of the process of satisfying needs is shown. It helps establish the activities necessary to achieve this goal and enables to plan required information resources. In the range of exploitation and design tasks the application of original strategy of exploitation by older persons was proposed. This strategy uses 6R method which in the future will be supplemented on elements commonly executed strategies and policies of exploitation. Decision making in accordance with proposed strategy will be possible by performing calculations and simulation with the use of multidisciplinary model, whose conception was indicated in the article and which uses matrix of assessment of the quality of life.

Keywords: quality of life, older persons, human engineering, exploitation of technical means, psychology