Value Based Matching

An Outcome Based Referral System

SMART SEARCH & MATCH

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It's Time for Value

Against a background of stretched budgets and rising unemployment, it is critical that the labor market programs and early intervention strategies you adopt are proven to be cost-effective. This means that PES faces a crucial challenge: to provide clients with intensive support on the one hand, yet promote a self-help strategy on the other.

In the context of employment policies, there are several different methodologies for allocating resources, including: a) universal provision, b) "first come, first serve", c) queuing and d) differentiation. To optimize the positive impact of labor market policies, differentiation of client need is becoming increasingly necessary. Public Employment Services have developed alternative ways to allocate individuals to services, such as targeted service delivery systems.

Profiling and Segmentation is just the first step of a comprehensive "Expert Targeting System[1]". Profiling-driven client segmentation helps PES to identify the clients in most need of assistance. This allows them to ration General Employment Services accordingly.

The first step is about creating "face-time" between clients and service-providers.

In a second step, clients in more pressing need of reintegration services are referred to more intensive forms of services: the Active Labor Market Policies (ALMPs). Referral systems allow PES to target specific reintegration programs to different categories of job seekers. The challenge in this process is identifying which programs will produce the highest pay-off for which clients: what is the most effective path back to employment for each client?

Considering the cost-effectiveness requirement alluded to above, a well-designed Referral System should do more than determine which programs create value for the individual and shorten their unemployment spell. Just as importantly, it must be able to balance the budget allocated to the portfolio of investments made in clients. In other words, the purpose of the Referral system is to offer a systematic approach to selecting and planning the appropriate services for individual reintegration, while at the same time balancing the cost of the portfolio as a whole.

The second step is about improving the Market Value of a client.

[1] The "Expert Targeting System" can be characterized by Profiling, Customer Differentiation and Cost-Effective Allocation of Resources.

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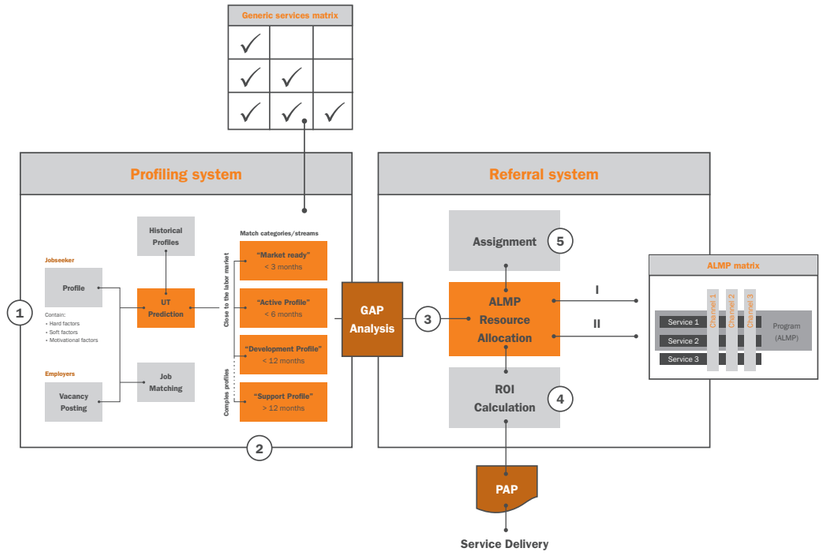
The Profiling system and the Referral system combined form an invaluable Expert Targeting System to help PES *simultaneously improve value and minimize costs*. We characterize this Expert Targeting System with the slogan "**It's Time for Value**". Time Value[2] means that the money you hold today is worth more if you invest it in bringing people back to work, because it earns you interest in the form of taxes in future. In short, it is about knowing the present value of future income.

The Profiling system and the Referral system have the same starting point and use similar methods, but they are in fact complementary. Collectively, WCC calls this combination of systems and modules **Value Based Matching** (VBM). Value Based Matching consists of two sequential elements: 1) Profiling and Customer segmentation based on individual expected unemployment terms, and 2) Value creation (increasing the social rate of return) through cost-effective resource allocation.

Overview of the Referral system

In the picture below, the Referral system is the second step of an Expert Targeting System.



[2] Time Value is also a central body in finance theory. It is the method to calculate the present value of a likely stream of future income.

The Referral system **1)** estimates the potential outcome for putting a certain client in each available program[3] based on that program's contribution to UT reduction through a (statistical) model. The system considers **2)** whether the gains of a program - benefit savings and (tax receipts on) earnings - exceed its costs (Accounting module). Finally, the system **3)** plans the optimal distribution of clients across programs and services (Assignment module). In brief, the Referral system makes sure that every individual is assigned to the program that offers the best chances of successful reintegration.

The Referral System's results can be taken either as optional, e.g. providing a discussion framework for creating an individual action plan at the caseworker's discretion, or as compulsory, e.g. being the sole factor that determines whether a client is transferred to further support. Whether it is advisable to opt for the latter approach is dependent on the caseworker workload that PES is prepared to accept.

Direct links to resource allocation

PES is not the first Public Employment Service to adopt a referral system for computing which measure or intervention is expected to work best for a specific client. Several countries have developed effective referral systems in close cooperation with researchers:

1. Canada : SOMS = Service and Outcome Measurement System;
2. Switzerland : SAPS = Statistically Assisted Programme Selection;
3. Germany : TrEffeR = Treatment Effect and Prediction;
4. Some US states, like Georgia and Kansas: FDSS[4] = Frontline Decision Support System.

What is surprising, though, is that in many European PES, resource allocation seems only to cover the frequency of client contact according to different profiles. The German PES gives recommendations for a minimal frequency for different profiles among unemployment benefit clients. The distribution or rationing of services across client profiles is only a minor determinant within the budget planning process of the Bundesagentur für Arbeit.

Other factors, like regional unemployment rates, play a major role in the "budget dialogue" between local and central levels. In France, the frequency of interviews is related more directly to the different segments of clients, but in the other European countries, there are no quotas at all for financial and staff

[3] See Appendix 1 for a definition of Programs, Services and Channels

[4] The referral system FDSS is used in conjuction with the profiling system WPRS (Worker Profiling and Reemployment Services).

requirements based on customer profiles. Rather, it is the workload (client-to-caseworker ratio) and the average time allocated to an interview which determine staff resources. In Denmark, for example, the government will only refund up to a set maximum the costs of active measures per full-time activated person.

Links to PES Policy

Reintegration measures should not necessarily be applied to all clients. One possible reason for excluding clients from measures is if these measures failed to produce results for clients with similar characteristics in the past. When results are insufficient, this may signal that clients had social or health problems that labor market measures could not solve. If the priority is simply to *reduce inequality*, it makes sense to apply reintegration measures first of all to the most disadvantaged – that is, to those among the disadvantaged for whom these measures have at least some effect.

However, PES may also decide to apply the measures in such a way that the total net effect is as large as possible. In this approach, clients with the highest expected effects are prioritized, and these are not necessarily disadvantaged. A third possibility is to aim for the *highest social rate of return* (SROI[5]). This approach goes a step further, in that it takes into account the benefits for the economy as well as the costs of the measures. That means that given a choice between two reintegration measures, we might still pick the less effective one if it happens to cost much less. Cheaper measures can be applied to more clients and may thus produce a higher effect for all clients taken together. Here, the size of the reintegration budget is critical: for example, if the budget is relatively high there may not be a need to prefer relatively cheap measures. When aiming for the highest social returns, the degree to which measures can contribute to reducing labor market shortages is another relevant factor. In this point of view, training programs would gain importance.

There are two conclusions to be drawn from the above. One is that the Referral system's design will be influenced heavily by PES's chosen business model. The other is that for an optimal allocation of the reintegration budget, we must adopt a two-pronged approach. Profiling clients on the basis of their UT and risk of long-term unemployment is not enough - we also need to map the effects of various measures on clients' reemployment chances.

[5] Social Return On Investment: SROI, or the social internal rate of return, refers to the costs and benefits to society of investment in education and entitlements. These costs include the opportunity cost of people not participating in the production of output and the full cost of providing education, rather than only the foregone income cost that is borne by the individual. The benefits include the increased productivity associated with the investment in education and a host of possible non-economic benefits such as lower crime, better health, more social cohesion and more informed and effective citizens.

Together, our Profiling and Referral systems can provide both kinds of information. The combined models *can predict how long a person with a given set of characteristics will remain unemployed*, and also *to what extent specific measures can shorten the unemployment spell*. Such models, applied to detailed groups and measures, would enable us to *determine what type of measure is most effective for a given client at what stage of the unemployment period*.

In practice, data limitations may dictate that only broad categories of measures and broad client groups can be distinguished - this is something we have to verify in the project's first phase. Furthermore, when estimating models, we also face the problem that data about 'soft' factors are only partly available or even unavailable (which would require us to collect them ourselves, either through tests/assessments or through questionnaires).

Active Labor Market Policies at PES

Battling rising unemployment rates, Public Employment Services are looking to intensify the role of Active Labor Market Policies (ALMP). Once a client is assigned to a program by the referral system (or in most countries, by the caseworker) participation is mandatory.

PES introduced ALMPs to reduce unemployment by helping clients to gain and maintain skills, by improving job-matching between employers and employees, and by serving as a signaling device for clients or a screening device for firms. These ALMPs include training programs (such as job search and personality courses), language courses, and further vocational training for gaining or improving crucial skills. ALMPs also comprise temporary wage and employment subsidies, both for competitive and for non-competitive jobs. The latter are often referred to as job creation schemes or employment programs, whereas the former may take the form of subsidies for temporary jobs (interim jobs) or subsidies for jobs intended to become long-term (job introduction allowances).

Maximizing the total net effect - and more

Clearly, a measure must have a proven positive net effect for it to be selected. But this is not necessarily the only criterion; more general policy goals also play a part in this choice. Choosing to work towards reducing inequalities and maximizing the total (social) rate of return (social inclusion) are valid goals in their own right.

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Whatever the aim, the most important issue is how to allocate PES's scarce financial and staff resources. To answer this question, we analyze client profile micro-data and statistics, then use these analyses for systematic distribution of resources. We define rules for decisions that weigh the customers' problems and needs and earmark certain proportions of the available resources for specific customer groups or individuals. Financial and staff requirements quotas based on customer profiles are what determines the extent of support that will actually be granted. In this respect, referral is closely associated with the functions of operational and financial controlling in the employment agencies.

The added value of the Referral System

As mentioned before, the Profiling and Referral systems are complementary. Whereas Profiling and Segmentation constitute a broad targeting exercise, the Referral system can tailor vocational and non-vocational activities exactly to a given client.

The Profiling System predicts the expected duration of unemployment (UT) if no active treatment is chosen. It does so on the basis of client profiles and the current labor market situation. After this assessment, the clients are segmented into "Match Groups" according to their distance to the labor market. This segmentation allows PES to assign clients to General Employment Services [6] (GES) right after the onset of their spell, on the basis of broad eligibility rules. Rather than spread PES staff time equally across all jobseekers, it is focused on the hardest to place. Easy-to-place clients are capable of finding work through job postings in the labor office and the "virtual labor market": internet, job banks, self-registration via the internet, call centers and so on. Clients with the highest unemployment risks are assigned to the most intensive forms of General Employment Services (e.g. interviews and collective information sessions).

Referral is a Statistically Assisted Program Selection (SAPS) system targeted towards clients with a risk of being long-term unemployed (i.e. *development clients* and above). The system estimates the decrease in the employment term that can be expected if a specific client takes part in a particular labor market program. If a variety of heterogeneous labor market programs are offered, as is the case with PES, then it is preferable to add a SAPS system to the profiling system (Berger, Black and Smith 2001).

[6] Appendix 2 defines the term GES and ALMP.

Resource Allocation Module

To assess the success of a program, PES should not just consider the duration of the employment term. After all, subsequent employment is not necessarily the result of previous program participation. To provide an example: a highly skilled young job seeker is assigned to a full-time computer course, and finds a job after four months. However, there is nothing to suggest that this client might not have found a job within two months if not assigned to the time-consuming course (which would have left more time and energy for job-searching). Therefore, to determine the true effect of a program, we should compare, for all the available programs, the hypothetical employment situation that would ensue after participating in this program. This comparison should also include the option of non-participating in any program - the "no-program" option.

In reality, such a comparison is complicated by the fact that the employment status can only be observed *after* participation, and only for the program actually chosen. In other words, when a client attends a language course, this closes off all other possible outcomes. The potential employment status for if he or she had, instead, participated in an employment program becomes unobservable. Also, it is highly likely that people in different programs have different characteristics to begin with.

For example, if there are highly skilled clients in program A and poorly skilled clients in program B, the first group will have higher employment chances even without participating in program A. This means that there is no simple way to compare the labor market outcomes of clients attending language courses with those assigned to employment programs, or to compare between any two types of programs in general.

Luckily, micro-econometric techniques make it possible to overcome these selection biases. One of the techniques we plan to employ is based on the idea that we want to compare the employment state of an individual in program A with that of a similar individual in program B, where similar means that the two individuals should be identical with respect to all characteristics that matter for their employability as well as their selection into programs, with the condition that there is no selection bias on any of these characteristics.

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This way, the labor market outcomes of participants in program A and program B can be compared to judge the impact of program A versus B. Of course, this estimation technique is only applicable if a very rich data set is available that includes all variables that affected both program assignment and labor market outcomes.

Treatment Effect Heterogeneity

Several evaluation studies found *treatment effect heterogeneity* [7] in that a particular program seems to impact differently on different subgroups of the unemployed at different stages in their unemployment spell (Gerfin and Lechner, 2002). caseworkers are probably aware of this heterogeneity (which is also evident in the different characteristics of participants in different services) when assigning programs: for example, nationals are more likely to be assigned to language courses, whereas highly qualified unemployed individuals participate more often in computer courses. In a simulation study, however, Lechner and Smith (2006) concluded that in assigning clients to programs, caseworkers do about as well as random assignment (success was measured in terms of predicted unemployment rates (pUT) one year after the program's start). Furthermore, if clients had been assigned to programs according to the highest predicted outcomes, the post-program employment rates would have been raised by 8% under the same programs or even by 14% in the absence of resource constraints.

In other words, the employment of clients could have been improved by allocating them into different programs, or at different times in their unemployment spell or not at all. Studies and pilots have shown that higher overall employment rates can be achieved by statistics-based program assignment. In a world without resource constraints, statistical assignment would improve every individual's employment chances.

In practice, of course, every PES is restricted by these constraints; only a limited number of training slots is available at any given time. Statistical program assignment then might result in a situation where some clients no longer get access to training, as all slots are taken by other clients with higher predicted impacts.

[7] A feature common to all social and behavioral phenomena is variability across units of analysis at different levels, such as individual and family characteristics and contextual (such as neighborhood and clinic) characteristics. Individuals differ greatly not only in background attributes but also in how they respond to an intervention or program. We call this type of variability "heterogeneous treatment effects." The estimation of treatment effect heterogeneity plays an essential role in 1) selecting the most effective program from a large number of programs, 2) determining subpopulations for which a program is effective or harmful, 3) designing an individualized optimal service allocation.

Statistical assignment versus non-statistical assignment

Using referral, it is possible to find out not just that allocation was not optimal in the past, but also to predict which measure would be best for a client now and in the future. During the project, we will collect data on profiles and treatment outcomes of the population intermediated by PES. From these ex post data, we will be able to identify ex ante which programs improve labor market outcomes for which subpopulation, and thus, how we can achieve higher employment rates through more efficient allocation. Compared to an ex post ALMP evaluation, a prediction has to deal with many more challenges. Chief among these is the fact that every estimate is necessarily based on data of past participants. We can only predict potential labor market outcomes for enrolling a client in program A or B if other clients already participated in it. And if a new program C with different features is introduced, predictions become less accurate. Predictions will only make sense if economic relationships do not change too much, or change in a relatively predictable fashion.

A second challenge is that many of the data necessary to estimate the effects of programs on past participants may not be available due to administrative or data security reasons. The approach we propose first uses all available data on past participants to estimates impacts free of selection bias, and then averages these with respect to the variables not available for the pertinent client.

Since Value Based Matching for PES is still in the first stage of development, we cannot expect all microdata to be present, nor know the extent to which each program reduces UT. Also, it has been indicated that the number of programs will grow rapidly soon. For this reason, we recommend not starting with statistics-based program assignment, but with a non-statistical (GAP Analysis-based) program selection[8].

We will base predictions on two types of data sets. One set, drawn from previous clients and obtained from the UI system, will be used to estimate the causal effect of programs. The second set contains information on current clients from the UI database. Combining these sources will yield a wealth of detailed information on registration and de-registration of unemployment, benefit payments, sanctions, participation in ALMP and employment status, and characteristics such as qualification, education, language skills, job position, experience, profession, industry, and an employability rating provided by the Employability Index algorithm [see PES02-Profiling].

[8] We advise PES to start collecting data right after the start of the project.

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In the proposed implementation of the SAPS system, employment outcomes are expressed as the expected number of months in stable employment within the following twelve (12) months. The choice of this measure will of course be synchronized with PES's official goals. An employment spell is considered stable if it lasts for at least three months without a break - a job held for a few weeks will not be considered a positive outcome. This definition of the outcome variable favors fast reemployment and penalizes short employment spells.

PES have a variety of programs available, with the official classification distinguishing 100 different types. These programs are grouped into broader categories. To these, we will add a "no program" category for when clients do not participate in any programs today, but still leave the option for later. Categories may include: 1) job search and personality courses; 2) language skills training; 3)computer skills training; 4) vocational training; 5) further training and employment programs; 6) job creation schemes and 7) subsidy programs. There are several reasons not to define narrow categories. First, the number of past participants observed in the data would be small for some courses and statistical precision would suffer. Second, specific courses might no longer exist. A broader structure means that categories remain relatively unchanged.

Goal definition

The main purpose of using a statistical assignment model is to reveal systematic relationships between some observed variables, X (profile data, services consumed, etc.), and an outcome variable, Y (UT reduction), and then to use this information for better program assignment. Ideally, we would specify a welfare function for the SA society (e.g. improving the social rate of return) and let it guide our implementation of the system, allocating programs to maximize the function (e.g. maximizing equity or maximizing efficiency). We consider the goal of maximizing efficiency to be attainable, in the sense of offering programs to those for whom the expected gain is largest.

Having defined the goals of the system, the first objective then is to define the outcome variable. In our VBM system, the outcome variable is the duration of unemployment, but it could also include duration of subsequent jobs, average time spent in unemployment over a certain time period, the wages in the next job, or the discounted future earnings of an individual.

With **efficiency as our primary goal**, the net monetary benefit of participating in a program (A) would be a good variable to use for the statistical program assignment model. But for this to work, we do need access to data on the programs' costs. If such information is unavailable, we may choose the duration of unemployment[9](B) as the relevant variable, because: 1) the main focus of PES is to shorten the duration of unemployment, 2) shortening the duration of unemployment is one way of increasing earnings. It is important to keep in mind, though, that in scenario B, though, we will actually be maximizing the *effectiveness* of the system rather than its *efficiency*.

In summary, we intend for our model to maximize the effectiveness of programs in terms of their ability to decrease the duration of unemployment. To operationalize this, we predict the future outcome[10] for each client, conditional on participation in any of the possible programs. Subsequently, the difference in the predicted outcomes compared to the option of "no program" is calculated, and the program with the best effect (or no program if all impacts are negative) is chosen. This is how the sequence of services can be identified that most often leads to successful employment outcomes for individuals with specific characteristics. It should be emphasized that this algorithm does not replace the staff's referral decisions. Rather, it provides additional information that enables caseworkers to make more informed decisions.

Path analysis

A component of the Referral system is an algorithm based on analysis of the various ALMP services that clients have received to assist their efforts in searching for and obtaining a job. It is apparent that clients typically receive more than one service during their participation period and that they receive those services in various sequences. For instance, a welfare recipient may start out being referred to a program by the social service agency, then to a basic education program, and then back to a job search initiative. This would hopefully culminate in a job interview and then employment. Even after obtaining a job, the individual may participate in post-employment activities. But another client entering the same program may take a different route to employment. Therefore, for programs that offer a sequence of services, the analysis must identify the predominant paths that participants typically follow.

Considering a collection of individual activities, such as attending a job search workshop or enrolling in an education program without taking into account how they relate to other services does litte to capture the cumulative nature of the delivery of services.

[9] Similar multivariate duration model as in the profiling module.

[10] The stochastic variable of interest is the duration of unemployment, UT. To model the selection process into programs, we need to define another variable, duration until assignment to ALMP (lock-out period, (l)UT).

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Once the pathways, or sequence of service activities have been identified, the effectiveness of these strings of services will be analyzed with respect to each individual's estimated likelihood of employment. Some specific paths will be more effective in leading to employment for some clients than others, depending upon the clients' propensity[11] for employment as measured by the estimated employability. For PES, we expect the pathways to be relatively short, because initially, a limited number of programs is available for referral. In some cases, clients are provided only one service before finding employment or otherwise exiting the program, and this amount is expected to rise in the coming years.

The salient point is that we expect definite sequences of activities to occur, and that in the beginning, many of these paths consist of only one recorded activity. This is an important realization, because at the start of the project, we will lack both profile micro-data and outcomes. The accuracy of a statistics-based referral system is largely dependent on obtaining longitudinal administrative data. If complex pathways were taken into account right away, it would decrease the system's accuracy.

We will estimate a model that relates employment within a certain time-period after exiting from the program to participation in services and other characteristics including the employability index from the employability model. We interact the employability estimate for each individual with a variable indicating whether or not they received either one of the two post-employment services.

Non-statistical Referral

As alluded to above, longitudinal micro-profile data and data on outcomes of services referral may not be available right away, and this means they must be developed. An alternative way to refer clients to services is based on the concept of gap analysis. A gap analysis is undertaken between the expectations of two parties - in this case, clients and employers. The typical scenario for PES is to analyze the gap between client skills and employer requirements, and make a targeted offer of specific courses with the greatest positive impact on the client's desired career path.

For individuals, skills gap analysis can be used to produce personal development and training plans. It can also be used to bolster morale by showing clients their progress in improving their personal employability. ELISE's Gap Analysis is not limited to skills. Possible outcomes of ELISE's Gap Analysis could include advising clients to widen their job search area, or to lower their salary expectations. A client may even be advised to relocate if better job opportunities present themselves in another part of the country.

[11] A propensity score is an estimate of the probability that a person would undergo the "treatment". Sometimes, this probability is in itself a predictor of outcomes.

Gap analysis can be done with paper-based assessments and supporting interviews. However, if it is to be performed across a large number of job seekers and vacancies, this creates a huge burden on management and administration. Computer-based gap analysis can be applied both on a continual basis or as a one-off exercise by caseworkers.

The ELISE Gap Analysis module performs gap analyses on a real-time data set of clients and vacancies. Gap identification is based on an actual database of jobs, so the results are more actionable. In fact, to facilitate this action, PES can also offer tie-ins to training providers by showing the client available training, apprenticeship or coaching options.

ELISE gap analysis answers the following questions:

- What is missing from my CV that vacancies relevant to me require? *(matched vacancies)*
  The gap analysis shows what needs to be fixed on the offered side based on the top matching vacancies;
- What is missing in my CV that my peers do offer? *(similarity search)*
  The gap analysis shows what needs to be fixed on the offered side based on the competition;
- What causes a job to be less attractive to me given the vacancies matched to my CV? *(reversed match)*
  The gap analysis shows what needs to be fixed on the demanded side based on jobs matching with the client's CV;
- How do my demands differ from what my peers typically demand of a job? *(similarity search)*
  The gap analysis shows what needs to be fixed on the demanded side based on the matching peers;
- What causes a job to like my CV less, compared to the jobs that do like my CV *(reverse match)*.
  The gap analysis shows what needs to be fixed on the offered side, based on jobs liking the clients' CV;
- What causes the job which I like most, to like my CV less *(search)*.
  The gap analysis shows what needs to be fixed on the offered side, based on jobs the client likes.

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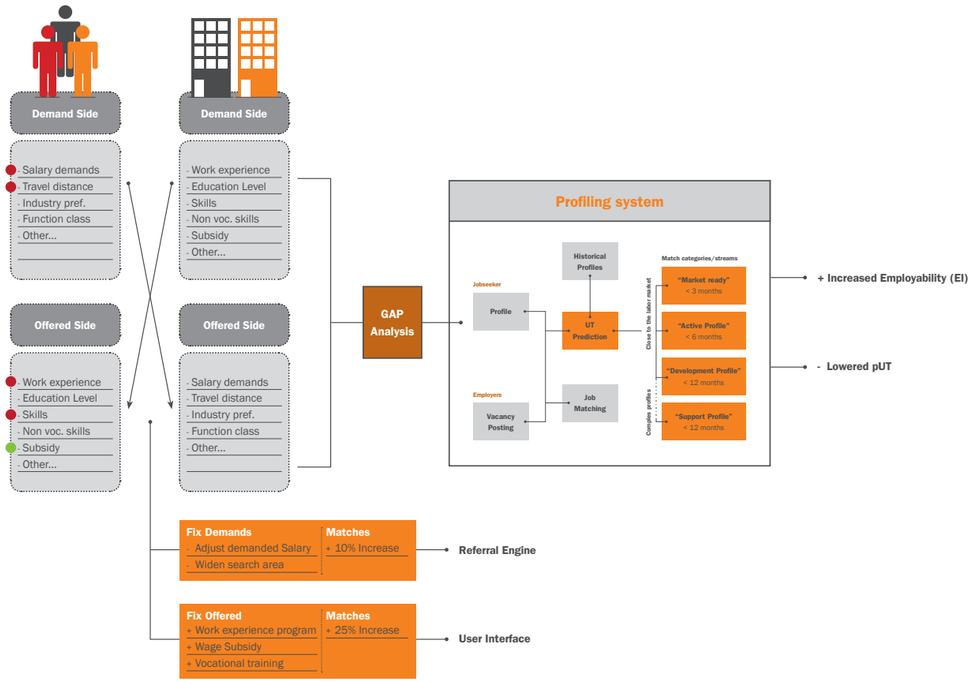
The figure below illustrates the mechanism of the Gap Analysis module



In the example above, the client's demands are clearly too high compared to what the market is prepared to accept or to what competitors are willing to settle for. This client also lacks work experience and skills. By adjusting this clients' salary demands and offering him or her a work experience program (learning on the job), wage subsidy and vocational training, this client's chances of finding a job increase. In the image, this is reflected by the increase in number of matches found and by the increased Employability Index. If a profiling run had been carried out with these missing skills and experience, it would have shown a decreased predicted Unemployment Term[12].

[12] At the start of the project, when limited empirical data is available for calculation, we would need to work with UT estimators for each ALMP to be able to calculate SROI. As time goes by, these UT estimators will become more reliable.

The gap-based referral method works in a different way than the statistical form of program selection (SAPS) in that it does not predict the probability a program will work for an individual. Neither does it take into account personal characteristics such as soft skills, motivation and health. On the contrary - one of the advantages of a gap-based referral approach is that the system may also be used to highlight missing programs and services. This provides invaluable market intelligence to PES.

Appendix 3 contains a more detailed description of the ELISE Gap Analysis module.

Accounting module

Various macro-economic studies have been carried out by many countries to assess the value of active labor market policies. These studies conclude that there is considerable heterogeneity in the impact of ALMPs, so for some groups of clients, the programs are more effective than for others. Research also shows that when programs are implemented on a large scale, displacement and general equilibrium effects[13] may be sizeable. This means that without incorporating programs in a macro framework, micro treatment effect evaluations will provide poor guides to public policy (Boone, 2004).

Three-step evaluation processes (Caliendo, 2005) have been developed that: 1) estimate the impacts of the program on the individual (through micro-econometric evaluation), 2) examine if the impacts are large enough to yield net social gains (macro-economic evaluation) and 3) determine if this is the best outcome that could have been achieved for the money spent (ex post cost-benefit analysis). Based on these evaluations, macro-level reintegration budgets can be allocated to specific target groups (e.g. young people or women).

Within any given target group, individual budgets (micro investments) can be allocated according to PES-defined policy rules, such as 1) broad eligibility rules, 2) queuing, 3) equal spread, 4) prioritizing on pUT, 5) prioritizing on cost, 6) prioritizing on highest Present Value of Future Income, 7) MPT-based[14] rules or 7) prioritizing on Social Return On Investment (SROI). In our Value Based Matching approach, we suggest using this last rule.

[13] Market situation where demand and supply requirements of all decision makers (buyers and sellers) have been satisfied without creating surpluses or shortages.

[14] Modern Portfolio Theory, used to compute mean values of the return for every client business case in the portfolio. These values are estimated based on historical data. The MPT capability can be used to accommodate an investor's preference in the tradeOff between return and risk associated with every Target Group under consideration.

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The goal of the Accounting module, then, is to provide a framework for the implementation of a **micro investment instrument**. PES will use this instrument to **calculate** individual clients´ **value increase potential** in relation to investments made through ALMPs. The Accounting module will be part of an outcome-based referral system, using costs and future income potential and social yields as calculating variables, expressed through the outcome variable SROI (**Social Return On Investment**).

Social Return on Investment

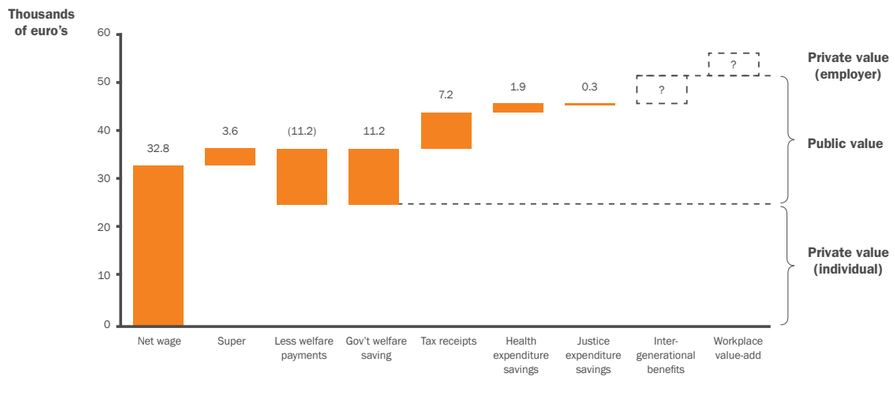
As a market designer, PES needs to establish a clear picture of the value of a job. This means taking into account the full economic benefits outside the immediate transaction: the 'externalities'. We must consider not just the narrow financial value of finding a client a job, but also the broader social value that this creates. Only in such a 'full-cost economics' approach to policy development can we account for the complete range of private and social costs and benefits of the market's activity. (Hetherington and Cooney, 2007).

There are obvious economic benefits to placing an individual into work: income for the individual, tax receipts and reduced welfare payments for the public. The intangible social benefits, though, are potentially far greater. These have the dual advantage of decreasing taxpayer outlays and improving quality of life.

There is evidence for such social benefits of employment in the areas of health and justice. Mathers and Schofield (1998) show that unemployed individuals between the ages of 25 and 64 are twice as likely to report being in poor or fair health (in contrast to good or excellent health), and to report 30-40% more chronic serious illnesses than their working compatriots. These differences could not be explained by higher levels of smoking, drinking, inactivity or obesity. In a review of regional indigenous communities, Weatherburn et al. (2006) find that unemployed residents are 54% more likely to be charged with a criminal offence and 88% more likely to be imprisoned than employed residents.

There is also an important intergenerational multiplier effect at play: the children of a newly employed person are now more likely to be employed and enjoy these same benefits. We believe that these benefits, both private and social, represent the **total value of a job** and therefore, they ought to determine what a government must invest in placing an unemployed person into work. To make clear what this means in practice, take the example below, in which we place a single, childless worker in a job paying 40,000 a year.

The worker enjoys a net annual gain of 25,201, made up of wages and superannuation minus benefits withdrawn. The public gains 20,550 in tax receipts, welfare savings and reductions in health and justice expenditure. All in all, this is a net gain of 45,751, or 3,813 for every month the worker stays employed. And just as importantly, this is not a one-off, but **cumulative value creation**.



It is important to note that this is an extremely conservative estimate of the value of a job. Using a childless worker in our example means that the intergenerational benefits which accrue to children are not even incuded. Under conventional finance theory, such benefits would be discounted near to zero because they occur well into the future, but from a social perspective, their value should not be ignored. Additionally, we assume that there are net returns to the employer for hiring the individual (otherwise they would not do so). Interestingly, these workplace returns do not accrue in out-of-work situations where the activity would not otherwise be undertaken by the private sector. Public works programs alone do not break the cycle of welfare dependency, or deliver the full suite of benefits outlined in this paper. If they are not improving an individual's employability, it is difficult to see the intrinsic value of these programs.

The analysis above suggests that moving a single, childless worker into a job paying 40,000 per year creates a combined public and private value of almost 4,000 per month (based on a conservative estimate of the combined benefits of increased private income, higher tax receipts, lower welfare costs and other social goods). But if we are to capture this value, the design of the market must change. There are four specific areas in need of such changes.

An Outcome - Based Referral System

SROI calculation mechanism

When estimating investments in clients, the main factor is the cost of programs. When assigning clients to programs, we would like to do so based on cost-benefit considerations, rather than on the effect of unemployment duration alone. It would be natural to include measures of program cost either directly into the identification of best programs or to make cost estimates available to caseworkers when they make assignments.

A conventional cost-benefit (ROI) calculation shows whether benefit savings and (tax receipts on) the earnings gained by a program exceed its cost.

For example:

- If an unemployed person is left without services from PES, the expected UT is 12 months;
- UI for this candidate is 1000 / month. Total cost of unemployment is 12,000;
- Based on the candidate's profile, we have determined GAPS that can be overcome through
  1. skill training and
  2. a jobsearch activation program. The total cost for these programs is 1500, and they are expected to reduce UT by 3 months;
- 3 months' worth of UI reduction yields 3000;
- Thus, investing 1500 yields a return of 3000;
- Net savings: 1.5 months of UT (or 1500)

An ROI calculation is a simple way to determine the bottom line return of any investment. The operative word, however, is simple. One major factor that doesn't appear in a ROI calculation is time. For instance, consider investment A with an ROI of 1000% and investment B with an ROI of 50%. Based on a simple ROI calculation, the decision would be easy – invest in the former. But what if investment A takes five years to pay off and investment B pays off in a month?

Clearly, PES as investor must look at ROI calculation methods which take time into account. The algorithm we propose to use is based on a method that performs an economic valuation of employees based on the Present Value of Future Earnings. Using this method, we can determine what an employee's future contribution is worth today. This information then enables us to create a "business case" for clients before they are referred to labor market programs.

Of course, as is true for any business case, we need to establish an investment horizon. This horizon can be determined either by broad rules (e.g. “all investments made must yield a positive return within a year”) or by specific rules for each target group (e.g. “investments made in young people must yield a positive return within three years, but investments made in well-educated mid-career professionals must yield a positive return in 3 - 6 months”). The examples below show that there is a clear need to be able define such business rules as part of the Referral system - rules that can be created or modified by a PES policy maker.

Target Group 1: Saudi Nationals

Positive Business Case

Fix Demands - Voc. Training: 1.500 - pUT reduction: 3 months	**Budget rule TG1** - 1.500 max budget
UI Cost: 12.000 - pUT 12 months - UI cost calc: 1.000	**Horizon rule TG1** - ROI positive business case within predicted UT

Target Group 2: TBD

Negative Business Case

ALMP Investment - Voc. Training: 1.500 - pUT reduction: 3 months	**Budget rule TG1** - 1.000 max budget
UI Cost: 12.000 - pUT 12 months - UI cost calc: 1.000	**Horizon rule TG1** - ROI positive business case within 6 months

A business case built upon the concept of SROI is a bit more challenging, but a proper definition of the term can help in this respect. Social Return on Investment refers to the costs and benefits to society of investment in education and entitlements. These costs include the opportunity cost of people not participating in the production of output and the full cost of providing education, rather than just the foregone income borne by the individual. The benefits include the increased productivity associated with investment in education, as well as a host of possible non-economic benefits, such as lower crime, better health, more social cohesion and more informed and effective citizens.

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Going by this definition, our SROI business case would look like this:

Negative Business Case

Social **Cost**	Social **Returns**
- Entitlement Cost - Cost of GES - Cost of ALMP	+ Income Tax
- Sunk PES cost (overhead)	+ Sales Tax
- Other Social Cost (e.g. Crime, Health)	+ Social Cohesion + Social Inclusion

If we design our Accounting module solely on individual “business cases”, we become inflexible to policy changes. For instance, if there were no consequences for approving each individual business case, the cost might run out of control. The logical conclusion to be drawn is that we also need a rationing mechanism that distributes reintegration budgets across the portfolio of clients, either based on a set of rules or by using statistics. There are several techniques to ration budgets across individual clients or client-groups in PES’s portfolio. These appropriately named “portfolio techniques” can be used in conjunction with the rules engine and the present value calculations to determine the maximum reintegration budget for each individual client.

PES as market maker

Economists generally agree on what constitutes a good product market, but much less so on what constitutes good labor market institutions. As a result, the public debate is dominated by clichés and slogans. “Get rid of labor market rigidities” is one of the most frequently-heard truisms. Meanwhile, policy makers focus on politically feasible, incremental reforms with little sense of their ultimate goal.

But it's not about market versus state anymore. The real debate should be about how to design the market: how to set the rules of the game to encourage behavior that advances policy goals. This means that the government must truly act as a *market maker*.

By visualizing the public sector as a marketplace, we strive to break away from cost-based budgeting approaches. In this context, revenue is the truest indicator of value. Government agencies, who aspire simply to break even, should aim instead for a model in which they accrue the highest possible "social revenue" at a feasible cost. By opening up operations to the influences of the market, and by establishing estimates for the cost of labor-market services offset against the value of work, leadership can effectively gauge the impact of their investment decisions.
If we treat job seekers as entities within a market, we can apply the tools of modern portfolio theory - for instance, to better inform Public Employment Services which of the available investment choices would be optimal. Effectively, the body of taxpayers asserts its investment priorities. It then becomes the responsibility of the PES leaders – with the aid of modern portfolio models – to allocate these tax "investments" effectively.

Assignment module

The goal of the Assignment Module is optimal assignment: to distribute unemployed workers across services and programs so as to achieve the lowest total sum of unemployment terms.

In the resource allocation step of the process, we determined the program (or program combination) with the best chances of reducing a client's UT. In the accounting step, we calculated the return on investment of the service(s) provided to the individual (optimized against the portfolio of clients). Now, the Assignment module calculates the optimal distribution of clients across programs. The assignment mechanism that assigns individuals to programs takes into account: 1) program type; 2) available slots in each program; 3) sequence/timing of events; 4) SROI of the intervention. If the SROI is positive[15], the assignment mechanism is activated.

At any point in time, a caseworker can assign an unemployed client to a program or select the *no program* option. Hence, the question is actually not just choosing the best program, but also when to assign a client to a program (for it might be fully booked and not be available).

[15] This is a business rule which we have to define and refine over the course of the project.

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Therefore, we have framed the following (restricted) assignment mechanism: *Assign the best program, but impose restrictions on the number of slots in each program*[16].

Scheduling

Scheduling is one of the core areas of process operations in the Referral system. It deals with the allocation of available resources over time to perform a collection of tasks with the goal of optimizing one or more system objectives.

The key decisions made through a scheduling model are:

1. Selecting the tasks to be performed;
2. Assigning the tasks to units;
3. Sequencing, Start time, Duration and the Volume processed.

In context, our scheduling model works to 1) select programs and services (done by the SAPS); 2) assign clients to programs and channels; and 3) determine start time and sequencing. In our assignment model, we take into account the bundling and scheduling of events (the sequence of services within a program and a combination of programs).

Scheduling occurs after a program or combination of programs has been selected for a particular client. Dependent on program availability, planning, eligibility criteria and the number of open slots, clients are assigned to programs. The challenge is to find an optimal distribution. Generalizing, the distribution problem is as follows: *There are a number of "agents" and a number of "tasks". Any agent can be assigned to perform any task, incurring some cost that may vary depending on the agent-task assignment. The goal is to perform all tasks*[17] *by assigning exactly one agent to each task in such a way that the total cost of the assignment is minimized.* The example below illustrates our approach to this problem.

[16] Based on this mechanism, we are able to plot the average duration of unemployment for each assignment. To compare results, it is necessary to model in two other assignment mechanisms: 1) Assigning the Worst program and 2) Assigning a Random program. This will provide us with an idea of the potential improvements from the system compared to not having this system in place.

[17] If the numbers of agents and tasks are equal and the total cost of the assignment for all tasks is equal to the sum of the costs for each agent (or the sum of the costs for each task, which is the same thing in this case), then the problem is called the linear assignment problem. Generally, if reference is made to "the assignment problem" without any additional qualifications, then "the linear assignment problem" is intended.

Suppose that a taxi firm has three taxis available (the agents), and three customers wishing to be picked up as soon as possible (the tasks). The firm prides itself on speedy pick-ups. For each taxi, the "cost" of picking up a particular customer will depend on the time taken for the taxi to reach the pick-up point.

The solution to this assignment problem is whichever combination of taxis and customers results in the smallest total cost. However, this problem can be made rather more flexible than it appears. Suppose that there are four taxis available, but still only three customers. Then a fourth dummy task can be invented, perhaps called "idling", with a cost of 0 for the taxi assigned to it. The assignment problem can then be solved in the usual way and still give the best solution to the problem.

Similar tricks can be used to allow for more tasks than agents; tasks to which multiple agents must be assigned (for instance, a group of more customers than will fit in one taxi); calculating multiple journeys; or minimizing time rather than minimizing cost. The same model is valid for assigning clients to programs and services. In a weekly run, we consider the system to be stable - a steady state of programs and available slots which are optimized against a number of clients assigned to a (combination of) program(s).

Timing

As shown above, our Assignment system is based on a realistic mathematical representation of an event scheduling and assignment problem that aims to maximize saturation. A crucial aspect of this process is the correct timing of the Profiling, Segmentation and Referral steps.

For a majority of clients, it will be very difficult to predict the length of their unemployment spell at the very beginning of said spell. At this stage, predictions will be most accurate for specific groups, such as people with health problems or older low-education clients. For the majority, it may make more sense to postpone the profiling process until a few months into the spell[18], or to repeat profiling after a few months ("dynamic profiling"). By this time, many clients in the "Market-ready" and "Development" categories [see PES02], who are often more able, motivated and in possession of a well-developed social network, will have found a job already.

[18] For system optimization purposes we have set this period to 3 months.

An Outcome - Based Referral System

For clients with an (immediately apparent) high risk of long-term unemployment, early intervention is the best way to shorten unemployment duration as much as possible. But for other clients, early intervention could actually have adverse effects: it may stigmatize them and discourage their efforts to look for a regular job, even as they are perfectly capable of finding a job on their own or with only limited help. In other words, early intervention may be counterproductive and lead to lock-in effects (De Koning et al. 2005, Rudolph and Konle-Seidl 2005).

Appendix 1 – Designing the right mix

Because of increased demands and greater budgetary stringency, one of the core priorities of Public Employment Services is to find the most effective and efficient ways to deliver services to clients. One possible avenue is to target service delivery at the individuals in greatest need of assistance [PES Product Descriptions – Employability profiling] while providing those capable of helping themselves with effective tools to do so.

Job seekers interact with PES in multiple ways. There are three general types of **service encounters**: remote encounters, phone encounters, and face-to-face encounters (Dialogic 2004). Usually, four types of **service delivery channel** are distinguished:

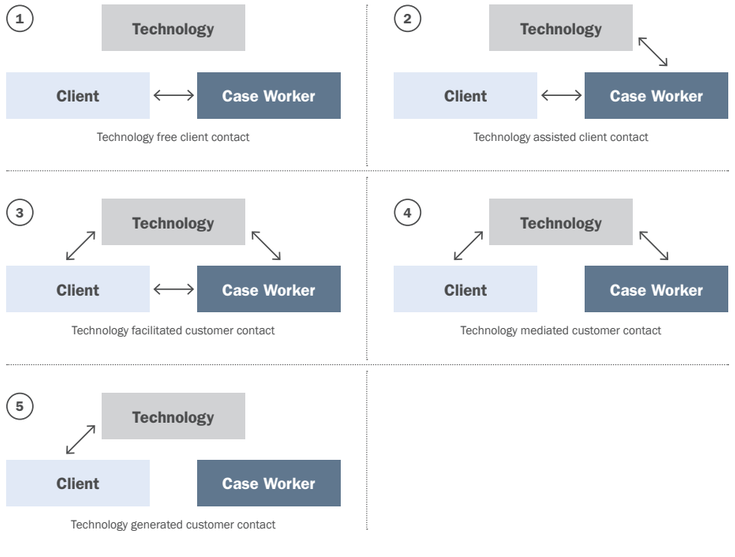
1. Personal - counter or job fair;
2. Electronic - internet, social media or e-mail;
3. Printed or written - letter or fax;
4. Telephone - direct call, IVR, call center.

Personal service delivery mainly relies on face-to-face communication, telephone delivery on spoken (but remote) interaction, and written delivery on print media. In contrast, electronic services use multiple media: websites and e-mail mainly use text, similar to print media, while web-conferencing, for example, uses both audio and video.

The nature of contact

Although ICT has led to new service channels (e-mail, internet, VoIP, tablets) it has also changed the nature of contact via implementations in the back office. There are five conceptual archetypes of customer contact in relation to technology, as shown in the image on page 29.

The first customer contact type is technology-free (1), as often seen in face-to-face contact. The second type, technology-assisted (2), is when the caseworker uses technology. For example: a front desk where the caseworker or a service representative has access to a desktop computer to provide information to the client. The third type is technology-facilitated (3): for example, a client and a caseworker both browse the internet, or go over a questionnaire or assessment together on the telephone while the caseworker helps the client find the necessary information. What these conceptual archetypes make clear, is that ICT has affected the entire environment of service delivery.



Multi-channel management

Many influences affect channel choice - chief among them are: convenience, ease of use, preference for dealing with a real person, concerns about safety and (perceived) risk, complexity, trust, and flexibility. Other factors that have been suggested are interactivity, the "fit" between service and channel, previous experiences, and cost. Overall, face-to-face contact is perceived to be the richest channel, followed by telephone, e-mail, and websites. We take a rather broad perspective of the word "channel" by sticking to the interpretation that "*a channel is the means by which a message is sent by a source or obtained by a receiver*".

In the private sphere, interactions between individuals and businesses or public services have become increasingly dominated by digital forms of delivery, which are replacing more traditional face-to-face and printed channels. Although the number of electronically available services has grown in the last decade - mostly to increase cost-efficiency and enhance client orientation - many PES still rely mainly on face-to-face interaction with clients.

Multi-channel management (MCM) is on the radar of a growing number of PES. Integrated multi-channeling is a way of making services (ALMPs and general services) available through different channels, such as job fairs and self-service portals. Teerling (2007) defines MCM as “the effective and efficient deployment of channels for the communication, interaction, transaction and/or distribution of services to the client”.

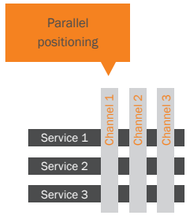
Although this definition appears clear-cut, in practice the distinction between services and channels becomes somewhat muddled when service distribution is limited to one particular channel. Also, the very nature of a service may exclude a particular channel. A service-channel matrix is usually the instrument of choice for describing the availability of services within channels.

	Registration of unemployed	De-registration	Unemployment Benefit claims	Creation/ update of Individual Action Plan	Information on suitable Job Vacancies etc.	Information and guidance	Information on employment measures	Applications/ referrals to/for employment programmes	Job/vacancy matching
F2F	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Telephone	No	Yes	No	No	No	Yes	Yes	No	No
Internet	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Email/SMS	No	Yes	No	No	Yes	Yes	Yes	No	Yes
Social media	No	No	No	No	No	No	No	No	No

As mentioned above, MCM is about the effective and efficient deployment of channels to communicate with and deliver services to clients. In the literature (Pieterson and Van Dijk, 2006), a distinction is made between four different MCM strategies, described below.

Parallel positioning

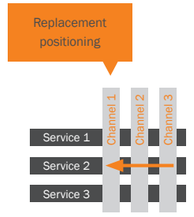
Channels are positioned next to each other. Clients are free to choose channels, and services are available through each channel.



An Outcome - Based Referral System

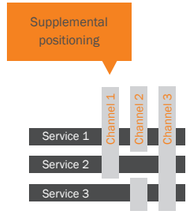
Replacement positioning

Channels can replace each other. The assumption is that channels can be superior or inferior to each other. Clients would prefer to use the best channel, and therefore one channel would replace another.



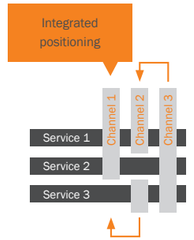
Supplemental positioning

Channels have supplemental values. Each channel has its own characteristics that make it suitable for certain types of services or client groups.



Integrated positioning

All channels are integrated in the entire service delivery process. This means that all services are offered via all channels, but that the strengths and weaknesses of channels are considered in the design. Clients are guided to the best channels, and channels seamlessly refer to each other.



At first, most PES used parallel positioning, making newly developed channels available in tandem with existing means of communication. However, as MCM strategies evolved, the development of specialized tools available primarily on certain channels (particularly the online channel) became more widespread, and the development of more individualized approaches to job seekers has made it easier to steer clients into the direction of the channels most suitable for them.

In some countries, such as the Netherlands, financial pressures are dictating a move towards replacement positioning, with a goal of 90% of interactions taking place online by 2014. Other countries make efforts to move towards supplemental positioning, exploiting the relative strengths of different channels. A number of countries are beginning to move towards integrated positioning, which also takes into account the integration of front- and back-office functions.

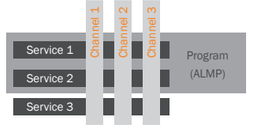
Based on the Teerling definition above and the integrated positioning of channels, we define integrated Multi-channel Management as: “the effective and efficient deployment of multiple service channels within one public service delivery process, or the use of different channels for different service delivery processes where the different channels relate to each other, for the communication, interaction, transaction with and/or distribution of services to the client”.

The four positioning strategies are ideal types; in practice, a combination is often used. Regarding the function of channels, a distinction is made between:

- **Primary channels:**
  channels that are central to the multi-channel strategy and used for the bulk of service delivery.
  Very often, this is the online channel.
- **Secondary channels:**
  channels that target specific functions or services that are not being targeted by the primary channel.
- **Support channels:**
  channels that serve as auxiliaries for other channels (e.g. help desks).

An Outcome - Based Referral System

System Relationship between ALMPs and General Employment Services



Active labor market policies include training programs such as job-search and personality courses, computer courses, language courses and further vocational training. They also comprise temporary wage and employment subsidies for competitive and non-competitive (extraordinary) jobs. The latter are often referred to as job creation schemes or employment programs, whereas the former may be in the form of subsidies for temporary jobs (interim jobs) or subsidies for jobs intended to become long-term (job introduction allowances).

To maintain consistency throughout the design process of the PES system, we can define (Active Labor Market) Policies as “a collection of services offered as part of a program to help specific target groups reduce the time spent in unemployment”. The term service also has many meanings and definitions, but in the context of programs and channels, it is best defined as “the business transactions and interactions that take place across a particular channel between a public employment service provider and a client”.

Appendix 2 – Activating the unemployed

The essential goal of activation strategies is to encourage clients to become more active in their efforts to find work and/or improve their employability.

Activation strategies include:

1. Early intervention by PES and high contact density between clients and employment counselors;
2. Regular reporting and monitoring of work availability and job-search actions;
3. Direct referrals[19] of unemployed clients to vacancies;
4. Setting up back-to-work agreements or personal action plans;
5. Referral to ALMPs after a period of unsuccessful job search to prevent loss of motivation, skills and employability as a result of longer-term joblessness.

General Employment Services (GES) differ from Active Labor Market Policies (ALMPs) in that participation in the latter is obligatory for relevant target groups. These target groups mainly comprise clients in higher risk categories, and the services involved are relatively specific to individuals' characteristics.

Examples of ALMPs[20] are:

- Skills and non-skills training;
- Subsidy programs;
- Work Experience programs;
- Job Creation schemes;
- Personal Action Plans (PAP).

Examples of General Employment Services are:

- Requiring unemployed people to attend intensive interviews with employment counselors;
- Direct referral to vacancies;
- Applying for jobs as directed by employment counselors (or independently searching and applying for jobs);
- Offers of suitable work (as is the case in work-first strategies).

[19] The term *direct referral* refers only to occasions when the PES offers a specific vacancy to the client, not when job-seekers themselves select the vacancy (that is called s*elf-referral*).

[20] Individuals may be referred to ALMP provided by the PES or to qualified private agencies and with performancebased contracts.

An Outcome - Based Referral System

Job search assistance or "work-first" strategies often have a large impact and their cost is relatively low. Long-term labor market programs, such as training and job creation measures often have little or negative short-term effect on outcomes. However, compulsory participation in long-term programs may have a motivational effect, encouraging people to find work before program participation starts. Intensive employment services, individual case management and mixed strategies with selective referrals to long-term labor market programs tend to have the largest impact (OECD Employment outlook).

Appendix 3 – Gap Analysis

One of the more advanced ELISE usage scenarios involves performing a Gap Analysis between the expectations of two parties, such as client and employer. This analysis can be done two ways: 'One-to-One' and 'One-to-Many'.

'One-to-One' is rather straightforward and usually performed by simply calling ELISE's API function 'DetailMatch'. All criteria are shown side-by-side, making it easy for users to see where mutual expectations are met and where they differ.

The 'One-to-Many' scenario is slightly more complicated. For years, ELISE has been supplying the 'SelectMismatch' API call, which mathematically computes the average 'gap' between one party (e.g. job seeker) and the top 100 of best-matching results (e.g. desired jobs). Although having a single API call take care of everything is immensely convenient, in reality things are often complicated by the unfortunate fact that there is no such thing as a 'standard' definition of Gap Analysis, nor agreement on how it ought to be computed and presented. Also, given that the supplied API function has limited customization capabilities (since the algorithm is 'built-in', the behavior is effectively fixed) an alternative approach to implementing Gap Analyses could be more suitable in certain situations.

Here is one typical scenario in which customization may be preferable to the stock API call: a self-service portal wishes to expand its service portfolio by partnering with a training company that offers specialized courses to a particular industry or field (e.g. courses in programming languages for IT professionals). By leveraging ELISE matching results with a quick gap analysis of a client's IT skills, the self-service portal can make each individual job seeker a targeted offer of specific courses most beneficial to his or her desired career path.

In this particular case, it is important to compute the Gap Analysis only on the basis of client skills, without taking into account any other criteria (such as desired salary or location). In addition, there needs to be a way to fine-tune the algorithm (for example to decide which data are used to compute and influence the 'gap' - skills weight factors, job ranking/match score, is skill a 'must-have', how many jobs should be used for the analysis, and so on).

The method

For clarity's sake, we will consider the implementation of a scenario described in the previous paragraph. To start with, we'll need two data sources:

- A client profile;
- A list of jobs used to gather and compute data relevant for Gap Analysis.

Calculating the gap on a client's skills is a three-step process:

1. First, the list of jobs needs to be generated – commonly, this is done by performing a search operation based on the client's profile;
2. Once the list of Job IDs is available, detailed data must be gathered on how the client's skills fare against each job's requirements;
3. Finally, with all data available, we need a way to rank the skills (collected from all jobs in the input list) and present to the client the currently missing skills that would be most beneficial to attain.

The way this ranking algorithm works will determine the quality of gap analysis, and the definition of its rules is under complete control of the application developer. The simplest form of such an algorithm could look like this:

- For each skill (from all jobs generated in the first step) compute its 'total weight' (e.g. if the skill 'Java' appears in 3 jobs with weights of 100, 150 and 300 points, its total weight is 550);
- Sort the skills in descending order of their total weight;
- Loop through this list and check whether the client actually has that particular skill;
- If not, add this skill to the gap analysis result set;
- If enough results (say, 3 or 5) are found, or if the end of the list is reached, present the client with a list of the most important lacking skills based on jobs he or she is interested in.

Starting from this basic scenario and depending on the desired behavior and level of sophistication of the algorithm, a limitless amount of additional fine-tuning is possible. Further issues to consider are:

- Should the match score of a job be taken into account? In other words, should a skill's 'total weight' be higher if it is required by jobs with a higher match score?;
- Is expanding the client's skill set considered more important than skill specialization? In other words, should affinities be utilized? Example: if 'C#' and 'VB .Net' are defined with 80% mutual affinity and the client knows 'C#' but jobs have strong preference for 'VB.NET' should he or she take a course in VB.NET or is the existing C# knowledge sufficient, so that a different course would be more useful?;
- Should 'total weight' be more strongly influenced by number of jobs requiring the particular skill? In other words, instead of just linearly adding up points, should the skills importance have more 'exponential' behavior?;
- Should 'total weight' be more strongly influential if a job marks the skill as a 'must-have'?;
- Should skills with more immediate benefit be preferred? For example, if some skills necessitate significant experience (say, 5 years) and others minimal or none, then a client could see a quicker pay-off from acquiring skills with less stringent proficiency requirements.

Conclusion

There is no single 'right' way to go about calculating Gap Analysis that would work for everyone in every situation and yet, the basic idea is rather straightforward. Indeed, the same approach could be used to figure out the gap for education level instead of skills. Furthermore, multiple properties can be combined in a similar fashion to determine which one would be the best choice to spend time on (e.g. should a job seeker concentrate on acquiring skills or improving his or her education record?)

Gap analysis can also be useful to employers by helping them optimize search ads. Even before the ad is published, a gap analysis can reveal whether it is perhaps 'shooting too high' or 'aiming too low' with respect to the salary offered or the skills required.

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Appendix 4 – Literature

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  we examine the environment to discover gaps, inefficiencies, or failures within the current matching processes and design the right approach to Value Based Matching;
- **Business consulting**
  we manage the implementation of the ELISE Value Based Matching solutions recommended in the Strategic Solution Design. Business Consultants play a central role in keeping your organization on the road map to long-term margin increase.

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Founded in 1996, WCC Smart Search & Match specializes in the development of search and match software. Its flagship product ELISE delivers fast and accurate matching for many of the world's largest staffing firms and public employment services. WCC's smart search and match solutions help recruiters, job boards, staffing agencies and government departments of labor to connect mutually suited candidates and jobs easily, quickly and most effectively.

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