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Abstract

This paper concerns the problem of generation gap management resulting from personnel restructuring in foundries in Poland. Structural changes to steelworks led to a sharp decline in employment caused by decreased steelworks production. New hiring was limited as a part of employment rationalisation in the steelworks sector. Such personnel policy eventually led to a generation gap. Ratios between individual age groups of employees are imbalanced at steelworks: the numbers of young personnel are low and of those aged 50+ are high. This research forecasts changes in employment levels for the 2013–2019 period, aimed at closing the generation gap. The paper consists of three parts: (1) a descriptive analysis of labor market demographics in Poland's steel industry; (2) proposed methodology for HR management model, and (3) econometric models forecasting labor demographics in Poland's steel industry.

Keywords: restructuring process, generation gap management, metallurgical enterprise
JEL: C13, J11, M54

Introduction

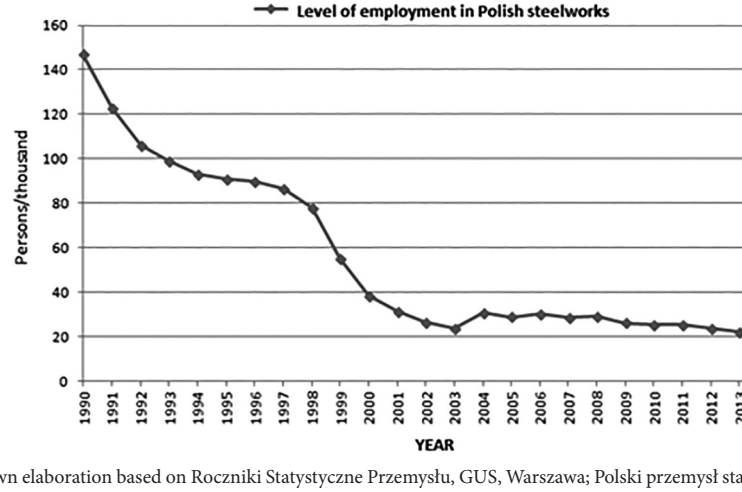
Foundries are typically considered large companies in terms of employment. In 1990 147,000 people were employed in the Polish foundry industry; restructuring of steelworks led to a reduction by 124,800 thousand people in this sector. According to the newest data, the sector employs just 22,200 individuals, most of whom are employees with long-term experience. There are some companies where employees aged 50+ comprise almost 50% of the personnel. This human resources structure characterizes, inter alia, the largest steelworks, namely ArcelorMittal Poland (which employs over 11,000 people). The problem of aging personnel is caused by industry restructuring, demographic shifts in Poland's labor pool, and changes in the job market. Aging societies are a problem in many countries. The 27 member states of the European Union show that over 17% of their population is aged 65+. The same group comprises just over 13% of Poland's population [Eurostat Yearbook, 2011, p. 118]. Changes in the age structure of societies lead to a generation gap phenomenon (relations between generations X and Y). According to the literature, Generation X includes people born between 1965 and 1981, whilst Generation Y (i.e. Millennials), includes persons born between 1982–2000. The personnel gap is understood as an imbalance between the experienced personnel of a company (employees aged 50+) and young employees. This gap is seen as a threat to the economy (a symptom of deficit, delay, and non-conformity) [Naegele, Walker, 2008]. The gap may lead to a shortage of personnel that could occupy key positions in the future. Difficulties in the timely replacement of experienced employees may negatively affect production. Employees with professional experience (Generation X), which currently form the core of personnel at foundries, will soon reach their statutory pension age. In order to provide personnel continuity, actions defined as generation gap management must be undertaken. Employees with professional experience must be replaced by young people.

It is worth mentioning that generation gap management is not a separate area of management, but instead refers to a method of ensuring full coverage of positions based on the age structure of current personnel. A special area of age management includes mitigation of negative effects caused by the generation gap. In regards to the existing generation gap, defined as an inter-generational difference (between Generations X and Y), generation gap management refers to characteristics differentiating Generations X and Y.

A Descriptive Analysis of the Labor Market Demographics in Poland's Steel Industry

Changes in the labor market demographics in Poland's steel industry were caused by a restructuring of the economy and consequent changes in human resources demand and supply. Restructuring in the steelworks sector eliminated 124,800 positions. The highest decrease in employment was recorded in 1991 and 1992, when over 20,000 people per year left the industry. In 1993–1998 employment continuously declined, but at a slower annual rate. A high employment decrease of 22,300 people was recorded in 1999, followed by a 16,500 decrease in 2000. These employment reductions of nearly 38,800 resulted from the closure of unprofitable steelworks (Huta Baildon, Huta Kościuszko, Huta Gliwice foundries declared bankruptcy), as well as by organizational transformation of various companies (separation of new companies from the biggest foundries: Huta Katowice and Huta im. T. Sendzimira in Kraków) [Gajdzik, 2013]. The following years witnessed further reductions as over 10 thousand people were sacked by companies in the steelworks sector. An economic improvement in the steel market in 2004 was beneficial for employment levels, but a few years later over 3,000 employees left the steelworks sector during the global crisis. Today, further employment reduction is foreseen as target forecasts for steelworks sector employment is 15,600 as compared to the current 22,200 (Figures 1 and 2). Employment in Polish steelworks in particular years is presented in Table 1.

FIGURE 1. Employment in Polish steelworks in 1990–2013



Source: own elaboration based on Roczniki Statystyczne Przemysłu, GUS, Warszawa; Polski przemysł stalowy [2007–2012 reports], HIPH, Katowice; Biuletyn AGH [2014], No. 77, pp. 1–6, http://www.biuletyn.agh.edu.pl; Czerwińska [1998], Problemy restrukturyzacji hutnictwa w Polsce, No. 618, Biuro Studiów i Ekspertyz, p. 4, biurose.sejm.gov.pl/teksty_pdf_98/i-618.pdf

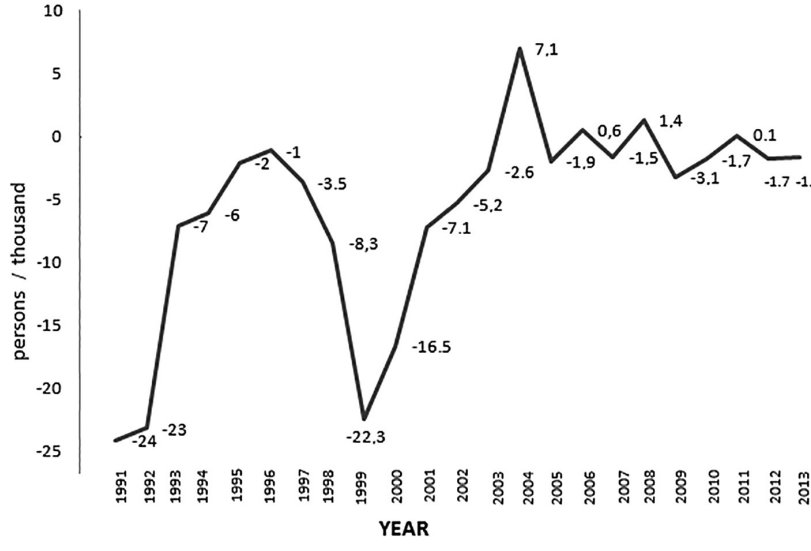
TABLE 1. Employment level and dynamics in Polish steelworks in 1991–2013

Year	Employment	Changes
		–/+ year to year before
	persons	persons
1990	147,000	-
1991	123,000	–24,000
1992	106,000	–23,000
1993	99,000	–7,000
1994	93,000	–6,000
1995	91,000	–2,000
1996	90,000	–1,000
1997	86,500	–3,500
1998	78,200	–8,300
1999	55,200	–22,300
2000	38,700	–16,500
2001	31,600	–7,100
2002	26,400	–5,200
2003	23,800	–2,600
2004	30,900	+7,100
2005	29,000	–1,900
2006	30,400	+0,600
2007	28,900	–1,500
2008	29,400	+1,400
2009	26,300	–3,100
2010	25,500	–1700
2011	25,600	+0.100
2012	23,900	–1,700
2013	22,200	–1,700

Source: as in Figure 1.

These employment reductions led to changes in personnel age structure. Before the restructuring, personnel aged 30 or younger comprised 20% of human resources. Currently this is the smallest age group, comprising between 5% and 12% of total employment. The most recent implementation of the first human resources rationalization program at foundries and steelworks was conducted 25 years ago. Recently, hired then employees hired are reaching their late 50 s [Gajdzik, Ocieczek, 2015].

FIGURE 2. Employment dynamics in Polish steelworks 1991–2013



Source: as in Figure 1.

Proposed Methodology of Action – a Model of HR Management

Generation gap management is focused on generations' differences. Briefly speaking, older employees work more effectively, are loyal to their employers, but do not use (or are hesitant to use) innovations and new technical and organizational solutions. Experienced employees are competent and knowledgeable, they own the resources of tacit knowledge [Gajdzik, 2008]. Young employees are characterized by: computer skills, immediate acceptance of new solutions, linguistic skills, high ambition and creativity and professional development orientation. Young people often see their career as a series of 2–3 year periods. Talents are sought amongst young personnel. An individual with unique skills and knowledge is considered to be talented [Espinoza, Ukleja, Rusch, 2010; Guthridge, Komm, Lawson, 2008].

The difference between one generation and another is not measurable in numerical terms, However, certain generation specifics becomes clear when applying some evaluation criteria. The presented generational characteristics comprise a reference for development and implementation of a new human resources management model. Our study, aimed at limiting the negative effects of the generation gap at steelworks in Poland, is based on the following methodology:

1. Initial identification determining the composition of a company's human – generation profile diagnosis (initial report);

2. Valuation of positions and selection of key ones (key positions ensure continuity and safety of technological processes);
3. Design and implementation of a training model permitting knowledge transfer (including tacit knowledge), as part of the cooperation between long-term employees and younger personnel;
4. Motivation adaptation to the needs and expectations of employees, which takes into account generation differences – a professional development scenario for individual generation groups (where role assignment considers the motivation system, and qualifications of various generations, which should be complementary in knowledge and experience);
5. Working in multi-generational teams (teams of employees at age-managing companies are comprised of individuals of various ages, in which mature employees are trainers or mentors young employees);
6. Personnel fluctuation control aimed at narrowing the generation gap (age management should pay particular attention to the "best employees" category – e.g., those who are difficult to replace -, if they are in the 50+ age group, special actions must be taken in order to prepare their "worthy successors"); and
7. Monitoring changes introduced to the human resources policy, including calculations of human resources costs.

The above model is still at a preliminary stage and needs further research and scholarly feedback. The literature on good practices in business in HR management is vast and businesses often rely on it for HR solutions. Some of those helpful tools include: the matrix of staff fluctuation management in reference to the work efficiency [Martin, Bartol, 1985; RJP – realistic job preview [Breaugh, 1992; Premack, Wanous, 1985], and programs of work-life balance, etc. One solution to diminishing the generation gap proposed in the literature involves employee leasing. Large companies use such solutions (for example Xerox) referring to leased employees as "specialists" or "workers for special tasks". In that sense, the days of traditional downsizing are over in HR management. Generation management is realized in long time by using various HR tools.

Knowledge of older generations enables the selection of appropriate motivation, communication and development tools. Age management is based on age segmentation – an age-based division of employees. The monitored age is a statistical analysis of employee age (by the HR Department or its equivalent). A banding system may be used to classify employees according to their age. Age monitoring helps to identify problems and develop reactive strategies. Employers adapt their HR management tools to the needs of individual age groups. This applies mainly to training, motivation and recruitment.

The Polish market shows a clear disproportion between the number of younger and older workers. The appearance of the generation gap in steelworks resulted from the introduction of actions known as 'age management'. Its main goal is to transfer knowledge between generations. Generation teams have been introduced to foundries and steelworks.

Employees with longer employment at the foundry are mentors for their newly recruited colleagues. The knowledge transfer, which takes place during work usually involves tacit knowledge, resulting from many years of work at a particular position. These transfers of tacit knowledge or of silent knowledge between employees became a necessity at foundries and steelworks, preventing the loss of basic skills and technical competences gained by current personnel. Exchange of knowledge through cooperation also became a form of motivation – an acknowledgement and endorsement of a professional experience by the employer. Former positions, such as blast furnace worker, caster, and roller were replaced by positions with a significant component of IT and automation [Castro, Munck, 2014; Male, Bush, Chapman, 2011], resulting in the creation of such new title s as blast furnace operator, continuous pouring line operator, and rolling mill operator. Changes in age management at foundries and steelworks also apply to recruitment. To protect steelworks against mass losses of employees with long-term professional experience (through reaching the retirement age), more young employees had to be recruited. However, newly hired employees comprise roughly 1.5% to 2.5% of the personnel.

Econometric Models Forecasting Labor Demographics in Poland's Steel Industry

One adaptation-based forecast model appropriate to determine a change in development trends of the forecast variable is presented by C.C. Holt; the so called two-parameter model [Dittmann, 2008; Sobczyk, 2008]. The Holt method of so called double exponential equalisation, belongs to the group of adaptation-based forecast methods, and is often used for time series data, where a systematic component is distinguished in the form of a regular, linear trend including random fluctuations. The author of the described method also took into account the possibility of simultaneous changes to the trend itself, as well as to the basic level of the forecast variable. Use of the model developed by Holt requires, however, optimization of so called initial values of parameters denoted in formulas (1), such as F_1 and S_1. Holt advised that the values be estimated according to the following relationship:

$$F_1 = y_1,\ S_1 = y_2 - y_1 \tag{1}$$

This relationship indicates that the first evaluation of the average, equalized forecast should be accepted as the value of the first actual (empirical) observation, while the value of the trend print should be accepted as the difference between the actual: second and first values of the studied series. The smoothing process of the given time series is consequently performed using this method for periods from the second to the last period (namely for $t \in \overline{2,T}$) by determining the average value (data equalization) and existing

trend (or rather, by equalization of the given trend). Based on this method the following relationships are provided:

$$F_t = \alpha y_t + (1-\alpha)(F_{t-1} + S_{t-1}), \tag{2}$$

$$S_t = \beta(F_t - F_{t-1}) + (1-\beta)S_{t-1}. \tag{3}$$

The calculated F_t component in formula (2) expresses the average forecast value, subjected to exponential smoothing (up to, and including, the t period). The S_t component calculated according to formula (3) reflects the difference between average values F_t and F_{t-1}, thus comprising a measure of the increase in trend increase detected. It can be noted that formula (3) averages exponentially increase the afterwards. At the same time, Holt proposed that both smoothing parameters α and β should be from the closed range from zero to unity [0;1]. The average series level is estimated as a weighted average of current empirical values of the series and the obtained, new estimate of average value based on data from previous periods. When the actual time series forecast y_t^* is estimated (the so called *ex-ante* forecast) using the Holt model, it is calculated for periods meeting the $t > T$ condition. In order to perform it, the average value from the previous period F_T is added to the estimated values of trend slopes S_T during the last period, multiplied by the difference between the given period number of the constructed forecast, and the number of the period understood as the last period, for which weight smoothing parameters α and β were determined according to the following relationship:

$$y_t^* = F_T + (t-T)S_T. \tag{4}$$

The value of relative average error of expired forecasts ψ was used to optimize the smoothing parameters α and β since, according to the literature [1–4], the value of this error is not particularly sensitive to occasional, large errors. The error was determined by calculating, $\widehat{y_t}$ for each of the *t periods, (*where $t \in \overline{1,T}$), the value of the product equal to the relative difference:

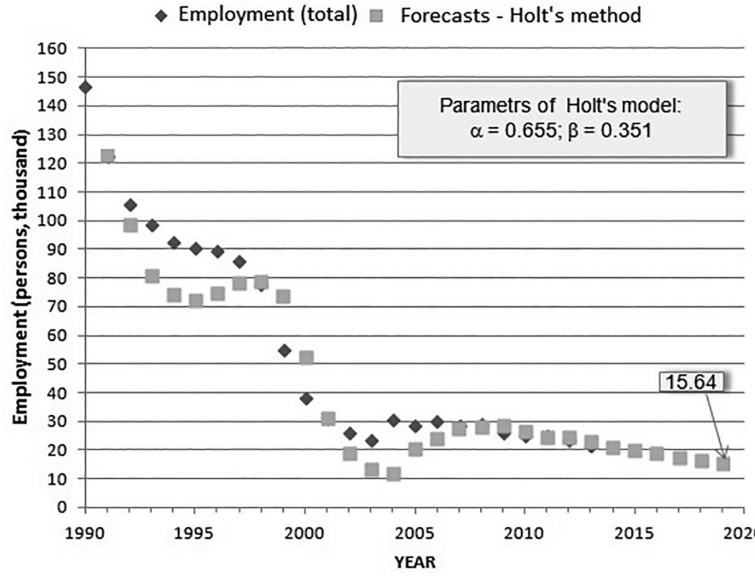
$$\frac{\left|y_t - \widehat{y_t}\right|}{y_t} \tag{5}$$

In this formula, y_t denotes an empirical value, namely that of execution of the Y variable during the given t period. Then, the calculated value of the sum of relative values should be divided by the number of relative values, as indicated in the following formula:

$$\Psi = \frac{1}{T}\sum_{t=1}^{n}\frac{\left|y_t - \widehat{y_t}\right|}{y_t} \tag{6}$$

The α and β parameters were optimized using the optimization tool *Solver* of the Excel spreadsheet (Figure 3).

FIGURE 3. Employment forecast for Polish steelworks until 2019



Source: own elaboration.

TABLE 2. Level of employment in Polish steelworks – age range

Year	1990	1994	1997	2000	2003	2006	2009	2013
Age range	thousand/%	thousand/%	thousand/%	thousand/%	thousand/%	thousand/%	thousand/%	thousand/%
up to 30	29.4	18.4	15.7	5.6	2.5	2.04	1.6	1.2
	24.0%	19.8%	18.2%	14.4%	10.3%	6.7%	5.9%	5.0%
30–50	94.1	59.9	56.05	26.7	16.6	19.15	15.–	10.6
	64.0%	64.4%	64.8%	69.0%	69.9%	63.0%	57.1%	0,5%
50+	23.5	14.7	14.8	6.4	4.7	9.2	9.7	10.2
	12.0%	15.9%	17.0%	16.6%	19.8%	30.3%	37.0%	47.0%
Total	147.0	93.0	86.6	38.7	23.8	30.4	26.3	22.0

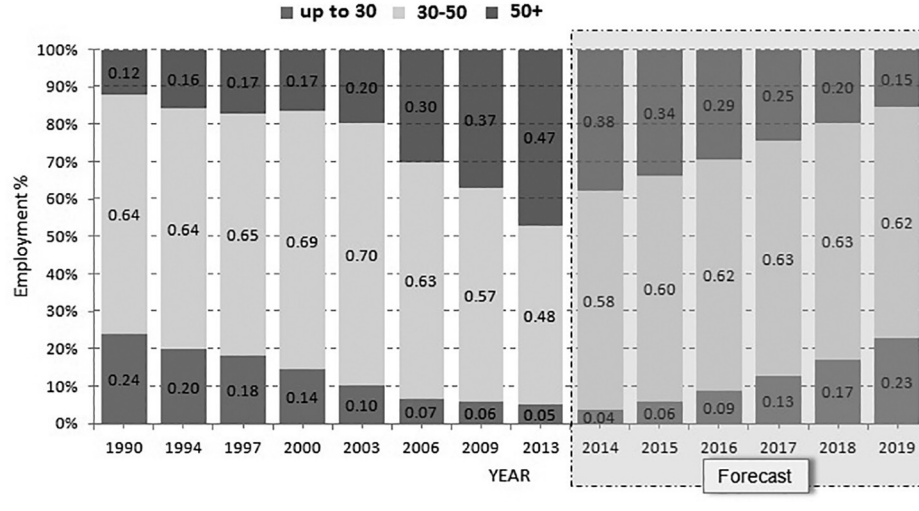
Source: as in Figure 1.

The 2013 model forecast matches closely the real statistical data (22.2 thousand employees as compare to the e forecast 23.1 thousand). In 2019, forecasted employment in Polish steelworks will be 15,700. At the same time market experts, based on an analysis of the steel market and UE policy (Climate Package) foresee an employment reduction in the Polish steelworks to 15,000 people.

The assumed forecast sets the basis for simulation of changes aimed at narrowing the generation gap. Shares of age groups in total steelworks employment were determined on the basis of statistical data (Table 2).

The analysis covered the 1990–2013 period. On the basis of calculated changes in employment levels and the structure of individual age groups, a forecast of changes aimed at narrowing the generation gap among employees was performed (Figure 4).

FIGURE 4. Changes to the generation gap of steelworks personnel in Poland



Source: own elaboration.

The Methodology Used

Age range up to 30

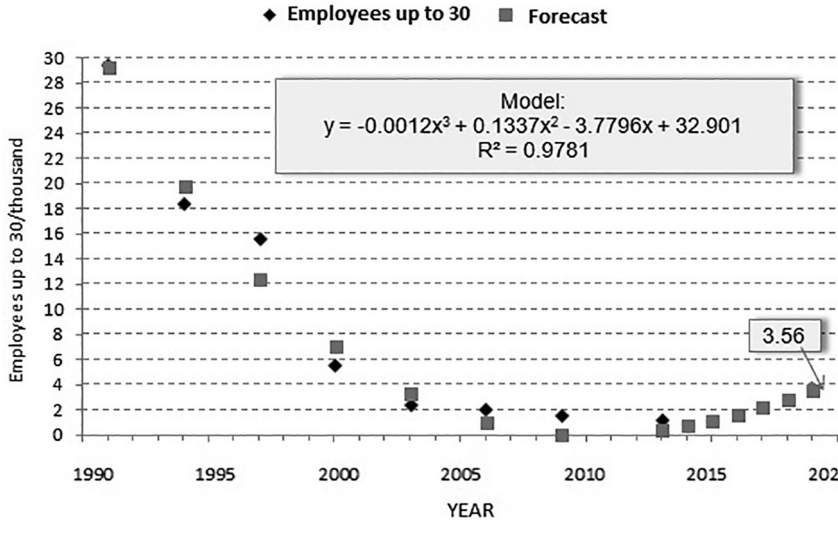
Assuming that in the years 2015–2019 the number of employees below age 30 will increase, the forecast relied on a model based on a third degree polynomial, characterized by an excellent fit to the actual employment levels in this age group during the 1991–2013

period with a coefficient of determination $R^2 = 97.8\%$ – namely ca. 98% of empirical results is explained by the model (7).

$$y = -0.0012x^3 + 0.1337x^2 - 3.7796x + 3.2901 \quad (7).$$

According to the forecast the number of employees aged below 30 years will be 3,600 by 2019. The average employment growth rate in this age group for the 2014–2019 period (calculated using a geometric average of chain indices) was forecasted to be ca. 35.9% (Figure 5).

FIGURE 5. The average employment growth rate in the age group up to 30



Source: own elaboration.

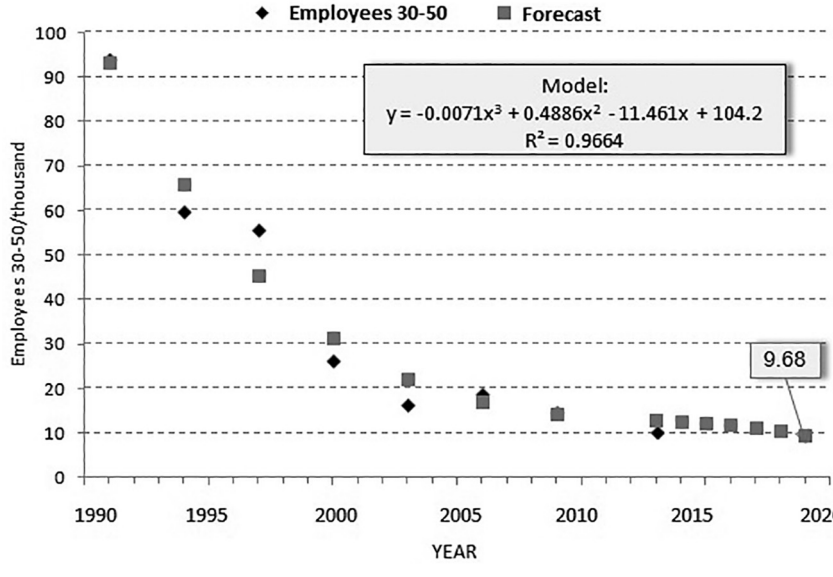
The age range of 30–50. By applying the aforementioned methodology for this age group, the following model (8) was developed, with $R^2 = 0.9664$.

$$y = -0.0071x^3 + 0.4886x^2 - 11.461x + 104.2 \quad (8)$$

The forecasted employment level in this age group for 2019 is 9,700 workers, which indicates that the average decline in the employment rate for the 2014–2019 period in the age group of 30 to 50 is ca. 5%.

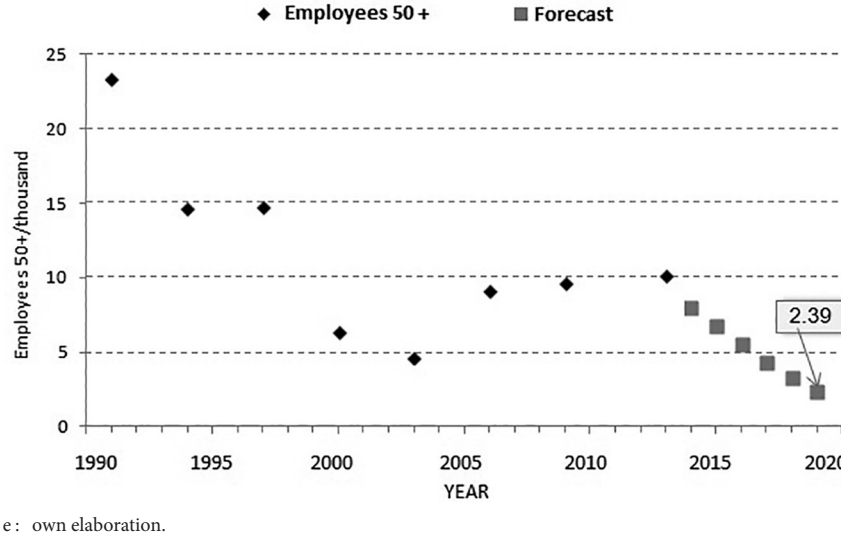
The 50+ group was estimated as the difference between shares of the two age groups discussed above and 100%. In 2019, a total of 2,400 employees aged 50+ is forecasted, and the average rate of decline is estimated to be ca. 21.7% (Figure 7).

FIGURE 6. The average employment growth rate of in the age group 30–50



Source: own elaboration.

FIGURE 7. The average growth rate of employment levels in the age group 50+



Source: own elaboration.

Conclusions

The restructuring of the Polish steelworks industry led to a generation gap. It resulted in bigger number of mature employees compared to the number of young ones. In order to protect themselves against the negative effects of the generation gap, foundries and steelworks implemented actions defined as age management. This paper presents a simplified methodology of actions, including change forecasts. The simulation of changes performed by the authors of the paper may be useful for steelworks sector companies in other countries.

Notes

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