Vocational training for job seekers in Georgia:

Technical assistance for the Ministry of Labor, Health, and Social Affairs

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1. Summary

The ISET Policy Institute (ISET-PI) was commissioned by the World Bank to assist the Social Service Agency (SSA) of Georgia, an agency of the Ministry of Labor, Health, and Social Affairs (MoLHSA), in setting up a system for providing job seekers with vocational and educational training (VET). The project had two specific goals.

The first and primary goal was to develop a methodology for identifying those qualifications offered by VET institutions that should be included in the VET system of SSA. For demonstrative purposes, the developed methodology was then to be applied to the programs offered by VET institutions in the four pilot municipalities of Gori, Rustavi, Kutaisi, and Batumi.

The second and secondary goal was to make suggestions how the matching of job seekers to training programs could be facilitated so that labor market demand, economic data, and relevant characteristics of the job seekers would be taken into account.

Key recommendations which address problems that were encountered during this project (mainly about data availability):

1. MoLHSA (including the SSA) should build analytical capacity providing information necessary to guide their policies.

2. MoLHSA, and the SSA in particular, should communicate to GeoStat which data is needed for monitoring the demand for qualifications.

3. Job seekers that were trained in the SSA system should be required to report their employment status, employer, and wage, for 12 months after receiving training.

4. In the worknet.ge system, training preferences are elicited in "open" questions, asking job seeker to fill in an answer, reducing the quality and usability of data considerably. To circumvent these problems, qualifications should be chosen through pull-down menus that only contain those qualifications locally available. To reduce complexity, the pull down menus could have a two-tier structure. On the first tier, the general area of interest would be specified (e.g. "office job"), and on the second tier, a specific qualification could be chosen.

5. The worknet.ge system is open to every job seeker, whether currently employed or not. If one would ask for the current employment status and existing qualifications of a job seeker, one could use this information for estimating unemployment rates for different qualifications.

6. Tests should be conducted to elicit the talents, strengths, and weaknesses of job seekers.

7. The assignment of job seekers to training programs can be supported either through a recommendation system or through a matching algorithm. At this stage, it is recommended to pursue the simpler option of a recommendation system.

2. Identifying economically relevant qualifications

The methodology proposed in this report is tailored for the specific purpose of identifying those skills which should be included in the governmental VET system, while it is not necessarily adequate for other purposes. In this regard, it is important to stress that the choice of qualifications to be included in the VET system of SSA does not have long-run, strategic character, but is intended to be reviewed on a regular basis. Consequently, the analysis offered in this report focuses on the short run, contrary to many other studies concerned with vocational training aiming to estimate the long-run demand for qualifications (see the literature cited in Section 2.1.).

Short run, however, does not mean that the methodology proposed here applies to the current situation only. As the parameters entering the analysis do not change quickly, we believe that under normal economic conditions it does not lead to inefficiencies if the qualifications identified with this methodology are included in the SSA VET system for a time span of 12 months before the selection is updated again.

The output of the methodology presented here will be a *ranking* of qualifications, which can then be used for selecting those qualifications that should be included in the SSA system (e.g. the top five qualifications according to the ranking).

2.1. Which information is relevant?

Vocational training addresses the needs of two different groups. It is demanded by job seekers who want to improve their human capital in a way that matches their preferences and, in the optimal case, maximizes their chances to get back into employment. At the same time, vocational training also addresses the needs of employers, whose businesses may face shortages in qualified personnel.

While in an ideal world the interests of job seekers and employers would coincide, in reality this is often not the case. Besides informational asymmetries (job seekers not knowing which qualifications are demanded by employers) the reason is that employers may be in need of qualifications that are not considered attractive by the job seekers. It is well known that this *qualification mismatch* is a relevant problem in Georgia, as was shown in various previous studies (see ISET (2012) and The World Bank (2013) and the literature provided there). Qualification mismatches are a common problem in many labor markets around the world (see, for example, Ghignoni and Verashchagina (2014) for Europe, McGuinness and Sloane (2011) for the UK, and Béduwé and Giret (2011) for France, and the literature overviews given in those articles).

Based on these considerations, it becomes clear that it is not enough to only include employers in the analysis. If one does not consider job seeker's preferences, it may happen that people may prefer to not participate in the VET system at all. And even if one can effectively incentivize job seekers to attend training programs, as it is for example the case in Germany, where the refusal to participate in training is sanctioned by a reduction of unemployment benefits (cf. Neubäumer (2012)), it is likely that involuntary training will be less effective. The reason why most studies on the demand for qualifications, for example for the European Union (Lettmayr and Nehls (2012)), New Zealand (Earle (2008)), and Australia (Shah (2010)), neglect the preferences of the people who are to be trained, is that those studies are concerned with making forecasts about long-run developments. These forecasts are used to support

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strategic decisions on how to develop the educational sector. The SSA, however, does not aim to shape the long-run profile of the Georgian labor force. Rather, it asks for a meaningful way to decide which existing training programs, typically lasting only 2-3 months, should be included in the vocational training system. In this context, job seeker's preferences must not be neglected, while they are less relevant for the long run (as they can hardly be forecasted).

For the objective of the SSA, it would be useful to not only consider job seekers' preferences, but also their given strengths and weaknesses. If certain talents are abundant (or scarce) in the target population, this should have an impact on whether to include qualifications that depend on those talents.

More intricate is the question whether the *qualities* of the VET programs should be taken into account. If an inclusion in the SSA system allows programs to improve their quality, then it is at least partly determined *through* the selection and cannot be taken as a factor to *guide* the selection. Alternatively, one might argue that quality should be included, because the support of the government will be particularly effective if it benefits programs that are already run well. In this vein, inclusion in the SSA system could be seen as a "reward" for high quality, turning the SSA system into an incentivizing mechanism for training programs to improve their quality.

Estimating the quality of educational institutions is methodologically very difficult. In addition to the effect training has for the job market chances of the job seeker (the so-called *treatment effect*), it is usually the case that some institutions, for example because of their reputation, attract better students in the first place (the so-called *selection effect*) (for an overview of the problems related to empirically distinguishing both effects, see Caliendo and Hujer (2006)). Therefore, job market performance of graduates is a flawed measure for the quality of an educational institution. Even if the graduates of one college do better in the job market than those of another, it does not mean that the first institution has higher quality than the latter. The difference may be entirely caused by the selection effect. Given these problems, the methodology proposed here will not take into account the quality of programs.

In summary, the ISET methodology draws on information about labor market situation and job seeker characteristics. The next subsection lists concrete information sources that can be utilized within these categories.

2.2. Sources of information that can be utilized

2.2.1. Employer demand

For the demand in the labor market, the following sources of information can potentially be utilized:

1. *Unemployment rates for different qualifications and time of unemployment.* The unemployment rate is the most direct indicator for oversupply and undersupply in a labor market. Unfortunately, unemployment rates by occupation are not routinely computed by GeoStat. In principle they could be estimated for broad occupations (according to the 1st digit of the ISCO code) using GeoStat's household survey, however this would be of limited practical value as almost all the occupations of interest would end up being in the same category, not allowing for comparisons between them.

One may also consider the time people are unemployed as an indicator of demand/job market chances. This is something one may ask directly from the job seekers participating in the worknet.ge system.

Due to a similar argument as for wages (see the next point), for the purposes of identifying the most relevant qualifications at a given point in time it may be even more informative to consider recent *relative changes* in unemployment rates and unemployment times.

2. Wage changes and wage levels for different qualifications. If data on wage changes is available, it indicates the scarcity or abundance of certain skills in the labor market more reliably than absolute wage levels. What matters most in this respect are changes in *relative* wages (e.g. the growth rate of wages earned by IT specialists, say, relative to that of the average wage).

SSA could monitor wage changes by occupation based on own sources of information (without involving Geostat). For example, SSA might ask employers to provide wage ranges when they post vacancies on the worknet.ge system (probably on a voluntary basis).

For background information on wage levels vs. wage dynamics, see the technical box below.

Technical box: Why are wage changes a more reliable indicator for skills shortages than absolute wage levels?

The absolute wage level corresponds to the marginal productivity of a worker if the production process is substitutive, i.e. when different production factors can be substituted for one another. If, on the other hand, the production process is of a Leontief type, i.e. when production factors have to be employed in fixed proportions, wages do not reflect marginal productivity. In the substitutive case, low wages indicate high supply of a qualification in the market, as, roughly speaking, a low marginal productivity leads to low demand. Conversely, high wages suggest that the marginal productivity is high, meaning that there is high demand for this qualification. With a Leontief production process, however, wages do not correspond to marginal productivity, but are determined through bargaining between employer and employed, where many factors may enter which have nothing to do with the availability of the qualification in the job market (e.g. "responsibility of the job", amount of education necessary to obtain the qualification, social prestige of the qualification etc.). While it is uncontroversial among economists that most production processes are neither purely substitutive nor purely of a Leontief type, in the macroeconomic literature it is a standard assumption that the global production process of an economy is substitutive. This is typically justified by an aggregation argument, as a huge number of Leontief production processes taken together will on an aggregate level result in a substitutive production process for the whole economy (for these theoretical arguments, see Mas-Colell, Whinston, and Greene (1995), Chapter 5). For the problem at hand, however, it would be problematic to disregard the fact that real-world production processes are almost never purely substitutive, because the analysis is done for individual qualifications, each of which constitutes but a small section of the labor market, reducing the effect of aggregation.

Looking at wage changes elegantly avoids this problem, as an increase in wages indicates a higher demand both in the substitutive as well as in the Leontief case. In the Leontief case, higher wages mean that the bargaining power of the employee has increased, which would typically be caused by an excess

demand or a supply shortage.

However, if wage level time series for individual qualifications are not available, absolute wages may still be used, as they capture the "substitutive part" of production processes in the economy.

3. *Employer opinions.* Employers, continuously concerned with hiring people, will typically have expertise on the overall situation in the labor market. In Section 4.1. it will described are the relevant questions for eliciting employer opinions on the demand for qualifications in the labor market. One may choose random samples from those employers registered with the worknet.ge system in a municipality, or, if the municipality is small, one may question all employers.

4. *Opinions of vocational training institutions and self-reporting of their graduates.* If vocational training institutions know about the future whereabouts of their graduates, they will have qualified opinions on whether or not the programs the offer enhance employment chances. In Sections 3.1. a suggestion is made to monitor job market performance of VET institution graduates in a systematic way (based on self-reporting). In Section 4.1. we explain what information VET institutions contributed when we applied this methodology in the pilot cities (in telephone interviews we asked the VET institutions to rank the programs they offer according to job market performance of the graduates).

Alternatively (or in addition), one might also conduct periodic expert meetings, moderated by the SSA, possibly bringing together both vet institutions and major employers in a municipality.

5. *Sector-specific macroeconomic data.* If a sector intensively draws on particular qualifications, the macroeconomics situation in that sector can be used to draw conclusions on the demand for those qualifications. For example, if it is known from macroeconomic data that a boom in the construction sector takes place (or, according to macroeconomic forecasts, is about to take place soon), this whould lead to higher priorities for those qualifications that are needed in construction.

6. *Government plans affecting certain sectors and regions.* For example, large-scale upgrading of infrastructure in one region will increase the demand for engineering qualifications and qualifications that are relevant for the construction sector in that region.

7. *Self-employment possibilities.* Qualifications also yield possibilities to offer one's services independently or even start an own business. Data on the share of self-employed in different professions can be used for the estimation of self-employment possibilities, but this data is currently not available. As suggested in Section 3.1., the SSA might communicate with GeoStat to make them collect such data.

Taking estimations of self-employment chances that were generated for other countries is problematic, as self-employment chances depend on the specific economic situation of a country. For example, while there arguably is a considerable demand for self-employed welders in Georgia, this will less be the case in more advanced economies where construction, at least when it comes to commercial projects, is typically carried out by specialized construction companies that offer turnkey buildings.

2.3.2. Job seekers' characteristics

Information on job seekers may come from:

1. *Asking job seekers.* Job seekers may be asked to provide information on their preferences and skills (self-assessment) when they register as unemployed (e.g. through the *worknet.ge* website recently established by the SSA).

2. *Testing job seekers.* Job seekers may be required to take tests designed to reveal their talents.

3. *Opinions of vocational training institutions.* Enrollment numbers for programs reveal the popularity of different programs. This information can be used for estimating the preferences of job seekers for different qualifications.

3. Recommendations for improving the information base

Much of the relevant data listed in the previous chapter is not available in Georgia or the SSA is lacking personnel capacities to analyze the relevant data. In this chapter, we make recommendations how to improve data availability and analysis.

3.1. Data on the job market situation

ISET PI makes the following recommendations:

1. MoLHSA (including the SSA) should build analytical capacity providing information necessary to guide their policies. Specifically, it would be useful if the SSA could carry out statistical analyses of available GeoStat data. For example If GeoStat would provide data on wage changes for different professions, as was discussed above, maximum benefit could be achieved if SSA would have the capacities to conduct econometric time series analyses.

2. MoLHSA, and the SSA in particular, should communicate to GeoStat which data is needed for monitoring the demand for qualifications. For example, the *household survey* is a potential source for wage changes, but it would have to be conducted in sufficiently close intervals. Also the sample size should be increased. Currently, it surveys 3000 households, which means that on average there will be roughly 30 households per qualification. Given de facto unemployment (or heavy underemployment) of about half of the Georgian labor force, this number reduces to 15 households. For many qualifications, this number will be much lower, so that wage tracking based on the household survey data may not be reliable. Likewise, GeoStat may also be asked to provide unemployment data by qualification.

3. Job seekers that were trained in the SSA system should be required to report their employment status, employer, and wage, for 12 months after receiving training. This would provide direct information about the marketability of different qualifications. Currently, there is a database where training institutions are supposed to report on the job market performance of their graduates, but this database is not regularly updated by the training institutions. Moreover, training institutions may have an interest to exaggerate the job market successes of their graduates so as to appear more effective.

3.2. Data on job seekers

ISET PI makes the following recommendations:

1. In the worknet.ge system, training preferences are elicited in "open" questions, asking job seeker to fill in an answer. As a result, it is sometimes not clear which qualification the job seeker had in mind. It is

often difficult to interpret the answers and connect them to existing qualifications. Moreover, the job seekers sometimes demanded training in qualifications that were not available at their location. To circumvent both of these problems, qualifications should be chosen through pull-down menus that only contain those qualifications locally available. There would be no ambiguity anymore, and all answers could be used for estimating preferences over available programs. To reduce complexity, the pull down menus could have a two-tier structure. On the first tier, the general area of interest would be specified (e.g. "office job"), and on the second tier, a specific qualification could be chosen.

2. The worknet.ge system is open to every job seeker, whether currently employed or not. If one would ask for the current employment status and existing qualifications of a job seeker, one could use this information for estimating unemployment rates for different qualifications.

3. One should conduct tests in order to elicit the talents, strengths, and weaknesses of job seekers. These tests could be similar to the standardized university admission exams conducted by the *National Examination Center* (NAEC) of Georgia, and it might be recommendable to cooperate with NAEC in this respect. Tests should check for basic skills, like language and math proficiency, and should be renewed in regular intervals. For this to be done efficiently, the quantitative problems could be generated with software that creates problems of the same structures but with different numbers.

4. The methodology proposed by ISET and its implementation in four pilot municipalities

The methodology presented here was applied to identify the economically relevant qualifications in four municipalities of Gori, Rustavi, Kutaisi, and Batumi. In line with the preceding chapter, the criteria used for evaluating qualifications offered in those municipalities were (a) the demand in the Georgian labor market amd (b) the willingness of job seekers to receive training in a field.

4.1. Eliciting the demand for qualifications in the job market

For eliciting the demand for qualifications in the Georgian labor market, ISET PI carried out 30 interviews with big employers in the four target cities. In Gori and Rustavi, these interviews were conducted in person, while in the other cities they were conducted by telephone. Most of these questions were eventually not used for this project. The questions that were used for assessing the demand for qualifications were:

1. What is the average monthly salary paid in your company (by qualification)?

2. What are the most demanded qualifications in the local job market according to your subjective view?

Both questions referred to qualifications that were presented to employers on a list.

In addition, telephone interviews with 24 training institutions were conducted, offering 137 training programs in total. The institutions were asked to identify and rank up to five qualifications that were most demanded by employers in the local job market according to information they had about the graduates' job market performances.

Potential sources of information left out were unemployment by profession/qualification and sector-specific macroeconomic data. While currently there is no data available on unemployment by profession, the reason for disregarding the macroeconomic data was the tight time frame of the project. SSA could in principle integrate also macroeconomic data into the proposed methodology.

4.2. Eliciting job seekers' characteristics

The assessment of the job seekers' characteristics considered their preferences for training and their local restrictions. The analysis was based on SSA data on job seekers, as available in March 2014. The data comes from the electronic *Labor Market Information System* (LMIS) (worknet.ge). In a first step, those people who wanted to receive training in the respective municipalities were identified, and the stated preferences for a location (e.g. Kutaisi) were taken as an approximation for the local restriction of that person.

Preferences for qualifications were reported in an unstructured way, so that the answers given by the job seekers had to be categorized manually. Here it turned out that some respondents thought that the question referred to *retraining* in a strict sense, i.e. training in skills that were already learned in the past, while others thought that *any* qualification could be asked for. Through the changes suggested in Chapter 3, this problem will be addressed.

Finally, vocational training institutions were asked to rank the popularity of their different programs.

4.3. Constructing the ranking

For each source of information a "priority value" between 1 and 5 was determined, where a higher number corresponds to higher priority. Specifically, this was done as follows:

1. For each qualification, we computed the average salary according to the employers' answers. Then we used a scale of 5 salary brackets to determine the priority value.

2. For each qualification, we counted how often it was mentioned by employers as demanded in the local job market. Then we computed the ratio of how often the qualification was mentioned divided by how many employers were asked in that municipality. The maximal value of this quotient is 1, the minimal 0, and we chose the bracket boundaries 0.2, 0.4, 0.6, 0.8, 1 to determine a priority value between 1 and 5.

3. VET institutions had to rank up to 5 qualifications they considered particularly effective for job market success. If an institution did not mention a qualification, its value was set to 1. Otherwise, the value was 6 minus the rank given to that qualification. Using this procedure for each VET institution, the average value based on all training institutions that were included in a municipality was computed (rounded to an integer number).

4. For the answer of the training institutions regarding the popularity, the same method as under 3 was applied.

5. The ISET PI team assigned a priority value to each profession according to its potential to yield self-employment opportunities.

6. The preferences of job seekers to be trained, stated in the worknet.ge system, were processed in the same way as the answers of the employers under 2.

The priority values for 1-6 were then weighted. The weights used for the sources 1-4 was 0.2., and the weight used for 5 and 6 was 0.1. These weights were chosen arbitrarily according to what seemed reasonable to the members of the ISET PI team. In principle, one could derive these weights through an econometric estimation, where the dependent (binary) variable would be "graduate with that qualification successful in the job market" (however this is defined) and the independent variables would be the six priority values.

5. Results

The methodology presented in the previous chapter was applied to the four pilot municipalities of Gori, Rustavi, Kutaisi, and Batumi. The detailed results provided in this chapter refer exemplarily to the municipality of Gori. The very same analysis was done for all other municipalities and can be provided on request.

5.1. Skills and qualifications that employers seek (exemplary for Gori)

ISET PI interviewed 8 employers in Gori, namely one greenhouse, one chicken farm, two restaurants, one supermarket, one apple processing company, one beauty salon, and one hotel.

These companies are rather small, but they are well-known and visible in the region and their businesses are labor-intensive. In total, the interviewed companies were employing more than 300 people in 23 different professions. 13 of these professions coincided with existing accredited training programs in Gori.

Average salaries of those professions offered by Gori VETs are given in the Table 1, and the qualifications most demanded in the job market among those offered by authorized Gori VETs, according to the views of Gori employers, are presented in Table 2.

Table 1: Average salary by professions based on 8 employers interviewed in Gori and coverage by existing training programs

	Profession	Average Salary (Lari)
1	Specialist in veterinary services	1100
2	Fruit-grower	1000
3	Specialist in land-reclamation	900
4	Primary processing specialist of fruits and vegetables	900
5	Milk processing specialist	700
6	Sewing specialist (tailor)	600
7	Tile Specialist	600
8	metal craftsman - a plumber	600
9	Painter	500
10	Welder	500
11	Electrician	500
12	Plasterer	500

13	Carpenter	500
14	Hairdresser / Stylist	450
15	Salesperson / Consultant	400
16	Accountant	400
17	Customs declaration specialist	400
18	IT	400
19	Office manager	400
20	Nursing Assistant	400
21	Masseur	400
22	Dental technician	300
23	Bricklayer	200

Table 2: The most demanded qualifications according to employers in Gori

Qualification	# of employers who named this qualification
Milk processing specialist	1
Welder	1
Fruit-grower	1
Nursing Assistant	1
Office manager	2
Dental technician	2
Specialist in land-reclamation	2
Accountant	2
Salesperson / Consultant	3
Primary processing specialist of fruits and vegetables	3
Specialist in veterinary services	3
IT	4

5.2. Skills and qualifications the job seekers want to obtain (exemplary for Gori)

Among 4,590 registered job seekers in the SSA database, only 43 are willing to receive vocational training in Gori.

Only 24 of those persons expressed preferences for training in qualifications that belong to vocational education. And for only 12 of those persons could be found approximate matches among the VET programs offered in Gori. Of the other 12 job seekers, 6 were willing to be trained in "anything employable" and for the remaining 6 there were no close matches in the program list.

The qualifications mentioned most frequently by the job seekers were tile specialist, IT, office manager, accountant, and nursing assistant. This overlappend with the answers of the vocational training institutions, which gave highest priority to the first three of those qualifications.

5.3. Ranking skills and qualifications

Applying the outlined methodology, the priority values for the qualifications offered in Gori are given in Table 3.

Table 3: Priority values of qualifications offered by VET institutions in Gori

	Salary ranking	Job market demand (employers survey)	Popular among students (VET survey and worknet.ge)	Self-employment chances	Job-seekers, willing to be trained (SSA)
Tile Specialist	4	1	5	5	1
IT	1	5	5	4	1
Specialist in veterinary services	2	4	1	4	4
Hairdresser / Stylist	4	1	1	5	1
Office manager	5	3	5	1	2
Welder	2	2	1	5	2
Sewing specialist (tailor)	3	1	1	5	1
metal craftsman - a plumber	3	1	1	5	1
Painter	3	1	1	5	1
Electrician	2	1	1	5	2
Primary processing specialist of fruits and vegetables	2	4	1	2	2
Plasterer	2	1	1	5	1
Carpenter	2	1	1	5	1
Bricklayer	2	1	1	5	1
Fruit-grower	2	2	1	3	4
Accountant	2	3	5	1	5
Customs declaration specialist	5	1	1	1	1
Masseur	2	1	1	4	1
Dental technician	3	3	1	1	1
Milk processing specialist	2	2	1	2	2
Specialist in land-reclamation	2	3	1	1	1
Salesperson / Consultant	1	4	1	1	1
Nursing Assistant	2	2	5	1	1

Using the mentioned weights, this gives a ranking of qualifications as in the following table, which also provides the final results for the other municipalities.

Table 4: Final rankings of the qualifications offered by vocational training institutions in the four target cities

Rank	Gori	Rustavi	Kutaisi	Batumi
1	Tile Specialist	Welder	Carpenter	Welder
2	IT	Metal craftsman - a plumber	IT	Painter
3	Specialist in veterinary services	Automobile carriageway technician	Automobile repairman - electro technician	Gypsum-carton specialist
4	Hairdresser / Stylist	Gypsum-carton specialist	Automobile carriageway technician	Tile specialist
5	Office manager	Tinman-painter	Automobile engine repairman	IT
6	Welder	Painter	Automobile metal craftsman Metal craftsman/plumber Welder	Electrician

5.4. Further economic analyses based on the methodolgy

The goal of this project is to develop a methodology, not to do research on the labor market of Georgia. The results derived for the pilot cities are to be understood as a "proof of concept", showing that the methodology can indeed be applied and can generate results. However, the results for the pilot cities are not the focus of this project and they should not be used adjust SSA policies. The focus of this project is the methodology, not the results. Nevertheless, it should be noted that the analysis prescribed by this methodology yields results which are not only interesting for the purpose of prioritizing qualifications. Many results of the analysis carried out in this methodology can be generalized and used to draw more general policy implications.

These are some examples how the analysis can also be used (in particular when data from many cities is available, not just from four pilot municipalities):

1. One may investigate what share of the jobseekers is really interested in obtaining vocational training.

2. One may also identify a potential mismatch between the interests of jobseekers and the existing course offerings.

3. One might look for further evidence (or counterevidence) for the alleged mismatch between the interests of jobseekers and employers demand which was shown to exist in Georgia in several studies (see Section 2.1. for the literature references).

4. One may check whether (or to what extent) freely negotiated wages in Georgia lead to market clearing for certain qualifications. Similarly, one may check in the data obtained for the methodology

proposed here whether wages are functioning as signals about labor demand for jobseekers. If enough data is available, one could present such results with suggestive scatter plots.

6. Matching jobseekers with training programs

The second part of the project aimed to suggest a system for matching job seekers with educational programs on an ongoing basis. ISET PI considered two possibilities for the design of such a system, namely as a *recommendation system* or a *matching algorithm*, which were then presented to the SSA.

The objective of both systems is to maximize the impact the training has on the employment chances of the job seeker. Arguably, this is also the primary goal for most job seekers, as they often state that they want to receive training in an "employable" profession. Therefore, if the purpose of the recommendation system or matching algorithm is communicated properly, and if it is transparent and trustworthy, the job seekers may want to follow its advice.

Both systems *rank* the available training programs for each job seeker, using data on:

1. Personal characteristics of the job seeker, including employment and training history, geographical restrictions etc.

2. Demand and supply of qualifications in the job market

3. The overall economic situation

In addition, a *matching algorithm* (but not a *recommendation system*) will also take into account data on:

1. The availability of places in the training programs

2. The preferences of *other* job seekers and the recommendations given by the algorithm to *them.*

6.1. Recommendation system

Recommendation systems make suggestions to job seekers *separately*. These kinds of systems are ubiquitous on the internet. For example, Amazon.com proposes books to its customers based on their purchasing history. In a similar way, a recommendation system for vocational training would suggest vocational training programs to job seekers based on relevant data about their characteristics and the job market situation.

Yet a recommendation system will *not* take into account what the other job seekers will be doing and what recommendations were given to them. A matching algorithm, on the other hand, aims at an overall optimum for the whole group of job seekers.

In a recommendation system, it can happen that the number of people recommended to choose a certain program is larger than that program's capacity. Because the advice comes as a ranking, this does not cause the system to be useless. The job seeker may then choose the program which is highest in the ranking and which has free places.

Likewise, a recommendation system has the problem that even if many job seekers follow the advice, oversupply and undersupply of certain qualifications in the job market is not ruled out. This is again due to the fact that recommendations are made *separately*. If there is a huge demand for, say, plumbers, and many people receive the advice to receive training in plumbing, this may subsequently cause an oversupply of plumbers. A matching algorithm, on the other hand, would make recommendations that lead to a satisfactory overall outcome in the labor market.

6.2. Matching algorithm

Genuine matching algorithms do not make separate recommendations, but propose a *globally optimal* assignment. In Western countries they are used, for example, to match interns to hospitals, students to universities, and kidneys to dialysis patients.

In a matching algorithm, the abovementioned problems would not occur (up to statistical uncertainty), because the matching algorithm would take into account how the suggestions made by the system affect the demand for a program. It would aim to keep the number of people likely to choose a program to remain below its capacity. The standard overview book on matching theory is Roth and Sotomayor (1990).

6.3. Which approach to choose at this stage and why?

While a matching algorithm is more ambitious and sophisticated, it also has disadvantages compared to a recommendation system:

The data requirements are higher (the capacities of programs have to be taken into account).

How the recommendations are generated will not be very transparent to the job seeker (though it is possible to give some general explanations). This may reduce acceptance and willingness to participate. The recommendation system, on the other hand, can construct the ranking in a very transparent way.

A recommendation system can be adjusted and changed on an ongoing basis by SSA personnel without the help of external experts. Given its complexity, this is hardly possible with a matching algorithm.

The two options were presented to the SSA. After some further explanations and extensive discussions it was decided that the simpler option of a recommendation system is to be pursued. Later, the system may be upgraded to a full-blown matching algorithm.

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