

# Evaluation of the Results of Support for Schools by Manufacturing Enterprises – a Competence Management Aiding Model

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## Abstract

Employers signal difficulties in sourcing technically-educated staff. They often engage, though to a limited degree, in cooperation with vocational schools to mitigate this difficulty. One of the reasons for the limited involvement of enterprises in cooperation with schools is the difficulty in assessing the benefits that it may bring. The aim of the study in the article was to develop and initially verify a model for evaluating the results of supporting secondary technical schools by manufacturing enterprises. The article features a multiple case study using several types of interviews, a distributed questionnaire and an analysis of secondary sources. The study was conducted in cooperation with four large manufacturing enterprises. The result of the research is a more thorough understanding of the possibilities and limitations in evaluating the results of support for schools. This support should translate in enterprises into more effective and efficient management of the competences of the future.

## Keywords

Competence management, HR, Support for schools, Staff shortage, Competences of the future.

## Introduction

Observations show that the availability (supply) of candidates for work and their knowledge do not always meet the requirements formulated in enterprises (demand) (Gábor et al., 2018). This state of affairs is influenced by many factors, such as:

- rapid development of new technologies, computerization and robotization, including the so-called Industry 4.0 (Brettel et al., 2014; Hermann et al., 2016), which is not kept up by the development of knowledge (Graczyk-Kucharska et al., 2017a),
- reluctance to work in certain professions, resulting from prejudices or employees' individual expectations (e.g. (Colomo-Palacios et al., 2014)),
- discrimination (sometimes unconscious) against certain social groups, e.g. women (The Future Jobs, 2016),
- too slow a pace of adjusting vocational training to the needs of the economy; this phenomenon

has persisted for many years (Hasanefendic et al., 2016; Osterman & Weaver, 2014)

- shortage of people with the required competences on labour markets (Lehmann et al., 2014; Levanon et al., 2014).

In order to limit the effects of the shortage of employees with the required competences, it is important, apart from the use of known solutions such as outsourcing and cooperation (Beaugency et al., 2015), change or extension of the location of an enterprise, introduction of automation, robotization and computerization (Adriaenssen et al., 2016), to involve enterprises in the education of future employees, in particular in vocational schools (The Future Jobs, 2016; Szafranski, 2015a), which are understood here as schools that provide education at the basic or secondary level. Sometimes this cooperation is stimulated by business environment institutions. For example, Article 166 of the Treaty on the Functioning of the European Union explicitly states that Union action aims to “stimulate cooperation on training between educational or training establishments and firms” (Treaty on the Functioning of the European Union, 2010). Such a commitment to the development of cooperation results from the fact that vocational schools are an important element of the social and economic system. They are one of the basic suppliers of skilled workers to enterprises. Some studies show that the development of competences of young employ-

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ees in enterprises is positively influenced by sharing knowledge with them (Naim & Lenka, 2017). Similar benefits can be obtained by enterprises if they share knowledge with future employees. It regards shifting the boundary of the influence of enterprises on the development of knowledge and accelerating this development (Szafranski, 2015a).

The question arises as to what cooperation activities with schools should be undertaken by an enterprise in order to increase the chance of sourcing graduates on the labour market where their shortage is noted, and, in the context of competence management, secure the required competences.

In the conducted research and projects related to the development of vocational competences, the author of the article noticed a number of problems hindering the development of relations between enterprises and schools, in particular vocational schools. Examples of barriers, which are also described in source literature, are:

- conflicting goals (Szafranski, 2015b),
- different communication codes (Szafranski, 2017b),
- inadequate adjustment of vocational education policies in many countries to the needs of the labour market (Mehrotra, 2017; Hasanefendic et al., 2016),
- insufficient acquaintance with knowledge management in many enterprises (Adriaenssen et al., 2016) and conviction of the key role of schools in the vocational training of future employees (Goźlińska & Kruszewski, 2013),
- insufficiently developed knowledge-sharing mechanisms between enterprises which need to grow (Adriaenssen et al., 2016),
- insufficient involvement of teachers in cooperation with enterprises (Nallasamy, 2017),
- new generational features of students belonging to generation Y (Millennials) and generation Z, including other determinants of their motivation to learn (Bencsik et al., 2017).

The study carried out in 2010–2021 using methods such as individual and group interviews (FGI), discussion panels/debates, Delphi technique supplemented by expert opinions (Szafranski, 2014; Szafranski, 2015b; *The time of professionals*, 2015; Szafranski, 2016) shows that relations between enterprises and schools leading to cooperation between them are an important stimulus for their sourcing on the labour market where a shortage of employees can be observed.

Although the source literature presents the results of research on selected forms of support, in particular internships, research is most often conducted in the

aspect of improving educational processes. Therefore, the impact of internships on the level of pupils' competences (Bayerlein & Jeske, 2018) or the adjustment of internships to pupils' needs (Mangione et al., 2006) is examined. As pointed out by some authors, there are not many studies even in relation to this most popular form of support for schools and pupils (Di Meglio et al., 2022). If researchers undertake a broader scope of cooperation between schools and enterprises, the studies are carried out in the context of the functioning of a school and not of an enterprise (Lai and Yuan, 2014; Wu & Wang, 2018). There are a few studies on cooperation between schools and enterprises (Ling et al., 2021), but they lack outcomes related to the evaluation of the results of such cooperation from the point of view of enterprises.

The observed cognitive gap became an incentive to conduct research, the results of which are described in this article.

The lack of reliable information about the measurable benefits of cooperation between an enterprise and schools may limit it. It is therefore advisable to develop a model for evaluating the results of support for schools by enterprises. Its use will facilitate the diagnosis of the benefits of cooperation.

## Literature review

The volatility of the environment and the accompanying high dynamics of changes in manufacturing enterprises mean that it is necessary, in addition to ensuring competences on an ongoing basis, to analyze in advance how competence-related needs will change in the future. Therefore, more and more space in research area is being devoted to the issues of competences of the future (Graczyk-Kucharska et al., 2017b; Bals et al., 2019; Jerman et al., 2020b). Sometimes research is narrowed down to the competences of Industry 4.0 (Graczyk-Kucharska et al., 2017a; Bogoviz et al., 2019; Flores et al., 2020).

While it is clear that competences of the future are those that will be needed in the future, it is no longer obvious how to determine the future, in what time frame and who should define such competences. In addition, expectations regarding competences of the future may differ in various industries, which is why researchers most often refer to them in selected areas, such as, for example, purchasing and supply management (Bals et al., 2019) or smart factories in production processes (Jerman et al., 2020b). Likewise, in this article, the main topic – support for schools – is placed in the context of changing requirements and future requirements in manufacturing enterprises in

the range of professional competences. These requirements are determined on the basis of enterprises' objectives, which may be, for example: increasing value (Pettit et al., 2010), increasing the effectiveness of employees' activities in an organization (Muller & Turner, 2010) an organization's resilience to instability (Ravichandran, 2018) and others. In principle, any competence-related requirement connected with an unachieved goal refers to the near or distant future. When a decision to cooperate with a school in terms of improving students' competences is made in an enterprise, it should be the result of the perceived possibility of satisfying one's own competence-related needs in the future, which should lead to the conclusion that they have been defined. Otherwise, it will be difficult to determine the effectiveness of cooperation with schools.

In manufacturing enterprises, vocational competences are and will remain important in the future. Therefore, a constant interest in them can be observed in research (Bogoviz et al., 2019; Lester & Religa, 2017; Pozolotina, 2018; Ahmad et al., 2019). As noted by Lester and Religa (2017), the concept of competences is interpreted very differently, and diversity in the understanding of professional competences is influenced, among others, by various professional standards in particular countries (Lester & Religa, 2017). Therefore, some researchers attempt to universalize the modelling of competences, for example professional competences for selected industries, while proposing to treat the competence-related approach as the overriding approach in the creation of the human resources management system in an enterprise (Pozolotina, 2018). In this article, professional competences will be perceived through the prism of the KSAO model (knowledge, skills, abilities, other features) described, among others, by Campion and et al. (2011) and will be understood as competences required to perform work assigned to a single position or all positions in an organization, depending on the scope of the conducted analyses. The consequence of such an approach will be the qualification of both technical/hard (do Vale et al., 2018) and behavioural/soft (Lou et al., 2019) competences as professional competences, as long as they are necessary to achieve an organization's objectives.

On the one hand, it is quite commonly postulated in the literature that the burden of the development of relations between enterprises and education should rest on educational units, in particular schools and universities (Absatova et al., 2013; Rampersad, 2015; Pavlin et al., 2016). In addition, it is indicated that for the proper functioning of schools it is necessary to implement in them a knowledge management system

(Chu, 2016a; 2016b; Shih et al., 2016). On the other hand, research shows the need for implementing in firms social responsibility systems focused on education (Goliński & Szafranski, 2019). The involvement of enterprises in supporting schools, and in particular the development of students' vocational competences, may accelerate their onboarding once students become employees. As indicated by Wipulanusat et al. (2020), the high dynamics of development of creativity coexisting with employees' vocational competences is crucial for generating innovative products, processes, relations. Contact between a student and firms can contribute to the development of both vocational competences and creativity.

The observation that enterprises can benefit from cooperation with schools (Business cooperating, 2017) and that cooperation with schools can be distinguished and managed opens a discussion on the role of enterprises in creating and supporting schools.

In the previous research papers (Szafranski, 2017a; Szafranski et al., 2019), 24 forms of support that enterprises provide to schools were identified and verified (TNS = 24). They were classified in the groups of direct support (BR): TNSBR = 11 and indirect support (ER): TNSER = 13. They are presented in Table 1.

Intuition shows that these forms of support for schools are useful for both sides of cooperation and society. However, decisions in firms should not be made solely on the basis of intuition or positive impressions arising after the occurrence of these activities, because each of them engages employees and sometimes also other resources of an enterprise. Therefore, it is important to look for methods to evaluate the results of support for schools by enterprises. The perceived cognitive gap in this respect led to the development of a model for such an evaluation.

## Evaluation of the results of support for schools by a manufacturing enterprise – a model

The model of the evaluation of the results of support for schools by enterprises is synthetically presented in Figure 1. It consists of a set of independent and dependent variables. Information about independent variables should be obtained from the environment and from within an organization. The values of dependent variables result from the processing of independent variables. Data processing takes place as a result of the use of the proposed indicators. Independent variables are described below and indicators are in Table 2.

Table 1  
 Forms of support for schools used by enterprises identified in the framework of own research

| Symbol           | Description of support  |
|------------------|---|
| Direct support   |   |
| BR1              | organizing internships for students   |
| BR2              | organizing traineeships for students  |
| BR3              | dual education  |
| BR4              | patronage of an entire school   |
| BR5              | co-organizing selected patronage classes in a school  |
| BR6              | participating in meetings with students in schools  |
| BR7              | inviting students to an enterprise for short visits (trips, workshops, etc.)  |
| BR8              | providing materials and teaching aids to schools or teachers (brochures, leaflets, films, electronic materials)   |
| BR9              | cooperating with a school in the preparation of a vocational exam (e.g. providing workstations, premises, advice on the organization of examination stands, co-organization of classes preparing for a vocational exam, etc.) |
| BR10             | equipping laboratories, work rooms, etc.  |
| BR11             | organizing vocational training (assisting in launching an existing but absent profession in a given school or cooperating with a school or schools in the development of a new profession that does not formally exist)       |
| Indirect support |   |
| ER1              | running a school centre/technology park/open laboratories   |
| ER2              | participating in local job fairs  |
| ER3              | participating in meetings concerning the local labour market  |
| ER4              | organizing competitions for school youth  |
| ER5              | publishing job advertisements   |
| ER6              | cooperating with career advisers  |
| ER7              | admitting vocational school pupils from other countries   |
| ER8              | cooperating in the field of vocational education with technical institutions of higher education  |
| ER9              | participating in the development and implementation of pilot vocational training programmes   |
| ER10             | participating in the preparation and holding conferences and seminars   |
| ER11             | co-organizing dedicated conferences and training events for the regional labour market  |
| ER12             | funding scholarships for students   |
| ER13             | funding internships/scholarships for teachers   |

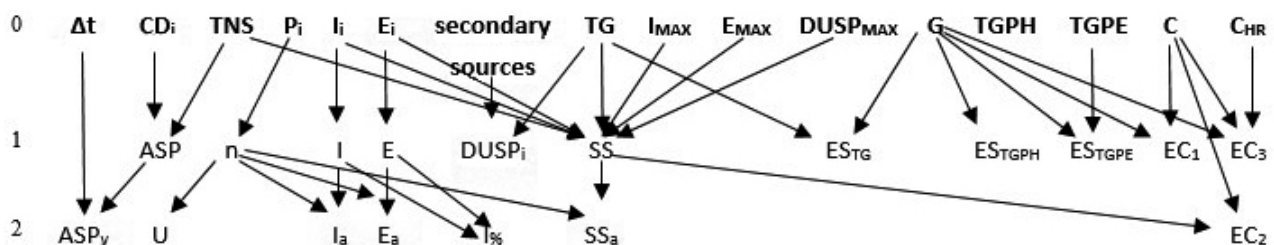


Fig. 1. Model of the evaluation of the results of support for a school/schools by an enterprise. Levels: 0) independent variables, 1) and 2) dependent variables – indicators of the first and second level

Independent variables include the following:

- $\Delta t$  – the considered period for which the selected indicator is analyzed; by default, it is given in years;
- CD (Cost Driver) – a concept taken from the cost of activities (Kaplan & Anderson, 2007), implemented here for the purpose of determining the unit cost of

a given form of support; for example, if an enterprise takes on interns, the CD will be equal to their number, but if it organizes meetings for students, the CD will be the number of meetings with students, not the number of students participating in meetings;

Table 2  
Indicators for the evaluation of the results of support for a school by a manufacturing enterprise

| Indicator name  | Formula for calculating the value of the indicator | Interpretation of indicators   |
|---|--|--|
| 1. Indicators of support complexity   |  |  |
| Number of forms of support  | $n = \sum_{i=1}^{\text{TNS}} P_i$                  | The greater the value, the greater the complexity, the lower the value, the greater the concentration of support.  |
| Degree of the use of the identified forms of support  | $U = \frac{n}{\text{TNS}} \cdot 100\%$             |  |
| 2. Indicators of the size of support in a period  |  |  |
| Size of support for a school in the students' education cycle                               | $\text{ASP} = \sum_{i=1}^n \text{CD}_i$            | ASP is the number of occurrences of all forms of support in the considered period. The students' education cycle is understood as the period from the first class to completing the last class by the students included in the study. The indicator, therefore, refers to a specific group of students in a specific period in a given school. The value of the ASP indicator answers the question of how many times during the period considered an enterprise offered support to specific years of students at school, and these could have been different forms, e.g. admitting a student for internship (each student is one support), a class trip to an enterprise (one trip is one support).<br>ASPs are the average support in a year. |
| Average size of support for a school in a year  | $\text{ASP}_y = \frac{\text{ASP}}{\Delta t}$       |  |
| 3. Importance indicators (from the point of view of enterprises)                            |  |  |
| Importance of support for a school in the evaluation made by an enterprise                  | $I = \sum_{i=1}^n I_i$                             | The indicators are used to determine how important the forms of support for a given school are for an enterprise.<br>$I$ is the greater the higher the rating and the more forms of support used by an enterprise. $I_a$ as an average importance rating can be interpreted as the importance of the entire support package.   |
| Average importance of support for a school in the evaluation made by an enterprise          | $I_a = \frac{I}{n}$                                |  |
| 4. Support evaluation indicators (from the point of view of schools)                        |  |  |
| Importance of support for a school in the evaluation made by a school                       | $E = \sum_{i=1}^n E_i$                             | The indicators are used to determine how important the forms of support offered by an enterprise to a school or group of schools are.<br>$E$ is the greater the higher the rating and the more forms of support used by an enterprise. $E_a$ as an average importance rating can be interpreted as the importance of the entire support package. Monitoring $I\%$ facilitates preventive actions so that the activities of enterprises do not differ from the expectations of schools.   |
| Average importance of support for a school in the evaluation made by a school               | $E_a = \frac{E}{n}$                                |  |
| Comparison of the evaluation of the importance of support made by an enterprise and schools | $I\% = \frac{I}{E} \cdot 100\%$                    |  |

Table 2 [cont.]

| Indicator name   | Formula for calculating the value of the indicator   | Interpretation of indicators   |
|--|--|--|
| 5. Support strength indicators   |  |  |
| Support strength for $a$   | $SS = \frac{\sum_{i=1}^n I_i \cdot E_i \cdot DUSP_i}{TNS \cdot I_{\max} \cdot E_{\max} \cdot DUSP_{\max}} \cdot 100\%$ | Enterprises can engage in many forms of support, and this does not have to translate into a large impact. In addition to high $I$ , $E$ indicators and the high complexity of support expressed by $n$ , the previously described DUSP parameter, i.e. the degree of use of the support potential, was taken into account in the support strength indicators. The product of these variables was compared to the product of their maximum values. DUSP is the quotient of TG (number of students who received support and completed school during the period in question) to all students who were educated at school during the analyzed educational cycle and whose supporting an enterprise could potentially be interested in. |
| Average support strength for a school  | $SS_a = \frac{SS}{n}$  | If, for example, $TNSBR = 11$ (see Table 1), then $TNSBR \cdot I_{\max} \cdot E_{\max} \cdot DUSP_{\max} = 11 \cdot 5 \cdot 5 \cdot 1 = 275$   |
| 6. Indicators of effectiveness   |  |  |
| Effectiveness of the recruitment of graduates who received support as students   | $ES_{TG} = \frac{G}{TG} \cdot 100\%$   | The ESTG indicators allow to evaluate what percentage of students educated in a school during a given period, covered by at least one form of support, where employed in an enterprise on the basis of a contract of employment after leaving school. The $ES_{TGPH}$ and $ES_{TGPE}$ can be calculated if an enterprise prepares annual plans for hiring graduates or employees.  |
| Effectiveness of the recruitment of graduates who received support as students in the aspect of the graduates' hiring plan | $ES_{TGPH} = \frac{G}{TGPH} \cdot 100\%$   |  |
| Effectiveness of the recruitment of graduates who received support as students in the aspect of the employees' hiring plan | $ES_{TGPE} = \frac{G}{TGPE} \cdot 100\%$   |  |
| 7. Indicators of effectiveness   |  |  |
| Effectiveness of support for a school taking into account the number of employed graduates                                 | $EC_1 = \frac{G}{C}$   | The effect of activities (in the numerator) is either the number of employed graduates who were supported by an enterprise as students, or the strength of support for schools. Expenditure (in denominator) is expressed as the total cost of activities supporting a school (in $EC_1$ and $EC_2$ ). In addition, the budget for the entire HR function can be included (in $EC_3$ ).  |
| Effectiveness of support for a school taking into account the strength of support  | $EC_2 = \frac{SS}{C}$  |  |
| Effectiveness of support for a school taking into account the number of employed graduates and the cost of the HR function | $EC_3 = G : \frac{C}{C_{HR}}$  |  |

- TNS (Total Number of Support) – the number of identified forms of support (all forms of support included in the analyses);
- P(TNS<sub>i</sub>) (presence) – indicator function; P(TNS<sub>i</sub>) = 1 if TNS<sub>i</sub> occurs and P(TNS<sub>i</sub>) = 0 if TNS<sub>i</sub> does not occur, where  $TNS = \sum TNS_i$ ;
- I (importance) – the potential impact of support on the employment of a graduate of a school whose support is provided by an enterprise; evaluation on a five-point scale {1, 2, 3, 4, 5} made by a representative or a team of representatives from an enterprise;
- E (evaluation) – evaluation of the benefits for a school resulting from the form of support used; evaluation on a five-point scale {1, 2, 3, 4, 5} made by a representative or a team of representatives of a school;
- TG (total graduates) – the number of students who received support and completed school during the period considered; unique students who received support are taken into account, i.e. it is important that they are supported, but it does not matter how many forms of support they received as students;
- DUSP (degree of use of the support potential) – the quotient of the implemented support scale to the maximum support scale; the indicator takes values from the range (0, 1). Example: an enterprise was interested in students learning to become a mechatronics technician. 30 students learn for this profession in a school. An enterprise provided various forms of support to 15 students, i.e.:  $DUSP = 0.5$ . The specific value of  $DUSP_{max}$  is 1;
- G (graduates) – the number of graduates admitted to work in an enterprise who received support as students; unique students/graduates who received support are taken into account, i.e. it is important that they received support, but it does not matter how many forms of support they received as students;
- TGPH (Total Number of Graduates Planned for Hiring);
- TEPE (Total Number of Employees Planned for Hiring);
- C (cost) – cost of support for a school;
- C<sub>HR</sub> (HR costs) – costs of the HR function, i.e. costs of all planned HR activities, and therefore not only costs of HR services. Example: the cost of the HR function is the cost of training sessions organized by HR employees, but also the cost of care for trainees resulting from the involvement of, for example, an employee of the manufacturing department.

The following indexes may occur in the listed variable symbols:

- $i$  –  $i$ -th support from a set of all provided by an enterprise;  $i$ -th evaluation, from all evaluations, etc.
- indexes, which are abbreviations of the name of a subgroup of forms of support, e.g. *BR*, *ER* (according to the symbols used in Table 1),
- $a$  – index expressing the average value.

These independent variables are sufficient to calculate indicators, the use of which will facilitate the evaluation of the results of support for schools. The model divides the indicators into seven groups, ranging from those for whose calculation it is easy to obtain data, but on the basis of which only a general evaluation of the results of support can be made, to those for whose calculation it is the most difficult to obtain data, but on the basis of which the most accurate evaluation of the results of support can be made. Therefore, the seventh group is made up of indicators of the effectiveness of support for schools. The effectiveness of support for schools expressed by a monetary measure was viewed as the most desirable in the model. Indicators can be calculated for activity planning and to verify the legitimacy of support after it has been provided. The table presents indicators for the evaluation of the results of support for one school. Where an enterprise cooperates with multiple schools, study results from multiple schools can be aggregated and generalized to evaluate the results of support for all schools combined.

The developed model was verified using the methodology described below. It was considered particularly appropriate to test the method in large and medium-sized manufacturing enterprises. Such enterprises have high staffing needs and more frequent staff exchanges than SMEs, and thus their competences. They are more likely than SMEs to show an interest in systemic, multi-directional cooperation with schools.

## Methodology

As part of the research work, the model was verified. The work was divided into several stages presented in Figure 2. The study as part of stages 1–4 was conducted in the period from May to November 2018, and the work as part of stages 5–7 was carried out in the period from December 2018 to April 2019. It turned out to be particularly difficult to organize a summary meeting attended by representatives of all the firms.

The development of the research process was preceded by an in-depth non-standardized interview in

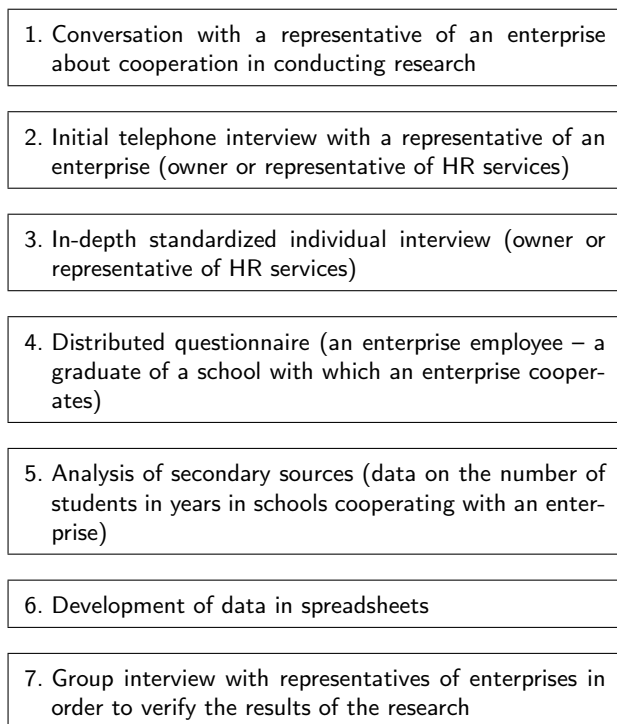


Fig. 2. Stages of empirical research carried out to verify the model of the evaluation of the results of support for a school/schools by a manufacturing enterprise

one large manufacturing firm. It resulted in the need to divide the research work into stages so that the study could run efficiently. The aim was to minimize the time of engagement of individual people who may have the data necessary to apply the developed model. As a result of the first interview, it emerged that the required data would be highly dispersed in enterprises.

It was planned that the talks at Stage 1 would take place in enterprises and that decision makers from HR services would participate in them. They could be accompanied by employees from the HR department who would participate in the preparation of internal data. It was planned that general data for analysis would be collected as part of Stage 2 from HR employees indicated for contact. They were planned to be collected as part of a telephone interview for which an appropriate questionnaire was developed. As part of this interview, it was also planned to clarify the doubts related to the subsequent stages of research and provide information on the scope of data, the preparation of which in an enterprise is necessary to efficiently carry out the third stage of research.

Individual interviews in enterprises (Stage 3) were planned for 1–2.5 hours. It was planned to collect most

of the data on independent variables necessary for the calculation of the indicators designed in the model. For the purposes of the study, at this stage, an auxiliary data collection sheet was designed.

As part of the previously mentioned first pilot interview, it was noted that employees of HR departments may not have data on the participation of school students in the forms of support offered by enterprises. Therefore, it was planned to obtain some of this data directly from employees of enterprises, who as students were able to use the offered forms of support in the past (the study covered a historical period). Therefore, it was planned that as part of Stage 4, the cooperating HR employees would distribute questionnaires to such employees and ensure that the data was properly collected.

At Stage 5, it was planned that some of the data for the study would be collected from secondary sources. For the purpose of collecting data from various sources and calculating the indicators covered by the model, a spreadsheet was developed (Stage 6). It was planned that the results of the research would be consulted as part of a group interview for which representatives from enterprises covered by the research would be invited (Stage 7). The research was carried out in accordance with the plan, and the results of the discussion became an inspiration to deepen the conclusions of the research.

The verification of the model was carried out with a limitation to types of direct support (BR – Table 1). It was assumed that the data provided by enterprises was correct. The study examined the support for schools addressed to students in the selected full cycle of formal education (4 years). It was assumed that if an enterprise demonstrated cooperation with more than one school, the school with which it maintained the most comprehensive cooperation would be selected for the analysis. Determining the scale of cooperation required an analysis of all relationships with schools indicated by an enterprise as partner schools.

The study was carried out in cooperation with four manufacturing enterprises. They are characterized in Table 3. The characteristics focus particularly on describing the scope of cooperation with technical schools.

A total of about 5,200 employees were hired in enterprises participating in the tests. The study examined the support provided by enterprises under the following relationships: A-R-a, B-R-b, C-R-g, D-R-j, where the capital letters are symbols of enterprises and the small ones are symbols of schools.



Table 3

Synthetic characteristics of enterprises that cooperated in the verification of the model for evaluating the results of support for schools

| Symbol | Business line  | Number of employees at the time of conducting research | Number of cooperating technical secondary schools and school symbols | Brief description of cooperation with a school/schools   |
|--------|--|--|--|--|
| A      | production of glassware; multinational enterprise              | 700  | 1; {a}   | cooperation without a signed contract; focused on cooperation with many professions, with a particular emphasis on a mechatronics technician |
| B      | automation solutions and components; family enterprise         | 100  | 5; {b, c, d, e, f}   | signed a contract with one of schools, not with the others; special interest in graduates in the field of mechatronics and logistics         |
| C      | production for the aviation industry; multinational enterprise | 1400   | 3; {g, h, i}   | signed a contract with one school, not with the others; special interest in mechatronics technicians and machining operators                 |
| D      | production of automation products; multinational enterprise    | 3000   | 4; {j, k, l, m}  | signed contracts with two schools and not with two schools; focused on the profession of mechatronics technician                             |

## Results

The values of the indicators calculated on the basis of the data obtained from the cooperating enterprises are summarised in Table 4. Table 5 features the supplementary data necessary to calculate the indicators from Table 4. Table 6 shows the variety of forms of support used by individual enterprises.

At this point, a brief interpretation of the results will be made.

**Comprehensiveness of support.** Among the identified forms of BR support ( $TNS = 11$ ), at least 9 forms were used in the surveyed enterprises (Table 6), where ( $n_{\min} = 5$ ,  $n_{\max} = 8$ ), i.e.  $U_{\max} - U_{\min} = 73\% - 36\% = 37\%$ . No form of support was used by all enterprises and forms P\_BR4 and P\_BR9 were not used at all. The values of the indicators testify to the high and varied comprehensiveness of support for schools.

**The size of support in a period.** The values of the indicators show that enterprises maintained a constant relationship with the cooperating schools. Although these values are quite different ( $ASP_{\max} - ASP_{\min} = 25 - 10 = 15$ ).

**Importance of forms of support from the point of view of enterprises.** For each enterprise,

the indicator takes into account only the forms of support used by each enterprise. Representatives of three enterprises evaluated the support used as very important, and one as important. The evaluations were slightly different. The average evaluation range was 0.8. Lower evaluations (e.g. 3.8) should be an incentive to analyze forms of support in terms of the legitimacy of using all of them.

**Importance of forms of support from the point of view of schools.** The research used data from other studies collected from 38 schools, in which the persons responsible for cooperation with enterprises, often acting as school deputy principals, evaluated all forms of support from Table 1 do Vale et al., 2018). All schools were located at a maximum distance of 130 km from each of the enterprises. To calculate the indicators, the forms of support used by individual enterprises were selected. School representatives rated the forms of support used by enterprises very highly. The  $I_{\%}$  indicator shows a high degree of compliance between enterprise and school evaluations. A large discrepancy could indicate the need to improve communication with schools in order to ensure that cooperation is adjusted to the objectives of both schools and enterprises.

**Strength of support.** The research shows that for enterprises A and B, the strength of support in-

Table 4  
Indicator values obtained as a result of test research

| Indicators   | Relationships of enterprises with schools |         |         |         |
|--|---|---------|---------|---------|
|  | A-R-a                                     | B-R-b   | C-R-g   | D-R-j   |
| 1. Indicators of support complexity                                  |   |         |         |         |
| n  | 5   | 8       | 5       | 4       |
| U  | 45%                                       | 73%     | 45%     | 36%     |
| 2. Indicators of the size of support in a period                     |   |         |         |         |
| ASP  | 25  | 16      | 10      | 13      |
| ASPs   | 6.25                                      | 4       | 3       | 3.3     |
| Importance indicators (from the point of view of enterprises)        |   |         |         |         |
| $I$  | 19  | 37      | 21      | 17      |
| $I_a$  | 3.8                                       | 4.6     | 4.2     | 4.3     |
| 4. Support evaluation indicators (from the point of view of schools) |   |         |         |         |
| E  | 23  | 35      | 22      | 17      |
| $E_a$  | 4.6                                       | 4.4     | 4.3     | 4.4     |
| $I\%$  | 83%                                       | 105%    | 98%     | 97%     |
| 5. Support strength indicators                                       |   |         |         |         |
| SS   | 20%                                       | 22%     | 2%      | 15%     |
| $SS_a$   | 4%  | 3%      | 0.3%    | 4%      |
| 6. Indicators of effectiveness                                       |   |         |         |         |
| $ES_{TG}$  | 1%  | 0%      | 5%      | no data |
| $ES_{TGPH}$  | no data                                   | 0%      | no data | no data |
| $ES_{TGPE}$  | 20%                                       | 0%      | 23%     | no data |
| 7. Indicators of effectiveness                                       |   |         |         |         |
| $EC_1$   | no data                                   | no data | no data | no data |
| $EC_2$   | no data                                   | no data | no data | no data |
| $EC_3$   | 25  | 0       | 280     | no data |

Table 5  
Supplementary data for the calculation of indicators in the analyzed enterprises

| Supplementary data  | Symbols | A-R-a   | B-R-b | C-R-g   | D-R-j   |
|---|---------|---------|-------|---------|---------|
| Number of schools analyzed  | S       | 1       | 1     | 1       | 1       |
| Number of identified forms of support for the BR group  | TNS     | 11      |       |         |         |
| Number of students from a school who received at least one BR support and completed school during the considered period                       | TG      | 100     | 7     | 149     | 23      |
| Number of graduates of a given school admitted to work in an enterprise who as students benefited from at least one support from the BR group | G       | 2       | 0     | 7       | no data |
| Total number of Graduates Planned for Hiring  | TGPH    | no data | 3     | no data | no data |
| Total number of Employees Planned for Hiring  | TEPE    | 5       | 3     | 30      | 630     |

Note: entry "no data" means that no data was collected in an enterprise in the analyzed scope, at least until the research was carried out.

Table 6  
Forms of support for schools used in the surveyed enterprises in 2013–2017

| Enterprise                 | P_BR1 | P_BR2 | P_BR3 | P_BR4 | P_BR5 | P_BR6 | P_BR7 | P_BR8 | P_BR9 | P_BR10 | P_BR11 | Total |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|
| A                          | 0     | 0     | 1     | 0     | 0     | 1     | 1     | 1     | 0     | 1      | 0      | 5     |
| B                          | 1     | 1     | 0     | 0     | 1     | 1     | 1     | 1     | 0     | 1      | 1      | 8     |
| C                          | 0     | 1     | 0     | 0     | 1     | 1     | 0     | 0     | 0     | 1      | 1      | 5     |
| D                          | 0     | 1     | 1     | 0     | 0     | 0     | 1     | 1     | 0     | 0      | 0      | 4     |
| Total                      | 1     | 3     | 2     | 0     | 2     | 3     | 3     | 3     | 0     | 3      | 2      |       |
| At least in one enterprise | 1     | 1     | 1     | 0     | 1     | 1     | 1     | 1     | 0     | 1      | 1      | 9     |

dicators are similar, for enterprise D, the indicator is slightly lower, and for enterprise C it is low, which is mainly due to the definition of a large potential group of pupils who could be supported. Although SS for enterprises A and D are different, their average  $SS_a$  support strength indicators are equal (4%). This was influenced by the lower diversity (comprehensiveness) of forms of support in enterprise D. The strength of support per form of support is the same.

**Effectiveness of support.** ES in enterprises is at a low level. Few students supported after graduation were employed in the surveyed enterprises.

It was not possible to calculate  $ES_{TGPH}$  and  $ES_{TGPE}$  for all enterprises, as in A, C there were no annual plans for employing graduates and in D annual plans for hiring employees, including graduates. In the case of enterprise B, more effective methods of supporting schools (including students) should be sought, so that the actions taken could be translated into hiring graduates. The highest effectiveness was observed in enterprise C.

**Effectiveness of support.** The costs of supporting schools were not analyzed in the surveyed enterprises. Therefore,  $EC_1$  and  $EC_2$  could not be analyzed. In enterprises, HR representatives were also unable to provide annual costs for the implementation of the HR function. On the other hand, HR employees were able to estimate the share of costs of support for schools costs in the costs of implementing the HR ( $C/C_{HR}$ ) function.

Representatives of the surveyed enterprises estimated ( $C/C_{HR}$ ) at: 8%, 12.5%, 2.5%, respectively. In one enterprise only the value of this factor was found to be very low. In  $EC_3$ , data from the estimates made were used. The effectiveness calculated in this way proved to be by far the highest in the case of enterprise C. This is due to the favourable relationship between the costs of supporting schools and the costs of HR and a higher number of employees compared to other enterprises.

During the interview conducted as the last stage of the research, representatives of enterprises rated the results of the research highly. They suggested repeating the study in the future. They noted that conducting research on a continuous basis would allow for the comparison of data over time. In addition, monitoring and a well-developed procedure would allow for the improvement of the data collection and archiving system. A representative of one of the enterprises expressed an interest in carrying out research in all enterprises of the cluster to which it belongs and of which it is the leader. Representatives of the enterprises asked not to use templates but only descriptions in reports dedicated to individual enterprises, which will facilitate reading the content of documents.

## Conclusions

As part of the presented research, the model of support for secondary technical schools by manufacturing enterprises was developed and initially verified. The most important conclusions of the research include the following:

- not all enterprises collect and analyze data on the formal education of employees recruited for work;
- the costs of supporting schools were not recorded in the tested enterprises, and no methods of calculating them have been developed so far, therefore the  $EC_1$  and  $EC_2$  effectiveness indicators could not be calculated;
- In the surveyed enterprises, employees responsible for HR most often had no problem estimating the percentage relationship of the costs of supporting schools to the costs of HR. Hence, in most of the surveyed enterprises it was possible to calculate the  $EC_3$  effectiveness index; it should be emphasized that the index was calculated on the basis of estimates and not hard data from the accounting system;

- effectiveness as the most accurate parameter for evaluating the results of support for schools should be monitored in the first place. However, the results of preliminary research indicate that even in large multinational enterprises, data for effectiveness testing may not be collected at least for the time being; therefore, a change in this state of affairs should be sought, and in the first place, simpler indicators for evaluating the results of support for schools should be implemented in HR departments, which are proposed in this publication;
- it can be concluded from the cooperation with the enterprises that took part in the survey that at least in large manufacturing enterprises there is openness to support schools and readiness to diagnose the results of this support.

Although, as noted by Flyvbjerg (2006) and Qureshi and Evans (2015), even one case is considered sufficient for qualitative research, there are limitations on how far these empirical results can be generalized. It is suggested that further research be carried out and ways to improve measurement methods should be looked for in order to obtain more detailed conclusions related to support for schools, especially to effectiveness.

Research on the developed model should be conducted at least in the following directions:

- expansion of the set of indicators for the study of ER category relationships (Table 1);
- analysis of indicator values over time;
- study of larger samples of enterprises and the inclusion of statistical methods in the study,
- study of the impact of macroeconomic variables on the values of indicators included in the model.

The results obtained so far indicate the desirability of continuing the research work. The development and maintenance of relations between enterprises and schools is an important issue both from the point of view of competence management in enterprises and from the point of view of the functioning of the labour market. This phenomenon is important from both economic and social points of view.

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