

# POPULATION AGING AND ITS CONSEQUENCES

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## Abstract

The demographic aging of the population and the associated pension system is a widely discussed topic today, which is gaining importance over time. Gradually, almost all developed countries, not only in Europe, are solving or will have to solve the demographic aging of the population shortly. They will have to face this problem as soon as possible and start solving some critical aspects and difficulties that this aging brings. It is primarily a problem of the pension system, which will not be able to function in the future as it functions today in the Czech Republic, for example. This pension system was constructed in the past when the issue of aging was not nearly as topical as it is today and will be topical in the next few years. The aging population applies not only to the pension system but also to other things, such as services that concern the elderly. Another significant factor will continue to be the increasing costs of healthcare, which will significantly burden the state's economy. Therefore, the government will have to take procurement to mitigate this population aging as much as possible. Possible solutions how to solve this situation will be brought in this paper.

**Keywords:** Population aging, Industry 4.0, Industry 5.0, projected structure of the population, Society 5.0

**JEL Code:** J00, J11, J19

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## Introduction

The paper aims to evaluate the demographic aging of the population of the Czech Republic. Furthermore, to assess its economic and social impacts on selected sectors of the national economy of the Czech Republic. The methodology is based on the analysis of literature sources and statistical data. Also, other theoretical methods of scientific knowledge were used: induction, deduction, research, and scientific abstraction for the generalization of the results. The development of demographic indicators has shown for a long time that the population of the EU countries is aging unstoppably. This trend is not a unique phenomenon only in EU countries, but a similar situation exists in other countries across the world. Several authors write about this; for example, Balachandran et al. (2019) wrote: "*reported countries, the numbers of*

*elderly and their population shares have been increasing rapidly in recent decades, and these trends are expected to accelerate in the coming decades"* Another author who deals with the consequences of an aging population is Szopa, B. (2016). She considers that there will be many changes in the future, and the problems connected with the aging of the population – people are necessary to analyse the macroeconomic and microeconomic aspects of the two groups.

It is impossible to think that this adverse situation can radically change because today's young people prioritize different life values than previous generations. However, it is essential to realize that the contemporary lifestyle is entirely different from the last age. They prefer traveling, building a career, free time, etc., to the traditional "sedentary" life and starting a family.

The aging of the population is a social phenomenon that has significant impacts on several areas of the life of the entire society. E.g., the lack of economically active people (pension policy), increased demands for social and health care, etc.

Individual EU countries take different measures; they prioritize resolving this situation as quickly as possible, efficiently, and effectively.

It is essential to realize that people in the post-productive age (seniors) have different needs than people in the productive age - period.

## **1 Literature overview**

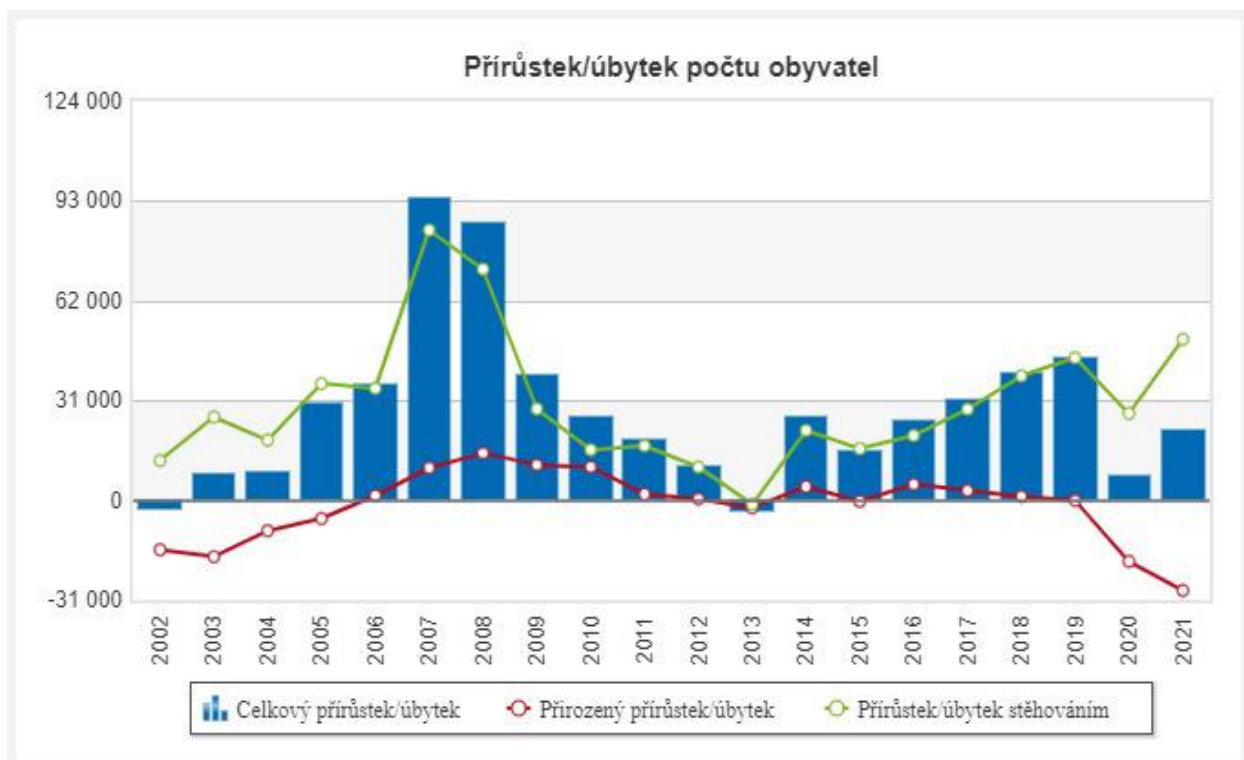
Many authors deal with the problem of the aging population and its economic, social, and political consequences. Nowadays, this topic is very frequently discussed. For example, Fiala and Langhamrova (2013) wrote: *"t is clear from demographic analyzes to date that the aging of the population will continue for at least several decades. Therefore, to consider how society should respond adequately to our aging population's economic, social, and other consequences, we must first have a relatively accurate idea of what our population will look like in the future. This can be obtained based on demographic forecasts and projections of further development of our population."*

Philipov, D, Goujon, A., and Di Giulio, P. (2014) are other authors dealing with the population's aging. These authors researched how rising human capital affects the consequences of population aging. These authors wrote: *"...the human capital of the elderly population is composed in a specific way that is shaped by their earlier schooling and work experience. For an elderly population of a fixed size and age-sex composition, this entails that the higher human capital is, the greater the total amount of public pensions to be paid."*

Another author who deals with population aging is Bujard (2015). He thinks that even the immigration may decelerate the population decline, it will be without any effect on aging, and society will have to deal with the problem of aging.

Other authors who deal with the problem of aging and its consequences are De Meijer et al. (2013). Among other things, they dealt with health-related causes of the relationship between age and health expenditures. They wrote: "*predictions that account for health, either directly or through the variable of mortality as a proxy, tend to find that population aging only moderately contributes to health expenditure growth. The results, therefore, seem to support the second view. However, the effect of population aging is much stronger for long-term care compared to acute care. The annual health expenditure growth attributed to population aging is up to 1 %, which is far from trivial.*"

**Fig. 1: Increase/decrease in the number of inhabitants in the Czech Republic (2002 – 2021)**



Source: Czech Statistical Office, 2022

As shown in figure 1, the blue columns represent the total increase/decrease in the number of inhabitants. The red curve represents the natural increase/decrease in the number of inhabitants, and the green curve - angle represents the increase/decrease by moving. Natural population decline has prevailed in the Czech Republic in the last few years. This increase in population has been increasing since 2013 only, thanks to the rise in migration. It had a

downward trend in 2020 because of the pandemic Covid 19 and the closure of borders due to Covid 19.

Some authors deal with Industry 4.0, which is possible to replace human labor with robotization and automatization.

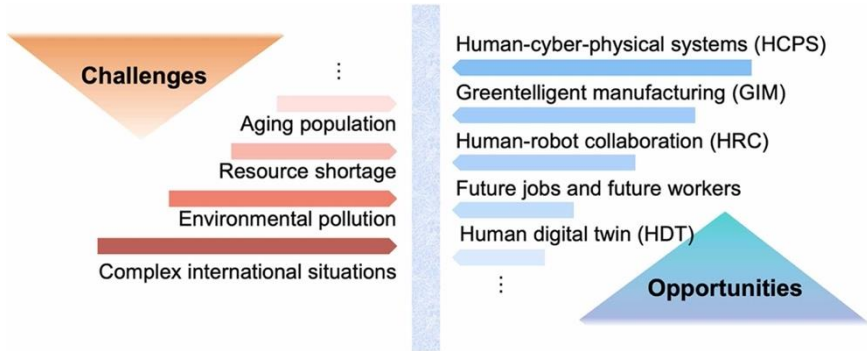
Majstorovic et al (2019) deal with Industry 4.0. He described this program as a new model of automatization of manufacturing technologies and the current level of development of the Industry 4.0 program.

Masarova et al. (2019) examined the impact of the Industry 4.0 initiative on societal changes. The following tasks have been identified to realize our objective: to define critical words (Industry 4.0 ambition, Internet of things) and to analyse the impact of Industry 4.0 on work-life balance. Research methods used in the paper: general theoretical methods of scientific knowledge - induction, deduction, analysis, synthesis of available bibliographic references, and scientific abstraction to generalize the results.

Huang et al. (2022) deal with Society 5.0 and Industry 5.0. He wrote: "*The concept of Society 5.0 was proposed to balance economic advancement with the resolution of social problems (e.g., old tendency, low birth rates, and lack of competitiveness) in Japan. The goal of Society 5.0 is a human-centric super-smart society to ensure all citizens can access high-quality lives full of comfort and vitality by providing necessary goods and services for individual people at the necessary level when needed through merging between cyberspace and physical space with 5 G, Big data, artificial intelligence, etc.*".

Huang et al. (2022) described the challenges and opportunities in Industry 5.0 and Society 5.0

**Schema 1: Summary of challenges and opportunities.**



Source: Huang et al., 2022

**Tab. 1: Age structure of the Czech Republic population in 1947–2021**

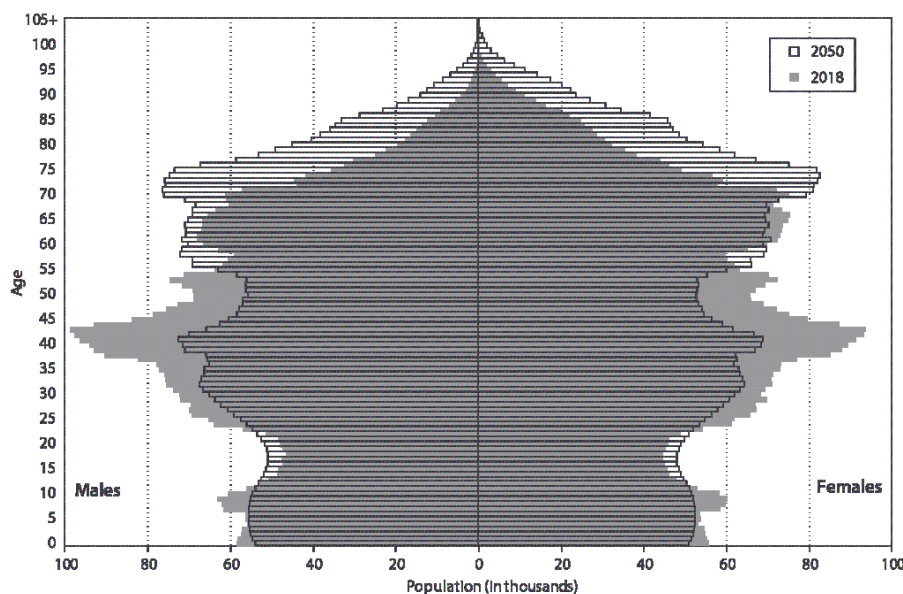
Year	Population						Population %		
	Total	0–14 years	15–64 years	20–64 years	65+ years	80+ years	0–14 years	15–64 years	65+ years
1947	8840287	2039645	6090160	5398747	710482	80348	23,1	68,9	8,0
1948	8893180	2096818	6071801	5406531	724561	83897	23,6	68,3	8,1
1949	8892449	2139927	6014231	5377451	738291	86584	24,1	67,6	8,3
1950	8978854	2203161	6015068	5411612	760625	92868	24,5	67,0	8,5
1951	9074172	2272098	6027105	5450305	774969	95374	25,0	66,4	8,5
1952	9177611	2342240	6044286	5488250	791085	99334	25,5	65,9	8,6
1953	9262646	2397522	6057570	5508915	807554	102871	25,9	65,4	8,7
1954	9329036	2445537	6065015	5515927	818484	104348	26,2	65,0	8,8
1955	9405047	2475043	6096427	5524539	833577	107662	26,3	64,8	8,9
1956	9480206	2502297	6124418	5526778	853491	108901	26,4	64,6	9,0
1957	9543780	2516431	6159915	5530212	867434	110035	26,4	64,5	9,1
1958	9597963	2497758	6208534	5534640	891671	117417	26,0	64,7	9,3
1959	9637840	2469772	6254454	5540185	913614	121089	25,6	64,9	9,5
1960	9566172	2435976	6220350	5487446	909846	117818	25,5	65,0	9,5
1961	9607129	2380828	6288723	5504925	937578	121525	24,8	65,5	9,8
1962	9642191	2325239	6355074	5522025	961878	124095	24,1	65,9	10,0
1963	9699179	2294061	6413790	5557064	991328	128030	23,7	66,1	10,2
1964	9756429	2276531	6457145	5588298	1022753	132960	23,3	66,2	10,5
1965	9802287	2246555	6498331	5606018	1057401	137100	22,9	66,3	10,8
1966	9839792	2210247	6537691	5654734	1091854	141747	22,5	66,4	11,1
1967	9866006	2173155	6565548	5698152	1127303	145680	22,0	66,5	11,4
1968	9886686	2139756	6590507	5735274	1156423	148686	21,6	66,7	11,7
1969	9906474	2115048	6608415	5760300	1183011	152178	21,4	66,7	11,9
1970	9809667	2081669	6534836	5705614	1193162	148100	21,2	66,6	12,2
1971	9843962	2075768	6546761	5733515	1221433	152330	21,1	66,5	12,4
1972	9891302	2086057	6554567	5761155	1250678	155728	21,1	66,3	12,6
1973	9953230	2126416	6549512	5783037	1277302	159011	21,4	65,8	12,8
1974	10023688	2190972	6528594	5798659	1304122	162795	21,9	65,1	13,0
1975	10093551	2253053	6510054	5814626	1330444	168566	22,3	64,5	13,2
1976	10158327	2308846	6496824	5830860	1352657	173725	22,7	64,0	13,3
1977	10215183	2356892	6485346	5839741	1372945	179702	23,1	63,5	13,4
1978	10269012	2388081	6489857	5837323	1391074	186051	23,3	63,2	13,5
1979	10315669	2407530	6504728	5827884	1403411	192550	23,3	63,1	13,6
1980	10292717	2414163	6509099	5817863	1369455	194810	23,5	63,2	13,3
1981	10308465	2419754	6559945	5859646	1328766	201095	23,5	63,6	12,9
1982	10321186	2424992	6613987	5908780	1282207	208438	23,5	64,1	12,4
1983	10326526	2426972	6667437	5972847	1232117	213324	23,5	64,6	11,9
1984	10333900	2422577	6692112	6007400	1219211	218546	23,4	64,8	11,8
1985	10340335	2411785	6703143	6016040	1225407	222379	23,3	64,8	11,9
1986	10344119	2392949	6711373	6010017	1239797	228398	23,1	64,9	12,0
1987	10350517	2362242	6729577	6002328	1258698	235569	22,8	65,0	12,2
1988	10360034	2316017	6765414	5993995	1278603	243931	22,4	65,3	12,3
1989	10362102	2252709	6817371	5995565	1292022	251632	21,7	65,8	12,5
1990	10364124	2193682	6867991	6003253	1302451	258954	21,2	66,3	12,6
1991	10312548	2120802	6876788	5983545	1314958	263878	20,6	66,7	12,8
1992	10325697	2064545	6932894	6022234	1328258	272305	20,0	67,1	12,9
1993	10334013	2009752	6981337	6072727	1342924	279640	19,4	67,6	13,0
1994	10333161	1948024	7028905	6140855	1356232	285096	18,9	68,0	13,1
1995	10321344	1893259	7055805	6204140	1372280	277109	18,3	68,4	13,3
1996	10309137	1842679	7078210	6267352	1388248	263167	17,9	68,7	13,5
1997	10299125	1795032	7102231	6329734	1401862	247832	17,4	69,0	13,6
1998	10289621	1751471	7126712	6393464	1411438	234256	17,0	69,3	13,7
1999	10278098	1707205	7152815	6453283	1418078	237215	16,6	69,6	13,8
2000	10266546	1664434	7179109	6496776	1423003	249767	16,2	69,9	13,9
2001	10206436	1621862	7170017	6495559	1414557	260302	15,9	70,2	13,9
2002	10203269	1589766	7195541	6530259	1417962	277204	15,6	70,5	13,9
2003	10211455	1554475	7233788	6569747	1423192	292753	15,2	70,8	13,9
2004	10220577	1526946	7259001	6601806	1434630	308332	14,9	71,0	14,0
2005	10251079	1501331	7293357	6639838	1456391	321532	14,6	71,1	14,2
2006	10287189	1479514	7325238	6673991	1482437	335554	14,4	71,2	14,4
2007	10381130	1476923	7391373	6744946	1512834	348546	14,2	71,2	14,6
2008	10467542	1480007	7431383	6794135	1556152	361866	14,1	71,0	14,9
2009	10506813	1494370	7413560	6797569	1598883	373047	14,2	70,6	15,2
2010	10532770	1518142	7378802	6796152	1635826	386512	14,4	70,1	15,5
2011	10505445	1541241	7262768	6721663	1701436	396383	14,7	69,1	16,2
2012	10516125	1560296	7188211	6677946	1767618	406181	14,8	68,4	16,8
2013	10512419	1577455	7109420	6629546	1825544	412049	15,0	67,6	17,4
2014	10538275	1601045	7056824	6593741	1880406	418698	15,2	67,0	17,8
2015	10553843	1623716	6997715	6539712	1932412	420536	15,4	66,3	18,3
2016	10578820	1647275	6942623	6483950	1988922	424841	15,6	65,6	18,8
2017	10610055	1670677	6899195	6436995	2040183	427422	15,7	65,0	19,2
2018	10649800	1693060	6870123	6402732	2086617	432907	15,9	64,5	19,6
2019	10693939	1710202	6852107	6374077	2131630	441100	16,0	64,1	19,9
2020	10701777	1719741	6823714	6333264	2158322	447526	16,1	63,8	20,2
2021	10516707	1693408	6654190	6150885	2169109	451143	16,1	63,3	20,6

Source: Czech Statistical Office, 2022

As it is possible to see in tab.1, the population of 0-14 years started to decrease from 1984, the population of 15-64 years began to decline from 2007, and 65 + years old people increased from 1947.

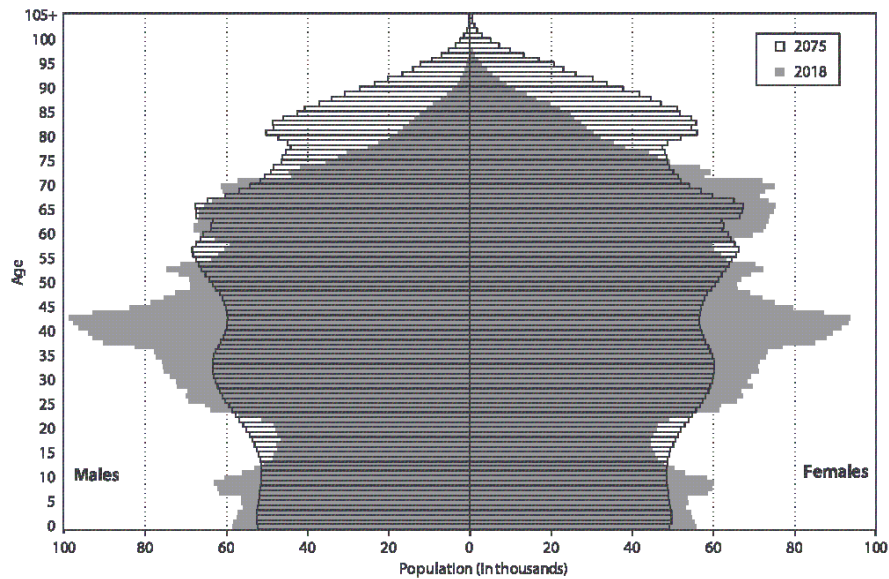
Kurkin (2019) predicted the structure of the population of the Czech Republic in the following decades. As shown below in figures 2, 3, and 4: *"The population pyramids show the shifting of the population into older age groups and the gradual diminishing of the generation born in the 1970s (currently the most numerous generations). However, this generation is expected to be the largest until 2051. Starting in 2052, the 1980s generation should be the numerically largest generation. In 2057 the 2010s generation will take the position of the largest group, and after that, only generations that are not yet born will be the most populous ones. The population's age structure is becoming more even than it was in the first year of Projection 2018 due to the smooth development of assumptions. The age at which there will be more females than males in the population is expected to move from 58 years in 2018 to 67 years in 2050 and then to 72 years in the last projected year. The share of males in the population is projected to increase from 49.2% in 2018 to 50.3% by the end of the project period (the 50.0% threshold should be surpassed in 2073). This development is mainly a consequence of the convergence of life expectancy by sex and a result of more males in net migration (even though the share of men in net migration is decreasing)"*.

**Fig. 2: Projected structure of the population of the Czech Republic by age, medium variant 2018, 2050**



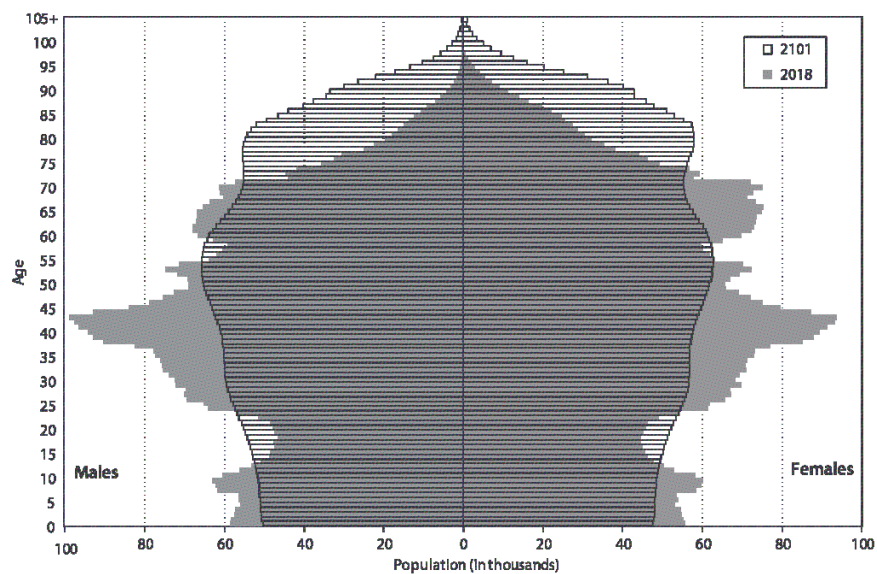
Source: Kurkin, 2019

**Fig. 3: Projected structure of the population of the Czech Republic by age, medium variant 2018, 2075**



Source: Kurkin, 2019

**Fig. 4: Projected structure of the population of the Czech Republic by age, medium variant 2018, 2101**



Source: Kurkin, 2019

More authors describe the positive impacts of education on the health of older people. For example, Waxman et al. (2016) examined Education's Impact on Healthy Seniors' Attitudes and Health Care Preferences Regarding Different Stages of Alzheimer's Disease. Or Jilkova (2021) analysed how employee benefits and education can support human capital development.

## Conclusion

It can be seen that there is a steady increase in retirement. Even if raising the retirement age can help reduce the growth of the social burden index of the population in the Czech Republic, there will still be a significant social burden on the people in the middle of the 21st century. Moreover, strong cohorts born in the 1970s will enter retirement age.

However, in the high variant, when the burden increases due to higher health care costs and consumption by people of post-productive age, aging slows later, and social responsibility declines. In contrast, with the lowest variant, it is not possible (even with a permanent increase in the retirement age) to prevent a permanent increase in the social burden. Therefore, not only the government but society must begin to respond to these demographic and economic changes. One possible solution is to focus on supporting fertility and migration, which can be understood as an appropriate financial "investment" in increasing human capital.

If the population development in the Czech Republic proceeds according to the above predictions, these conclusions will apply. Of course, it is necessary to neglect several qualitative indicators and the possibility of their possible changes. However, it is impossible to quantify everything related to the issue of aging, and the indicators enabling the measurement of indices of economic burden and dependency, or social responsibility, are unrealistic.

Of course, another option for dealing with the aging of the population is possible from the point of view of robotization and digitization, i.e., Industry 4.0. It is mainly a role reversal – machines will take most of the work from humans, but the result will remain the same. Factories will have 75-80% fewer people and many more robots. This affects and will significantly affect the demographic behaviour of the population in the future.

Not only the current but also the expected structural, cultural, and technical changes in our society will influence the future mortality level and the population's health status. Thanks to robotization and digitization, the share of physically demanding work, during which the body wears out quickly, will decrease. Thanks to this trend, further improvement in mortality rates can be expected. Furthermore, several cultural changes are taking place not only in the Czech Republic but also abroad, and these bring, among other things, higher education. It has been proven that more educated residents take better care of their health and live longer. There are also technical changes that also affect the field of medicine and health care. Medicine constantly develops new treatment procedures, preventing many "unnecessary" deaths.



It is necessary to realize that life expectancy will increase. The above changes will result in an improvement in mortality rates in the population.

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