Value Based Matching

(**Dynamic Profiling System**)

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The role of profiling in providing Public Employment Services (PES)

In the coming years, the success of Public Employment Services (PES) will hinge on the crucial balance between providing intensive support on the one hand, and adopting a self-help strategy on the other. Stretched budgets and limited resources dictate that labor market programs and early intervention strategies must be cost-effective. To ration services to the unemployed, profiling is an excellent tool. By profiling we mean assessment, performed by PES counselors or self-service portals, aided by matching instruments in combination with statistical tools.

This paper provides a framework for the implementation of a statistical (quantitative) profiling instrument based on the ELISE matching engine to screen and segment job seekers in relation to reintegration policy according to their distance from the labor market as expressed through the outcome variable UT (Unemployment Term). The aim of the profiling instrument is to increase the job search capacity of unemployed individuals by identifying and matching the programs and services that re-integrate individual job seekers with maximum efficiency. This way, we can deliver the most effective services to reduce an individual UT at a minimum of cost for the total client portfolio in terms of resource depletion and benefit exhaustion.

Various profiling tools have been developed across the world, each with the aim to make labor market integration more effective by better targeting services and scarce resources.

These tools have been used

1. to assess the risk of long-term unemployment among unemployed individuals and those about to become unemployed;
2. to segment job seekers according to the estimated level of assistance they require for achieving (re-)integration;
3. to diagnose individual strengths and weaknesses with regard to personal action planning;
4. to target appropriate services, measures and programs considered most suitable to meet the requirements of job seekers' particular "profile" by statistics-based program selection.

Unemployment intervention mechanisms

There are several alternative approaches to the largely indiscriminate intervention mechanisms that Public Employment Services currently use. These include 'eligibility rules', 'caseworker discretion', 'screening' and 'profiling' (Hasluck, 2008). In the eligibility rule process, individuals are channeled towards various forms of reemployment support on the basis of meeting certain criteria.

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Caseworker discretion is when PES staff members use their own judgment to gauge their clients' needs and direct them towards the most suitable type of intervention, while in screening, the caseworker attempts to score the job seeker's employability, typically using psychology-based techniques or interviews. As explained previously, statistical profiling is a method of assessment in which the client's reemployment support is based on a prediction of the unemployment duration (UT) generated by a formal statistical model that uses a range of characteristics of the individuals concerned (age, education level, unemployment history, and so on).

Profiling as a tool for customer segmentation

Using profiling as a diagnostic tool is a preliminary step on the road to achieving PES' real purpose: to re-integrate the jobless into the labor market fast and with lasting success through individual tailored interventions. We note that in Anglo-Saxon countries, 'personalized' also means a move away from group strategies, with interventions being based on assignment to specific target groups (such as 'young job seekers', 'disabled people', or 'single parents'). The methods for allocating job seekers to these different action programs are shifting from administrative rules (benefits eligibility) and the placement agent's subjective assessment to a personalized process combined with statistics-based program selection to support the placement agent's assessment.

In the first stage of statistical profiling, the estimated unemployment duration of job seekers is based on hard factors. It starts out from personal profiles and the evaluation of labor market potential. In addition to this, the existing demand for the job seeker's occupation and skills is examined, and candidates' chances on the labor market are calculated from their job preferences. The results lead to classification into one of two risk categories. "Market-ready profiles" (which have a short expected UT) are referred directly to vacancies matched by the matching engine. "Development profiles" are referred to an interview with a caseworker from PES. The caseworker aims to improve the results of the statistical profiling by taking a series of soft factors, such as health and motivation, into account. Finally, a reintegration plan is drawn up together with the candidate.

This second stage of profiling is called customer segmentation. In customer segmentation, job seekers are grouped according to their labor market opportunities and assistance needs. This shifts the focus from considering individual job seekers to clustering job seekers with similar profiles, similar needs and similar assistance requirements into in segments, as well as on matching the support demands with the labor market policy instruments available.

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One classification criterion is the "distance" to the labor market. The differentiation is between those who are able to search for suitable jobs with the self-help system of PES, in newspapers or via the internet, and those who require a placement agent's assistance and guidance, possibly even permanent coaching by a caseworker, due to poor labor market opportunities or as a result of language problems or insufficient classifications. For profiling to succeed, it is key to determine which elements of a job seekers' profile (hard factors, soft factors and contextual factors) will be determinant for the distance from the labor market. A more detailed description of profiling as an instrument for customer segmentation can be found further down in this document.

Profiling as a diagnostic tool for SWOT assessment

In a 'preventive' labor market policy to avoid long-term unemployment, profiling can be used to identify employment opportunities and reintegration instruments. Early intervention and personalized reemployment plans require careful analysis of the job seeker's strengths and weaknesses. A dialogue between the placement agent and the job seeker leads to a profile that serves as a basis for his or her personal reemployment action plan. Such personal profiling allows for successful matching against vacancy profiles.

Until now, job seeker profiles, at least for the purposes of matching, generally comprised no more than a rough characterization of mostly objectively measurable features - desired occupation, educational attainment, age, gender and vocational experience. But to accurately assess labor market opportunities and personalize action plans, a much more detailed description is required of the job seekers' skill and knowledge than has been the rule: interviews with job seekers must seek to arrive at a detailed profile on which to base placement efforts. For this, the organization needs to provide not only enough time, but also quality assurance guidelines. Most employment services use basic tools like questionnaires and manuals. Computer systems like ELISE have been designed to capture customer profiles and permit a more complex matching of job seekers and vacancies.

Determination of individual assistance requirements

The third step of profiling is choosing the appropriate reintegration measure or instrument, or a combination thereof. Clearly, a measure must have a proven positive net effect to be chosen. But this is not necessarily the only criterion; more general policy goals are also likely to play a role in the decision. Maximizing the total net effect is not the only possible aim; one could also aim to reduce inequalities or to maximize the (total) social rate of return.

A more detailed description of using profiling as an instrument for customer segmentation can be found in the document HRDF04 – Outcome-based Referral.

Profiling

In many countries, profiling is part of a customized "expert system". These service delivery systems are characterized by:

1. the use of profiling as a quantitative (statistical forecasts) or qualitative (structured interviews, capability tests) diagnostic tool to identify clients' risks of remaining unemployed;
2. the use of differentiation to give different customers access to different employment services according to their needs, with the aim to target resources.

The idea behind customized or personalized services is that individuals differ in their employability, and that their employability declines as the duration of non-employment increases. In many PES, it is the caseworker who makes the final decision on which services to provide to which client. This stands in contrast to the US and Australian profiling systems, where "hard" (statistical) profiling is compulsory for caseworkers, and where the results of statistical profiling are the only factor that determines whether or not to transfer a client to further reemployment support.

We propose that PES follow a coherent strategy based on Client Profiling (profiling), Job and Vacancy Matching (matching), Skills Gap Analysis (gap), Client Segmentation, and Targeted Resource Allocation (referral). These steps are part of an integrated system called Value Based Matching.

The Value Based Matching modules and underlying technology aim to create an optimum statistically assisted distribution of Clients across available programs and services, with the direct benefits of reducing the individual expected employment duration (UT) and lowering the cost/benefit ratio. The ultimate goal of the strategy is to optimize the portfolio of all unemployed persons in the system.

There is widespread agreement among researchers and policymakers that the best way of reducing the negative effects of unemployment (whether psychological, social or labor-market) is through prevention and early intervention. Research also shows that using diagnostic tools such as statistical profiling models makes the assignment process more objective. There is some evidence to suggest that caseworkers are less effective without systematic support instruments (Lechner and Smith 2005).
Moreover, if caseworkers rely only on their own experience, they tend to use ad-hoc criteria for their decisions, which could lead to discrimination (Lechner and Smith 2003).

Defining the term 'profiling'

Various sources have formulated definitions of profiling. We commonly identify the term with predicting who is at risk of long-term unemployment. Wider definitions cover the entire systematic process of determining the most appropriate services for a particular client based on his or her characteristics (as in Service targeting, Streaming). The divergence among definitions causes widespread confusion among PES. It is therefore necessary to consider how we define profiling.

We define "profiling" in the narrow sense to describe a statistical method of predicting the time a job seeker remains without work: the Unemployment Term (UT).

Profiling is designed to filter out various easy-to-place and hard-to-place categories of job seekers in order to offer them services of varying intensity levels. Prediction accuracy is an important element in the efficiency of a profiling system, because low accuracy can lead to a considerable waste of resources.

Profiling also allows for segmentation based on the expected duration of a client's unemployment. As the probability of finding a job decreases with unemployment duration, rapid intervention is deemed to reduce the detrimental effects of (long-term) unemployment as well as deadweight costs.

The availability of data

As a diagnostic tool, statistical profiling tries to identify clients' "needs" in terms of risk: for instance, risk of remaining unemployed or becoming long-term unemployed, risk of exhausting benefits, probability of finding employment within the next three/six/twelve months. To this end, the target variable, expected duration of unemployment, is related to client characteristics such as gender, age, education, occupation, work experience, country of birth, program participation and record on public assistance. To make accurate prediction possible, a good model ought to include not only all "hard" factors, but also "soft" factors such as motivational aspects, health, and social network, as well as data on the demand side, such as the regional unemployment rate.

The availability of (longitudinal administrative) data is crucial for the quality of the model and the accuracy of its UT predictions. The estimated relationships are used to "score" clients, e.g. by their distance from the labor market. In a further step (Value Based Matching – Outcome-based Referral), the results are used to decide access to different types of services.

Value Based Matching – dynamic profiling

Targeting employment services based on profiling

Since resources are limited and finite, PES will have to ration its services. The way this is done in some countries, for example the United Kingdom, is to make customers queue for services according to how long they have been unemployed. But most PES aim to provide customized support, and so they use customer segmentation to target their services on those in greatest need.

These job-seekers in need of intensive help can be identified from the outcomes of the profiling process. Profiling is just the first step of a comprehensive "expert system". In the second step, customers with similar profiles, and thus similar needs and assistance requirements, are clustered in segments. The customer group to which job seekers are assigned determines the specific reintegration services (training, job search assistance, work placements, and so on.) they are offered. "Job-ready" or "market-ready" clients - those with good employment prospects - are to receive only limited assistance, as they will generally be able to find work on their own. As a consequence, resources are freed up and can be dedicated to disadvantaged job seekers that have a greater distance from the labor market, and also to measures that address non-skill-related barriers, like confidence-building ("social activation").
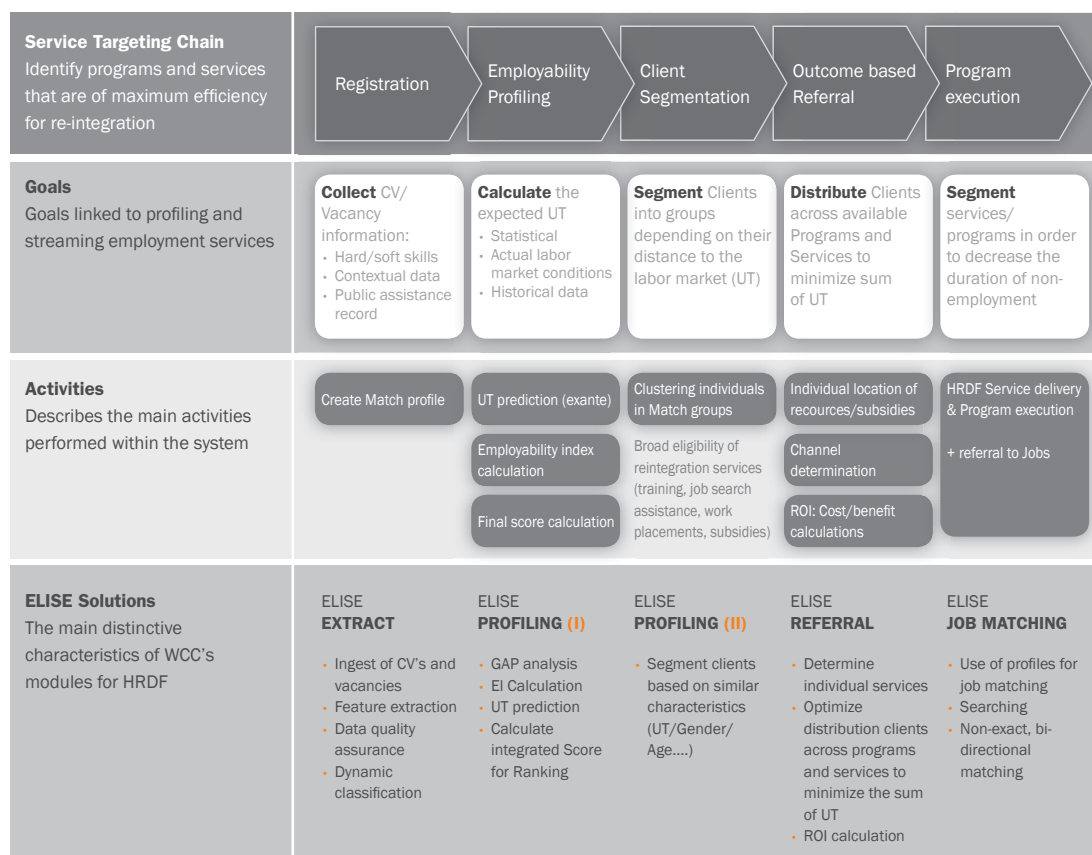

Profiling & segmentation process
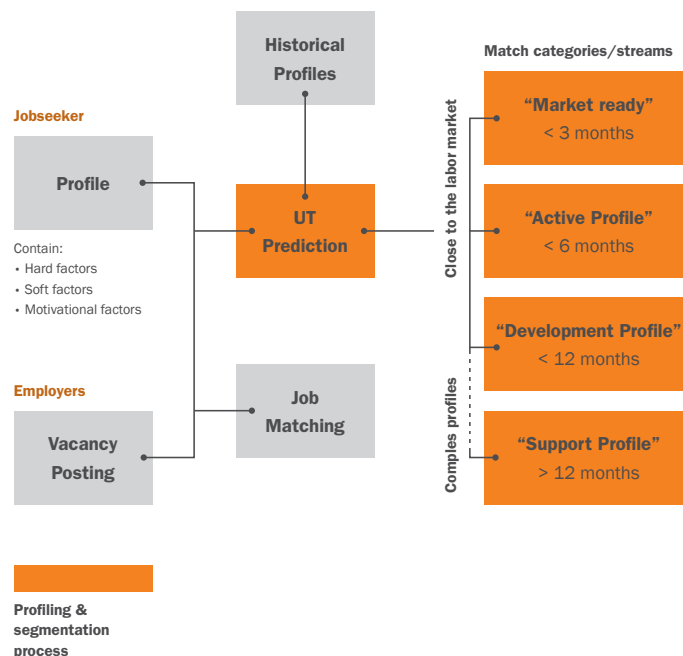
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But for an optimal allocation of the reintegration budget, merely profiling job seekers according to the expected UT is not enough. We also need to know the effects of any measures on clients' reemployment chances. With our approach, we want to predict how long a person with a given set of characteristics will remain unemployed, but also to what extent certain measures can shorten the unemployment spell.

In the course of the project, we need to acquire longitudinal data and develop models for detailed groups and measures. This will enable us to determine what type of measure at which stage of the unemployment period is most effective for any given client. In practice, data limitations may often dictate that only broad categories of measures and broad client groups can be distinguished. Furthermore, in estimating our model, we also face the challenge that data about "soft factors" may only be available partly or even not at all.

VALUE BASED MATCHING

	Registration	Employability Profiling	Client Segmentation	Outcome based Referral	Program execution
Service Targeting Chain Identify programs and services that are of maximum efficiency for re-integration					
Goals Goals linked to profiling and streaming employment services	**Collect** CV/ Vacancy information: • Hard/soft skills • Contextual data • Public assistance record	**Calculate** the expected UT • Statistical • Actual labor market conditions • Historical data	**Segment** Clients into groups depending on their distance to the labor market (UT)	**Distribute** Clients across available Programs and Services to minimize sum of UT	**Segment** services/ programs in order to decrease the duration of non-employment
Activities Describes the main activities performed within the system	Create Match profile	UT prediction (exante) / Employability index calculation / Final score calculation	Clustering individuals in Match groups / Broad eligibility of reintegration services (training, job search assistance, work placements, subsidies)	Individual location of recources/subsidies / Channel determination / ROI: Cost/benefit calculations	HRDF Service delivery & Program execution + referral to Jobs
ELISE Solutions The main distinctive characteristics of WCC's modules for HRDF	ELISE **EXTRACT** • Ingest of CV's and vacancies • Feature extraction • Data quality assurance • Dynamic classification	ELISE **PROFILING (I)** • GAP analysis • EI Calculation • UT prediction • Calculate integrated Score for Ranking	ELISE **PROFILING (II)** • Segment clients based on similar characteristics (UT/Gender/Age....)	ELISE **REFERRAL** • Determine individual services • Optimize distribution clients across programs and services to minimize the sum of UT • ROI calculation	ELISE **JOB MATCHING** • Use of profiles for job matching • Searching • Non-exact, bi-directional matching

Value Based Matching – dynamic profiling

The Service Targeting Chain

In the context of PES, the chain of activities or processes is generally referred to as the Service Targeting Chain. Because the basis of the ELISE architecture is a system for matching, we have named this process Value Based Matching. When starting their spell of unemployment, clients register online for UI entitlements, and a basic client profile is created. Using the information captured during registration, the process of profiling is triggered. This is the first step of the service targeting chain.

In the second step, a tentative prediction is made ex ante of the duration of the unemployment spell (predicted UT, or pUT score). The pUT score is based on statistical analysis and historical administrative data. Then, actual labor market conditions such as demand and crowding-out factors are used to calculate the Employability Index score (EI score). Finally, the profiling system combines pUT and EI to calculate a weighted score[1] (weighted average). These outcomes are used to identify clients in need of higher-intensity help.

In the third step, clients with similar profiles and assistance requirements are clustered in segments called match groups. Generally, which match group jobseekers are assigned to determines what specific reintegration services (training, job search assistance, work placements, and so on) they are offered. Clients assigned to a particular match group are entitled to receive a basic set of general employment services related to that particular match group, as governed by the broad eligibility rules set by PES.

The fourth step of the service targeting chain is what we have come to call "outcome-based referral". Here, we determine which additional services or Active Labor Market Policies (ALMP) an individual client should receive in order to further reduce the pUT. This step actually constitutes the "Value Creation" itself.

A smart distribution algorithm, ELISE's group matching algorithm, is deployed to determine the optimal set of services to be assigned to an individual to reduce the pUT and at the same time reduce the total sum of cost of ALMPs granted to the entire portfolio of unemployed individuals within a given timeframe. The algorithm takes into account the ALMPs a particular match group is eligible for, as well as the availability (saturation) of each ALMP and its contribution to reducing UT. The algorithm also infers the "profiling algorithm" and an "ROI calculation algorithm[2]".

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[1] See Appendix 2 for details on the calculation model used to score pUT.
[2] Present Value of Future Earnings Capacity of Employees model [cf. Lev & Schwartz, 1971]

Value Based Matching – dynamic profiling

In the fifth and final step of the chain, clients receive the services to which they are entitled as part of their match group. After concluding a service (for instance, a skills training course), the profiling process will run again and the pUT will be re-calculated. Now, when job matching, clients can be referred to additional vacancies that before the start of the process were out of the clients' reach.

The client's market value has increased as a result of the chain of activities. This leads to an increase in job search capacity; simply put, the number of matching vacancies is increased.

Designing the system

The central objective of our profiling model is the ability to assess the factors that influence a client's employment spell. The statistical profiling function calculates a numerical score on the basis of multi-variate regression. The estimated score ranks each job seeker in terms of their expected UT. The model is also aimed at providing PES policy makers with a framework for estimating, at the time an unemployment insurance (UI) claim is made, an individual's likelihood of remaining on, or exhausting, UI. PES Staff and policy makers can use the measures produced by the profiling model to identify clients in most need of assistance or requiring immediate reemployment services.

In our proposed system, we focus on statistical profiling as an intervention approach because of the potential it shows for predictive accuracy. Profiling is also a fundamentally objective method of assessment, certainly compared to the approaches listed under Unemployment intervention mechanisms. Especially in situations where caseworker discretion is minimized, profiling generates a more efficient and effective intervention system compared to blanket targeting. Profiling reduces the aggregate number of interventions, and thus the associated cost. Furthermore, with a profiling system, the intensity of interventions can be varied according to the duration of unemployment. Finally, a profiling score provides the caseworker with detailed information on the challenges facing each individual client, which allows for an even more tailored approach to support.

Data and methodology

Predictive analytics is an area of statistical analysis that deals with extracting information from historical data (ex post analysis of profiles, active labor market instruments and employment outcomes) and using this information to predict future trends and behavior patterns. At its core, predictive analytics relies on capturing relationships between explanatory variables (covariates) and predicted variables from past occurrences (in our case, UT), and exploiting this to predict future outcomes (in our case, the predicted UT). A predictive model can analyze past unemployment spells to assess the likelihood of a client exhibiting a specific behavior in the future. We propose that our predictive model perform calculations during live transactions such as registration, enrollment for or completion of training, to evaluate the improvement in terms of UT and associated UI claims, in order to reach a decision ex ante.

The approaches and techniques used to conduct predictive analytics can be grouped broadly into regression techniques and machine learning techniques. Within these categories, techniques include linear regression, logistic regression, probit and logit models[3].

To provide an example of a technique: a logistic regression model estimates the relative weight or 'points' of a number of risk factors (i.e. variables) that are associated with long term unemployment. Those variables have to be captured at the point of registration of the UI claimant. Variables include age, gender, education, language, literacy, recency of work experience, previous job duration, previous unemployment claim history, number of claims, location, disability/medical condition, family status, spousal earnings and contactibility, along with certain personal characteristics such as motivation or presentation which require either assessment by caseworkers or psychographic assessment (e.g. a personality test). In addition to these, the model factors in the size of the local labor market. Because the impact of different covariates (such as family background, presence of children) will vary according to gender, we will use separate estimates for men and women.

Two strategies dominate profiling systems in PES. The first involves logit or probit models, while the second relates to duration, as in the Duration model (Denmark), Binary probit model (Germany) and Logistic regression (Australia). Because there is no evidence to support preferring one methodological approach over the other, we focus on the duration model (unemployment duration, UT).

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[3] For a description of the various statistical techniques, see: http://en.wikipedia.org/wiki/Predictive_analytics

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In our profiling model, the dependent variable will be determined by the project objectives, as driven by PES's policy objectives. In the United States, where the principal concern is exhaustion of unemployment insurance (UI), the dependent variable is the period remaining to exhaustion. By contrast, in Ireland, where the policy focus is on the risk of falling into long-term unemployment, the dependant variable reflects the risk of remaining unemployed for more than 52 weeks.

Compared to ex post evaluations, predictions have to deal with many more challenges. Every estimate is necessarily based on the data of past participants, so predictions only make sense if economic relationships do not change too much or only in a more or less predictable way. For a job seeker participating in program A or B, labor market outcomes can be predicted only if other job seekers have already participated in these programs. And if a new program C with different features is introduced, predictions become less accurate or even impossible.

Risk Profiling versus Employability Profiling

The Profiling System will classify unemployed people who are entitled to benefits into risk categories based on the expected duration of their spell, so that the appropriate reintegration instruments can be applied to shorten this period. In this context, profiling is a means to mitigate risk. But profiling may also be used to evaluate the job seekers' chances on the labor market, taking into account demand for work. In that context, profiling is a means to improve mobility in the labor market. Since our profiling instrument will have to be used for both means - to predict unemployment duration (and the associated risk of exhausting benefits) and to promote fluidity and dynamism in the labor market - we use the phrase Risk Profiling and Employability Profiling.

Profiling and Referral systems

Our profiling system computes only a single risk factor, the probability of becoming long-term unemployed, for each individual job seeker. It then allocates job seekers to different programs according to the estimated risk score - the expected UT. This score reflects the extent to which an individual needs support in order to regain employment. In addition, a targeting system predicts specific individuals' potential labor market outcomes for every available program (including the no program option). The caseworker can then choose the program with the maximum expected outcome, both in UT and in UI (through the VBM ROI module and the Assignment module.

Process orientation

The profiling system can be implemented in various ways, depending on factors such as the availability of profile data, the involvement of caseworkers and the maturity level of IT. A basic "expert system" can be broken down into five steps:

1. During registration, the client fills out an online form in which he/she has to answer questions about issues such as desired profession and working hours, mobility, and professional and personal skills;
2. On the basis of this information, a first statistical profiling is done. In addition, the client's chances on the labor market are calculated on the basis of his/her job preferences. The statistical model estimates the client's unemployment duration on the basis of hard factors. The existing demand for the client's occupation and skills is also examined;
3. These results lead to a first classification of the client into one of the existing risk categories. "Market-ready profiles" (with a short expected duration of UT) are referred directly to vacancies through the matching engine. "Development profiles" are referred to an interview with a caseworker from PES. The interview aims to improve the results of the statistical profiling by taking into account a series of "soft factors" such as health and motivation;
4. Based on the results of steps 1-3, a decision is made about which reintegration strategy to apply to the client. The most common strategies are the 'quick job search' (for those clients able to find a new job without further assistance), the 'active search' (for clients in need of training or with skills for which there is not much demand on the labor market) and the 'supported search' (for clients who need intensive support);
5. Finally, a reintegration plan is drawn up together with the client.

The statistical profiling model first estimates duration on the basis of 'hard' individual characteristics (the 16 variables suggested earlier). The model is a decision tree which classifies the unemployed into three categories (which can be subdivided later on in the design phase of the project): Low (UT of 0-6 months), Medium (6-12 months) or High (>12 months). Alongside the statistical profiling, the labor market demand for the client's occupation is also examined through the Employability Index [See Appendix 1].

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Use of client profiles for automatic matching

In several countries, Public Employment Services have invested in the development of (internet) tools to improve profile matching. However, most countries have not exploited systematically the potential synergetic effects of using profiles for both automatic matching and for differentiating client groups based on expected UT. The exception to this is Germany, where the strength analysis within the 4PM profiling exercise also constitutes the basis for automatic matching using ELISE in the job exchange (Arbeitsagentur / jobboerse.de). The web-based tool VerBIS links information on regional labor market opportunities to client 'profiles' based on competencies, allowing for bi-directional matching of job seeker and vacancy profiles.

Lessons for implementation

The WCC team's country review of profiling approaches has highlighted a number of lessons. The key obstacles and success factors for implementation are briefly set out below, after which we will go into more detail regarding several lessons.

Obstacles

- Risk prognosis constitutes a high risk of misclassification;
- Risk profiling may overemphasize the focus on hypothetical positions in the labor market, leading to a too-early transfer to reemployment services without evaluating experiences during the job search;
- Focus on obstacles instead of opportunities;
- Early intervention strategies may diminish the search efforts of both sides, while at the same time triggering expensive labor market measures;
- Sophisticated profiling and targeting systems [i.e. Value Based Matching – Outcome Based Referral] as well as IT-based systematic approaches require substantial investment in acquiring good data;
- In some countries, there is no link at all between statistical profiling and resource allocation. This is often related to broad administrative rules (Eligibility rules) regarding the offer of different PES services, including ALMPs, which in some countries set certain timescales or define certain target groups to whom different measures are be offered.
- There is evidence from the USA and Switzerland that caseworkers are less effective if they lack systematic support instruments;

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Success factors

❖ Profiling instruments that make full use of available information (including information on soft skills) while ensuring that they are used as intended by frontline staff;

❖ Quality assurance - recalibrating the model every few months with the refreshed system data;

❖ Adequate staff resources, a favorable workload and highly-qualified placement staff to run the profiling system effectively;

❖ Integrated IT systems to support the matching process. In a number of countries, the system links client profiles to job matching, for example, the VDAB in Flanders (ELISE) and the German web-based VerBIS tool (ELISE) which links information on regional labor market opportunities to client profiles;

❖ In Australia and the USA, profiling is used as an automatic determinator of resource allocation (interventions, measures offered, etc.);

❖ A more recent development is linked to the development of dynamic profiling – a system which is linked to planned regular monitoring of job-seekers, including their potential re-categorization, should their likelihood of reintegration be considered to have changed.

❖ Experience shows that caseworkers may use profiling instruments if they are taught how to use them right.

Caseworker discretion

Caseworkers (also known as job coaches) use the limitations of statistical models to justify their refusal to use these tools. But there is evidence that if caseworkers rely wholly on their own experience, they tend to use ad-hoc criteria for their decisions. And because they all use a different set of criteria, this can even lead to discrimination on the basis of irrelevant factors (Bimrose et al 2007).

The results obtained from a targeting model are better than those of caseworkers assigning reintegration measures guided purely bytheir own opinions (Lechner and Smith 2003). It is therefore worthwhile to use diagnostic tools that improve the objectivity of the assignment process.

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Timing

A crucial aspect of the diagnostic process is the timing of each step. First, for a majority of job seekers, it will be very difficult to predict the length of their unemployment spell (UT) at the very beginning of this spell (de Koning et al. 2007). At an early stage, accurate predictions will only be possible for specific groups, such as people with health problems or older clients with lower education levels. For those clients for whom it is clear from the start that the chance of long-term unemployment is very high, early intervention is the best way to shorten unemployment duration as much as possible.

For the majority of clients, however, it may make more sense to postpone profiling until a few months after entering unemployment, or alternatively, to repeat the profiling process after a few months. By this time, many more able and motivated clients who have a well-developed social network will have found a job by themselves. These factors are often not included in statistical profiling models due to a lack of data. The clients who are still unemployed after a few months will be more homogeneous with respect to these unobserved variables. The remaining length of the unemployment spell will be easier to predict with a greater degree of accuracy.

So for a large group of clients, early intervention may have adverse effects: it may stigmatize them and discourage their efforts to look for a regular job, when they are perfectly able to find one on their own or with only limited help. Early intervention may be counterproductive and lead to lock-in effects (Konle-Seidl 2005).

Summary

Countries that already work with, or have worked with expert systems for profiling have demonstrated that the context of and decisions about the allocation of ALMPs often determine how profiling can be an instrument for resource allocation. These experiences must therefore instruct us how profiling can be modeled into the design of PES. During the design phases of the project, the right balance needs to be found between "man and machine". Face-to-face contact with a caseworker and the integration of the caseworker's experienced judgment and invention is good in itself, particularly for client groups who experience difficulties with self-confidence and self-motivation. This, however, is still open to debate in the project.

A reliable profiling tool can have a positive impact on placement outcomes in the longer term, but this only can be achieved if profiling is embedded in a methodology and based on reliable underlying data.

Appendix 1 – Employability index

The Employability Index (EI) is a way to measure the employability of a job seeker. Simply put, the profile of a job seeker is matched against all available jobs, after which we determine the average of the top N (depending on our needs, this number could be 5, 10, 100, etc.) best-matching jobs for every job seeker. Using a low average (e.g. the top 10) allows us to optimize the matching model. If we get relatively low scores, this would immediately identify potential problem areas. Using a higher average (e.g. the top 100 jobs or more) allows us to monitor trends more accurately since we are looking at more data.

Note that this Employability Index is not comparable to the Monster Employment Index, which only shows the number of vacancies per industry. Unlike the Monster index, our Employability Index can be calculated per occupation group, region, educational level, industry, and so on - in fact, it can be calculated against any search criteria present in ELISE.

The Employability Index can be used for three purposes:

1. to perform a What-If analysis;
2. to address business intelligence needs;
3. to calculate how easy it is for a client to get a job (friction).

Using the EI for a What-If analysis

"How do I know if my business rules for matching are optimally configured?" "And how do I know which search methods to use for each search criterion?" The answer to these questions is simple: by measuring - and the measure to use is the Employability Index.

To establish a base line for measuring, the first step is to start with whatever data is currently available, and see what kind of Employability Index this results in. Only then you can start asking questions, such as:

* What would happen if I changed some weights?
* What would happen if I removed some of the properties from my business rules?
* How would all this influence the job seeker's matching score?

This way, the Employability Index can be used to remodel your matching model without touching your data, allowing you to measure the impact of every change made.
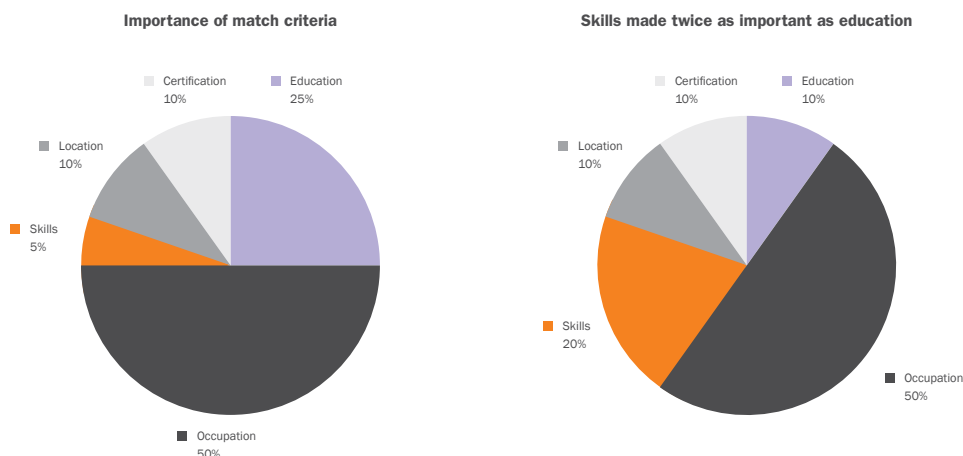
Example

If increasing the weight of Skills helps to deliver higher scores (as shown in the example below), then it might make sense to use this as the new default weight.

Example: What is the impact of Education on the Employability Index (EI)?

EI = 59% ⟶ **EI = 71%**

Importance of match criteria

Certification 10%
Education 25%
Location 10%
Skills 5%
Occupation 50%

Skills made twice as important as education

Certification 10%
Education 10%
Location 10%
Skills 20%
Occupation 50%

Using the EI for Business Intelligence

Public Employment Services can monitor job seekers' employability for each criterion they have available. For example, which occupation groups (according to the official taxonomy) have a low or below average employability? Are there specific geographical regions within the country that have a low or below average employability? This type of information is rather dynamic. For PES, the Employability Index is just one of the tools that can help to spot these trends early so that appropriate policies[4] can be implemented, such as the introduction of training programs and other highly targeted measures.

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[4] Similarly, for a staffing firm, the quality of the candidate pool of individual office branches can be measured. Office branches with a relatively high Employability Index have good candidates. But if the number of placements is not very high, then evidently these offices are incapable of placing these very employable candidates, which could indicate a management or business process problem. Conversely, if an office branch shows a very low Employability Index, this could indicate a poor qualification of candidates during the acquisition phase or a poor acquisition of new job orders.

Using the EI as a measure for friction

The Employability Index helps job seekers to understand their position in the labor market: it is a measure of the number of companies potentially interested in your profile, taking competition (crowding-out effects) into account.

The basic workings of the EI[5] are as follows:

1. The client matches with a number of jobs (above a certain matching threshold, e.g. 90%) - say 10 jobs are interesting for this particular individual;
2. Those 10 jobs themselves, match (above a certain matching threshold, e.g. 95%) with a number of clients - say 12 clients match above 80%;
3. The question to be asked then is: Does the client appear in the list of 12 matches?

The answer to the question of how many times a certain client appears above the matching threshold level of a candidate is answered by the EI:

- ❖ If the client is in first position (the best-matching result) of the employer's list, then we consider the EI to be high;
- ❖ If the client does not appear in the candidate list of the employer (below the threshold or top N list, to be defined), we consider the EI to be low;
- ❖ The more often and the higher the client appears in the top N list of matching candidates in the company view, the better: we consider a single (1 time) appearance in the #1 position in the top N to be worse than multiple (100 times) appearances in the top N.

The EI score obtained from this calculation can be used to power instruments in the front office (e.g. website or caseworker tools). It is imperative to design the dialogue around the EI in a user-friendly way.

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[5] The inverse of the Employability Index is what we call the "asset index": the number of times a certain job appears above the threshold level of a client.

Appendix 2 – pUT scoring

For the purpose of designing the system, we have determined the outcome variable of the Profiling model (Y) as being the UT (unemployment term). For the sake of definition, it is necessary we analyze the term UT further, whereby the remaining unemployment term (the spell) is the sum of the predicted unemployment term and the actual unemployment duration (the time the client has remained in unemployment at current):

$$UT = pUT + hUT$$

The profiling model calculates pUT based on an algorithm that is designed after longitudinal analysis of profile data (the covariates, X) compared to the outcome variable UT (Y). An ex post analysis and ex ante prediction, based on only historical data produces a bias in the model, for it does not take into account the actual labor market conditions (number of matching vacancies) and crowding-out effects (number of competitors).

The Employability Index (EI, see Appendix 1) can be designed into the system as a correction factor to compensate for these external factors:

$$UT(weighted) = \frac{xUT \times xEI}{EI}$$

The system modeling (ELISE architecture) behind weighted UT calculation is described in the image below:
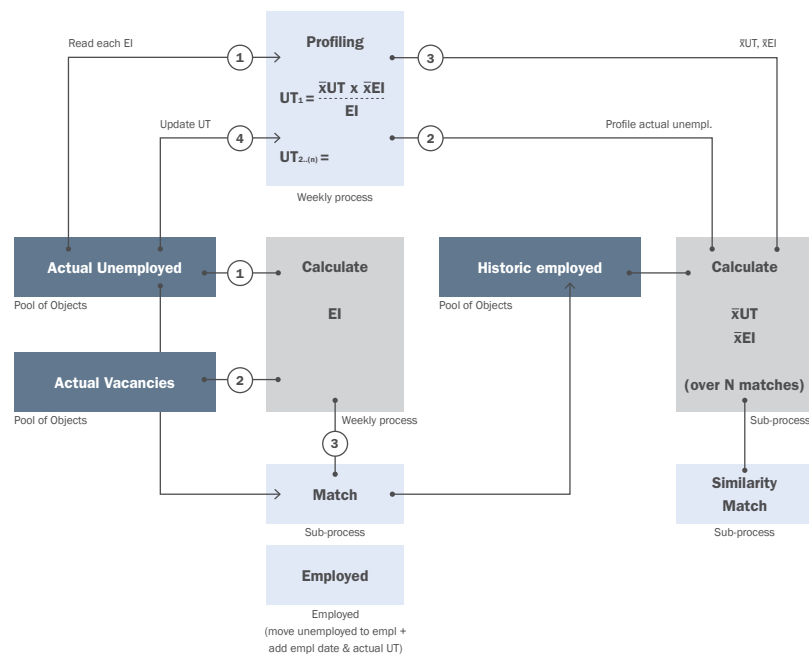
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