Projection of Productive Subject Teacher of Construction Technology and Property in 2019–2023

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Keywords: Projection, Productive Subject Teachers, Construction Technology and Property.

Abstract: Along with the enactment of the Director General of Education, Ministry of Education and Culture of the spectrum Skills Vocational Secondary Education Curriculum 2016 and the implementation of the 2013 National Curriculum for the revision of the national level Vocational High School in the new academic year 2017/2018, then a productive teacher expertise placement arrangement in accordance with the competence there is on the spectrum. This study aimed to describe the projected needs of Productive Subject Teacher of Construction Technology and Property in year 2019 - 2023, so that the known picture of needs. This study is a pragmatic approach to educational planning. The subject of this research is the Productive Subject Teacher of Construction Technology and Property in Semarang. Methods of data collection is the documentation of secondary data. The data analysis technique used is the technique of projection. The result of the projection calculation of Productive Subject Teacher of Construction Technology and Property at Vocational High School who opened the membership program in Semarang in 2019 requires 7 teachers, 2020 requires 22 teachers, in 2021 requires 24 teachers, 2022 requires 6 teachers and 2023 require 5 teachers.

1   INTRODUCTION

Falsean important part of human resource management is human resource planning. Human resource planning is to plan workforce to fit the needs of the company as well as effective and efficient in helping the realization of objectives (Hasibuan, 2011), According to Werther and Davis in Sutrisno (2009) stated that human resource planning is a systematic planning and procurement of the estimated needs of the employee. Human resource planning is a series of activities undertaken to anticipate business and environmental demands on the organization at a time when that will come, and to meet the manpower requirements posed by these conditions. Human Resources Planning is concerned with determining the need for labour in the future, both in terms of number and qualifications to fill a variety of positions in organizing various activities in the future. In the context of the term Human Resources management is closely related to the term needs analysis, workload analysis and determination of employee formation.

Teachers in this study consisted of teachers Productive according to Construction Technology and Property Program. Schools in this study consists of the State Vocational High School located in Semarang opening Construction Technology and Property Program.

Education cannot stand alone because in them involve many components and all components are interrelated with each other so as to be managed/arranged in an orderly manner in order to run properly (Rosemarie, 2009), Directly shortage of teachers will result in dual duties of teachers, provision of teaching assignments to teachers who are not authorized, and cannot be convening an educational program. This will prevent the implementation of programs to improve the quality and equity of education. Conversely, excess teachers meant wasting the country's financial and human resources, and can lead to social unrest (Chandra, Aunurrahman and Sindju, 2014),

Human resources is a source of competitive advantage that is timeless summer, not weathered by rain. He compared the position of these resources with the resources of other competitive advantages are now diminishing its value. The competitiveness

of an organization closely linked to organizational effectiveness in satisfying the needs of stakeholders, both inside stakeholders (suppliers, investors, distributors, employees, and customers) as well as outside stakeholders (public, government, and competitors) (Pfeffer, 1994),

The availability of sufficient teachers are key to the sustainability of the teaching-learning process well in every educational institution. Without teachers, education will only be a grandiose slogan for all forms of policies and programs will ultimately be determined by the performance of the parties are at the forefront, namely teachers(Wiharna, 2010),

Entry Joint Decree of 5 (five) of the Ministry of the Republic of Indonesia about structuring and equity civilian civil service teachers assigned in 2012 provides guidelines to regulate the presence of a teacher. Research result Siswantari (2013) Siswantari (2013: 421) Showed the teacher can teach in private schools to meet their teaching time to 24 hours and the concentration of teachers are not bothered if the implementation of a joint decree of the corresponding technical instructions, and there are many schools that do not fit the rules. Research result Kelvin (2016) found that the problem of management of teachers in Indonesia, partly because of the provision of teachers from three things: the discrepancy qualifications of teachers with the qualifications of applicants, the formation does not suit your needs, and mutations that teachers are not based on teacher qualification.

Projections in this study the intention is to find out situation current teachers and teacher needs a period of 5 years into the future or medium-term estimate calculation means teachers need to come based on the existing data. The need in this study is defined as the number of teachers needed in vocational secondary education with reference to the Education Minimum Service Standards mainly

Standards and Education Personnel. Teachers in this study consisted of teachers appropriate vocational Productive Field Studies in the city of Semarang in this study were selected on the areas of expertise of Construction Technology and Properties.

2 RESEARCH METHODOLOGY

Research using descriptive design approach for exposing data measured and converted in advance in the form of numbers or quantified and analyzed using descriptive statistical techniques. The approach used by researchers for the data to be searched and will be processed in the form of numbers and calculations.

The data used in this study, especially the data about the characteristics of the state of teachers, number of students, number of classrooms, the number of teachers available, the number of teachers who retired. The data is obtained based on educational data summary of each educational unit as primary data, the use of data analysis such documentation can be justified on scientific research as suggested by Best and Kahn (1993) that may be all for the benefit of certain scientific work, already available data used. Such data may not yet squeezed the survey results and further analysis can produce something very useful.

To process the data in this study used a mathematical equation or mathematical equation approach. Formulas of mathematical equations have been taking into account the availability of data and the characteristics of the data. Observing these conditions, been formula mathematical equation that refers to the Technical Guidance Rule 5 Secretary of Arrangement and Equity Master PNS (2011), the formula used to calculate the needs of classroom teachers is as follows:

$$KG_P = \frac{JTM}{24} = \frac{(MP_1 \times \sum K_1 \times KP_1) + (MP_2 \times \sum K_2 \times KP_2) + (MP_3 \times \sum K_3 \times KP_3)}{24} \quad (1)$$

information:
KGP = the needs of productive subject teachers
JTM = the amount of face-to-face meeting per week per teacher type
MP = the allocation of teaching hour per week on a subject
ΣK = number of classes / study group that follows a productive skill level on a particular specialization subjects;

KP = number of productive skill subjects on each study group at a level that follows the productive Certain subjects.
24 = Compulsory teaching hour per week, 24 hours
1,2,3 = Levels 1, 2 and 3

According to Gaffar (1987) formula to calculate the shortage of teachers is as follows:

$$KG = KGT - (GA - GP / GK / GS) \qquad (2)$$

Information:

KG   : shortage of teachers
KGT : total teacher needs
GA   : existing teachers
GP   : teachers who will retire
GK   : teachers who for some reason will come out
GS   : teachers who are not fully qualified for the lessons will continue.

3   RESULTS AND DISCUSSION

The supply and demand of technology education teachers has been a matter of concern for many years (Moye, 2009). It is clear that there is a shortage of teachers, especially technology education teachers, and the shortages will continue to Increase. The technology education teaching profession is concerned about teacher supply and demand (Ndahi and Ritz, 2008),

The education process is in desperate need of good planning in order human resource requirements can be met and in accordance with the required competencies. The initial steps in planning education is to analyze the needs of the educational components including employee needs analysis. The legal basis of the analysis and projections as well as the needs of teachers and the provision contained in Decree of the Minister for Administrative Reform No. KEP/75/M.PAN/7/2004. In the decree states that the employee needs analysis is the process done logically, orderly, and sustainable to determine the number and quality of staff required. This is similar to the one expressed by Slater Manpower planning which concerns how to recruit and deploy, develop and use the human resources at our disposal. The initial stage of the process is very much a present-tense affair: it involves stocktaking the labour force and describing or modelling its nature.

The decision above is a guideline for calculating the needs of employees based on workload in order to formulate the formation of civil servants. In Law No. 14 of 2005 about teachers and lecturers section 35 is described on the workload of teachers that the workload of teachers covers the main activities that include learning plan, implementing the learning, assessing learning outcomes, guide and train the learners, as well as carry out additional tasks. It was also explained that the workload of the teachers contemplated that at least 24 (twenty four) hours of face-to-face and no more than 40 (forty) hours of face-to-face within 1 (one) week.

Demand and supply perfect is if the overall supply meet demand requirements both quantitatively and qualitatively. Such balance in the law of demand and supply so-called "perfect equilibrium"(Gaffar, 1987), Perfect equilibrium state is very difficult to achieve as there are various factors that are difficult there are various factors difficult to control either on demand or on a component supply components. Analysis of demand and supply more depth is very important for planners to examine more detailed because the two components can uncover a variety of dynamic factors that influence demand and supply. Demand and supply are dynamic due to internal factors and external as the dominant influence was constantly changing and evolving. Factors that influence the demand is continuously applied in the school curriculum as a user of the teacher. The school curriculum must continue to grow dynamically and therefore affect the competence of teachers needed. Enrolment growth also affects the quantitative aspects of demand, as well as the burden of teaching and student study load. The quality standards of education in schools is also always live and develop well.

Procurement of employees conducted by an organization/institution after doing advance planning. But to get to the procurement and planning employee, an organizations/institution should conduct a needs analysis first. By conducting a needs analysis, an organization/institution will be able to know the exact number of how many employees are needed. Pidarta (2005) interpret the needs of a gap between what we have now with how it should be. Meanwhile, according to Gaffar (1987) needs of teachers are professional teacher demands of service users to provide services to students in educational institutions teacher's service users.

Vocational High School is a secondary school after junior high school. Equivalent to a high school. Vocational High School is one form of formal education unit which organizes vocational education in secondary education as a continuation of the school SMP/MTs or other form of equal or advanced learning outcomes recognized from the same / equivalent school SMP/MTs. (Act No. 20 of 2003, Article 18, paragraph 3). Vocational education is secondary education that prepares students primarily to work in a particular field. (Act No. 20 of 2003, Explanation of Article 15).

Estimates of teacher needs in vocational schools (SMK) system payed field of study. As there are three groups of teachers based on field of study is the field of study of normative, adaptive and

productive. Field studies in vocational earning a vocational skill groups of subjects according to the vocational competence. Number of hours per week that students receive for each subject based on the applicable curriculum.

Semarang has 11 Vocational High School who carry out various areas of expertise in the Skills Spectrum Vocational Secondary Education in 2016. Of the 11 Vocational High School in the city of Semarang, which serve as the object of this research is the Vocational High School who has a Construction Technology and Property Program (according to the Education Skills spectrum SMK 2016) as many as five schools.

Educational programs for competency skills Business Construction and Property and Design of Building and Modelling Information held for 3 years, while the competence of expertise Building Construction, Sanitation and Maintenance and Road Construction, Irrigation and Bridge held for 4 years. In this study, the overall calculation for the needs of teachers during teacher education and projected needs for each year during the educational process takes place. The assumptions used for this calculation is the number of students and study groups are considered fixed and only pay attention to the number of teachers who retired during the educational process takes place every year.

Table 1: The need for teachers for each competency.

Name of School	Skills Competencies	Number of study groups / levels	ideal number of teachers			
			2017	2018	2019	2020
SMK 3 Semarang	Design of Building and Modeling Information	2	1	6	11	11
	Building Construction, Sanitation and Maintenance	2	2	6	10	18
SMKN 4 Semarang	Design of Building and Modeling Information	2	1	6	11	11
SMKN 5 Semarang	Design of Building and Modeling Information	2	1	6	11	11
SMKN 7 Semarang	Road Construction, Irrigation and Bridge	2	2	6	10	18
	Building Construction, Sanitation and Maintenance	2	2	6	10	18
SMKN Jawa Tengah	Business Construction and Property	1	1	3	5	5

By using data on the number of teachers at vocational productive in Semarang which opens the Construction Technology and Property Program in the academic year 2018/2019 and ideal needs of teachers by the number of teaching hours by 24 hours as a reference, the availability and needs of productive teacher at the beginning of the year 2019 and so on can be calculated.

Table 2: Projected needs of teachers in 2019

Name of School	Skills Competencies	Number of study groups / levels	Number of Ideal Teachers			
			existing	Ideal	Retired	needs
SMK 3 Semarang	Design of Building and Modeling Information	2	4	6	2	4
	Building Construction, Sanitation and Maintenance	2	4	6	1	3
SMKN 4 Semarang	Design of Building and Modeling Information	2	6	6		
SMKN 5 Semarang	Design of Building and Modeling Information	2	9	6		
SMKN 7 Semarang	Road Construction, Irrigation and Bridge	2	12	6		
	Building Construction, Sanitation and Maintenance	2	8	6		
SMKN Jawa Tengah	Business Construction and Property	1	6	3		
			49	39	3	7

Noting the results of data analysis as in the table above, it can be shown that up to the end of 2018 there were three teachers who retired and they are all on one school. Details of the lack of teachers earning

each competency skills that opened in 2019 is the number 7 teachers. When examined carefully and compared to the overall availability of teachers, shortage of teachers who happen not to all schools

that opened the competence of existing expertise on technology Construction Technology and Property Program. In this academic year productive teacher shortage occurs only at SMKN 3 Semarang for all competency skills that are opened, this is due to the teachers who retire as many as 3 people. While other schools are still experiencing excess productive teacher. When compared to the total needs of the teachers on the Construction Technology and Property Program, then in the beginning of 2019 there are excess teachers. However, do not allow to perform mutation, because school teachers are still completing the student with the old curriculum until the end of the academic year 2018/2019.

Table 3: Projected teacher requirements by 2020.

Name of School	Skills Competencies	Number of study groups / levels	Number of Ideal Teachers			
			existing	Ideal	Retired	needs
SMK 3 Semarang	Design of Building and Modeling Information	2	6	11	1	6
	Building Construction, Sanitation and Maintenance	2	6	10		4
SMKN 4 Semarang	Design of Building and Modeling Information	2	6	11	1	6
SMKN 5 Semarang	Design of Building and Modeling Information	2	9	11	1	3
SMKN 7 Semarang	Road Construction, Irrigation and Bridge	2	12	10		
	Building Construction, Sanitation and Maintenance	2	8	10	1	3
SMKN Jawa Tengah	Business Construction and Property	1	6	5		
			53	68	4	22

At the end of 2019, the number of teachers earning pension is 4. In 2020 the productive needs of teachers is 22 people. This year all the school has implemented curriculum 2013 revision so that all the competencies in the open is the competence of the appropriate expertise to the spectrum of expertise in 2016 and the 3-year program has entered its 3rd year so that the number of productive teachers must be met. This year there are some schools that have excess teachers to meet the needs of at least 24 hours teaching hours can be done by giving the other tasks that can be recognized as additional teaching hours.

Table 4: Projected need for teachers in 2021.

Name of School	Skills Competencies	Number of study groups / levels	Number of Ideal Teachers			
			existing	Ideal	Retired	needs
SMK 3 Semarang	Design of Building and Modeling Information	2	11	11		
	Building Construction, Sanitation and Maintenance	2	10	18	1	9
SMKN 4 Semarang	Design of Building and Modeling Information	2	11	11	1	1
SMKN 5 Semarang	Design of Building and Modeling Information	2	11	11		
SMKN 7 Semarang	Road Construction, Irrigation and Bridge	2	12	18		6
	Building Construction, Sanitation and Maintenance	2	10	18		8
SMKN Jawa Tengah	Business Construction and Property	1	6	5		
			71	92	2	24

In 2021 the number of teachers' needs are as many as 24 people and the number of teachers retiring at the end of 2020 was as much as 2 people. Needs of teachers are very strong because this year

the expertise to implement the program for 4 year education process has entered the 4th year, so

needed productive teachers must be met.

Table 5: Projected teacher requirements by 2022.

Name of School	Skills Competencies	Number of study groups / levels	Number of Ideal Teachers			
			existing	Ideal	Retired	needs
SMK 3 Semarang	Design of Building and Modeling Information	2	11	11	1	1
	Building Construction, Sanitation and Maintenance	2	18	18		
SMKN 4 Semarang	Design of Building and Modeling Information	2	11	11		
SMKN 5 Semarang	Design of Building and Modeling Information	2	11	11	2	2
SMKN 7 Semarang	Road Construction, Irrigation and Bridge	2	18	18	2	2
	Building Construction, Sanitation and Maintenance	2	18	18	1	1
SMK Central Java	Business Construction and Property	1	6	5		
			93	92	6	6

At the end of 2021, the number of teachers earning pension is 6 persons. 2022 was a productive teacher needs is as much as 6 people. This year all the school has implemented curriculum 2013 revision so that all the competencies in the open is the competence of the appropriate expertise to the spectrum of expertise in 2016 for the program 3 years and 4 years. Noting the results of these projections, it can be stated that in this year the number of productive teachers needed to carry out the teaching and learning process on all skill competencies in all schools has been fulfilled.

Table 6: Projected teacher requirements by 2023.

Name of School	Skills Competencies	Number of study groups / levels	Number of Ideal Teachers			
			existing	Ideal	Retired	needs
SMK 3 Semarang	Design of Building and Modeling Information	2	11	11		
	Building Construction, Sanitation and Maintenance	2	18	18		
SMKN 4 Semarang	Design of Building and Modeling Information	2	11	11	1	1
SMKN 5 Semarang	Design of Building and Modeling Information	2	11	11	1	1
SMKN 7 Semarang	Road Construction, Irrigation and Bridge	2	18	18		
	Building Construction, Sanitation and Maintenance	2	18	18	1	1
SMK Central Java	Business Construction and Property	1	6	5	3	2
			93	92	6	5

Similarly with the condition in 2022 in which the number of teachers needs to carry out the teaching and learning activities have been met. So that the projected needs of teachers this year only pay attention to the number of teachers who retire until the end of 2022 as many as 6 teachers. Noting the results of the analysis, the 2023 takes as many as five new teachers.

Noting the results of the calculation of projected needs of productive teachers on the Construction Technology and Property Program for the next 5 years could be said that teachers need to be provided

are as many as 64 people with the details of the needs of each year as described above.

To get the number of productive teachers according to the projection results is not easy. The government as a party to carry out the recruitment of teachers are not necessarily open the formation of teachers as required by the school, therefore, the principal should make efforts to meet the needs of the teacher. The most common strategies used by principals to cope with the demand are increasing teaching loads of existing teachers, hiring under-qualified and uncertified teachers, and Employing temporary teachers for long periods of time. Reviews these findings redirect the problem of a shortage of quantitative teacher toward the problem of a hidden shortage that relates to the quality of the teaching force (Donitsa-Schmidt and Zuzovsky, 2014). We are the technology education profession. It is our responsibility to correct the supply and demand dilemma for our profession. Recruit one; you can make the difference (Ndahi and Ritz, 2008),

A similar argument is presented by Santiago (2002) which states that the Teacher supply can be Examined in terms of retention rates for the present stock of teachers, the flow of newly certified teachers from colleges and universities, the flow of returning teachers and graduates of teacher Programs who have been absent from the teachers labour market , the flow into the profession of individuals not holding a regular license, and the flow of private school teachers into the public system.

4 CONCLUSIONS

Based on the objectives, the results of research and discussion it can be concluded that the projected needs of the productive teacher at SMK in Semarang for programming skills Construction Technology and Property showed that within 5 years require the procurement of teachers as many as 64 people

The details of the annual requirement is 7 people in 2019, 2020 requires 22, 2021 required 24, 2022 need to be supplying as much as 6 teachers and 2023 additional required by 5 teachers.

Recruitment of teachers conducted by the government cannot provide assurance that every school will get the number of teachers according to their competence, therefore, the principal must take measures to meet the needs of teachers needed for teaching and learning can take place properly.

Efforts to do is to recruit teachers are not permanent or temporary teacher.

REFERENCES

Best, J. W. and Kahn, J. V (1993). *Research in Education.* 7th edn. New Jersey: Prentice Hall.

Chandra, I., Aunurrahman and Sindju, H. B. (2014). Proyeksi Kebutuhan Guru SMP, SMA Dan SMK Di Kecamatan Paloh Kabupaten Sambas Tahun 2016/2017. *Jurnal Pendidikan dan Pembelajaran*, 3(9), 1-11.

Donitsa-Schmidt, S. and Zuzovsky, R. (2014). Teacher Supply and Demand: The School Level Perspective. *American Journal of Educational Research*, 2(6), 420–429.

Gaffar, M. F. (1987) *Perencanaan Pendidikan Teori dan Metodologi*. Jakarta: Departemen Pendidikan dan Kebudayaan.

Hasibuan, M. (2011) *Manajemen Sumber Daya Manusia*. Jakarta: Bumi Aksara.

Indonesian Government Law No. 20 Year 2003 on National Education System.

Indonesian Government Law No. 14 Year 2005 on Teachers and Lecturers

Indonesian Government Regulation No. 19 Year 2005 on National Education Standard.

Indonesian Government Regulation No. 17 year 2010 on the Educational Management and Implementation.

Moye, J. J. (2009). Technology Education Teacher Supply and Demand--A Critical Situation. *Technology Teacher*, 69(2), 30–36.

Ndahi, H. B. and Ritz, J. M. (2008). Technology Education Teacher Demand, 2002-2005. *Technology Teacher*, 62 (7), 27-31

Pfeffer, J. (1994) *Competitive Advantage through People: Unleashing the Power of the Workface*. Boston: Harvard Business School Press.

Pidarta, M. (2005) *Perencanaan Pendidikan Partisipatori Dengan Pendekatan Sistem*. Edisi Revi. Jakarta: Rineka Cipta.

Rosemarie, S. (2009). Konsep Administrasi Pendidikan. *Jurnal Nasional LIPI*, 16/2.

Santiago, P. (2002). *Teacher Demand and Supply*. France: OECD.

Siswantari (2013). Tinjauan Kritis Terhadap Peraturan Bersama Lima Menteri tentang Penataan dan Pemerataan Guru Pegawai Negeri Sipil. *Pendidikan dan Kebudayaan*, 19(3), 421–429.

Slater, M. (1980). Manpower planning and research. Paper presented at *Aslib Proceedings*, 381–386.

State Apparatus Empowerment Ministry Decision. 2004. No: KEP/61/M.PAN/6/2004 on the Guidelines of Position Analysis.

Sutrisno, E. (2009) *Manajemen Sumber Daya Manusia*. Jakarta: Kencana Prenada Media Group.

Suwandi (2016). Analisis Studi Kebijakan Pengelolaan Guru SMK dalam Rangka Peningkatan Mutu

Pendidikan. *Jurnal Pendidikan Teknologi dan Kejuruan*, 23(1), 90-100.

Technical Guide on the 5 Ministry Regulation. (2011). The Arrangement and the Distribution of Civil Servant Teachers.

The Decision of Directorate General of Elementary and Secondary Education Management no 4678/D/KEP/MK/2016 on the Skill Spectrum of the Vocational Schools.

Wiharna, O. (2010). Perencanaan Kebutuhan Guru Sekolah Dasar Berdasarkan Pendekatan Kewilayahan. *Mimbar Pendidikan*, 26(1), 63–71.