

# MANAGING THE QUALITY OF HIGHER EDUCATION IN SCOPE OF SOME THEORIES

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**Abstract:** The notion of quality became a buzzword in today's debates about higher education. But despite its popularity, there are still many uncertainties and misinterpretations. In our paper we take a look at most popular models of quality. We describe the specific features of higher education and their impacts on the use of quality models. We take a look at quality assurance models as well, and argue that due to the nature of quality, institutional quality assurance is a tool with dubious efficiency. We neither forget the role of appropriate scholarship distribution in assuring possibly optimal efficiency and quality of higher education programmes

**Keywords:** Quality, Higher Education, Scholarship Distribution, Public Decision Making

## 1. Introduction

The late 20<sup>th</sup> and early 21<sup>st</sup> century brought immense changes into the world of higher education. One of the most important events is the shift of the higher education system from the self-oriented approach towards a market-oriented one. Among other factors, this is mainly the result of the increment in the number of enrolled students.

Having more and more enrolled students into a higher education system that possesses of a wider variety of trainings than ever before, the question of quality and quality assurance is gaining importance. This is a result of several interdependent phenomena. First, there is a common fear that the increment in the number of enrolled students will result in declining educational quality. Second, the private sector's been long criticizing the academic sphere for neglecting the prospective employers' needs. Third, fiscal restrictions in several countries placed emphasis on new aspects like rationalizing or the efficiency of education. Fourth, there is serious pressure from the taxpayers' side for more and more transparency in the higher education system, to give insight into the use of money, the work done and its quality. And finally, international competition is increasing among higher education institutions, which evidently raises the importance of quality considerations.

Quality assurance seems to be an obvious tool for managing quality. By definition quality assurance means all activities of an institution, organization or sector that aims to satisfy consumer needs by their products or services.

This approach is easy to apply if we are talking about regular products or services. But in case of higher education, the situation is more difficult, because there is more than one consumer: the student, its parents, the prospective employers, the private sector, the academic sector, and the whole society. Issues such as education financing and identification of funding sources add even more complexity.

The problem is unfortunately even more complicated, due to the nature of quality and the sources of quality. The information processing system of the individual consumer creates a bias that cannot be neglected when talking about quality and quality assurance. There are two paradox issues that are questioning the applicability of the most common –

technocratic – quality assurance systems, and their assumption of being rational and objective. First, the subjectivity of the source of quality – which evidently results in the subjectivity of measurement – and second, the subjectivity of the feedback are factors that cannot be neglected.

The aim of this article is to give an insight into the process of creating individual quality images, and by doing so, pointing out the limitations of higher education quality assurance systems. This article argues that the “human factor” cannot be neglected when creating quality measurement models, and while especially with higher education, objective measurement of quality is almost impossible, measures have to be done in order to enhance it. One of these measures could be the implementation of the proposed Scholarship Attribution Model which enables decision makers to attribute scholarships more efficiently, hence contributing to higher HE quality.

## **2. Quality**

What is quality? The question is difficult to answer. Generally speaking, quality means superiority or excellence, so a product or service is of good quality, if it is superior to its competitors, regarding product and usage features. This definition has a major problem: who is to decide which features are important to determine a product’s or service’s quality? Or even if the criteria are clear, who is to decide what value a feature must have so that the product service can be regarded of good quality? The same applies to higher education as well. Higher education can be regarded as a special kind of services, with multiple consumers; thus, quality principles can be applied as well – certainly with some constraints.

Since the breakthrough article of David Garvin (1983) the concept of quality is in the focus of interest. Garvin distinguished among five approaches of Quality:

1. Transcendent approach means, that we can only understand and recognize quality, after we have encountered it several times. Regarding higher education it means, that after we have studied at several good universities, attended several enjoyable and useful lectures, we can have a clue about what educational quality means.
2. Product-based approach means that products and services are evaluated after the presence or absence of certain characteristics. This approach considers quality to be precisely measurable. Differences in quality mean differences in some measurable product characteristics. Regarding higher education it means that the university that “produces” students who have better grades or find work quickly, is a provider of education of high quality.
3. Production-based approach means that quality is conformance to previously set specifications and standards. Regarding higher education it means that the university that possesses more professors or computers than it is previously set by some government regulation can provide better education than the university that has less professors or computers than the value set.
4. Value-based approach means that quality is a question of costs and benefits. A quality product or service is which provides performance at an acceptable price or conformance at an acceptable cost. Regarding higher education it means that it is not a problem, if the students gain only little knowledge, as long as examinations are easy to pass, or tuition is low enough.
5. User-based approach means meeting the consumer’s expectations. The goal is thus focusing on the consumers and giving them what they want. Regarding higher education it means to provide an education that fits the expectations of students and the prospective employers as well.

So what is quality? We'd better ask the question: according to whom? Every actor on the market has a different concept of quality. It is no wonder, since everyone has a different information processing structure, which results in different outcomes even with the same inputs. Thus, the same bunch of product features will result in a different evaluation in quality. That's why one must distinguish between objective and subjective quality. Subjective quality means the consumer's individual evaluation of quality, while objective quality is the technical superiority or excellence of a given product or service (Hjorth - Anderson, 1984). As one can expect, objective and subjective quality is not going to match in the vast majority of cases. But the concept of objective quality raises further questions. Being superior to something places the subject into a comparative context. The question is: compared to what is a product or service superior? A standard is needed, to which we can compare. Besides, the deviation from the standard – be it positive or negative – has to be objectively measurable and verifiable.

The problem is the following: the choice of the standard is never objective, since it is based on the subjective evaluation of a person or persons. If we set the standard differently, it will reorganize the ranking. But if a certain product can have more than one quality value, it contradicts the objectivity criterion. The second problem is the measurement. If we take the standard as fixed, the level of deviance can only be determined by subjective measurement. On the basis of considerations of this kind several researchers just as Maynes (1976) think that quality cannot be objectively measured.

As it was mentioned before, the individual evaluation of quality occurs in a comparative context. The range of compared products and services are usually restricted to those units, which are in the consumer's evoked set, so which are – according to the consumer's evaluation – appropriate to fulfill the same task (Ong, 1999). The consumer evaluates the product by comparing it to all the other products or services which are likely to be substitutes of it. Afterwards, he does the ranking, whereby the relative position of a product is the indicator of its quality. However, it is important to note, that the consumer's evoked set never contains the same items as the one of the producer or provider of service.

## **2.1. Abstractions**

Consumers store product information on different levels of of abstraction (Cohen, 1979, Olson and Reynolds, 1983). On the lowest abstraction level, there is a single attribute, and on the highest level, there is the overall evaluation about the value that the product has for the particular consumer. Early models considered quality as a lower-level attribute, so assumed that a product is characterized by its quality as well as by its color, size or weight. After the article of Ahtola (1984) quality is considered to be a high abstraction-level attribute, because the overall evaluation of a product or service is a result of numerous lower-level characteristics: internal and external attributes.

Internal attributes refer to the content of the product or service. If internal attributes change, the product will change, too. If one consumes the product, it consumes the internal attributes. This way, a university is characterized by its courses, lecturers, or the degree students can have.

External attributes – even if they are connected to the product – are not parts of it, they just give an appearance. In the case of a college, its external attributes are the building, the logo or the press advertisements.

## 2.2. Internal attributes

Internal attributes are product-specific. Moreover, within the same product line, the same attribute might give different results concerning quality. So not only plumbing and higher education are evaluated based on different attributes, but similar services, like a college and a university is evaluated differently, using the same attribute, just like the practical skills delivered<sup>1</sup>.

While characteristics, which lead us to the image of high quality, are product-specific, the higher-level attributes of quality are to be generalized more easily. This explains the phenomenon, when a consumer can compare products and services, which hardly have any common characteristics, which the decision could be based on. When the consumer decides between the options of going to the university directly after secondary school or having a year out in the US, working as a babysitter, the decision is not based on particular characteristics but – working on a higher abstraction-level – the overall evaluation of the usefulness of both options. According to Johnson (1983), consumers do not store sets of individual characteristics in their mind, but rather images of high-level abstractions. It has several advantages. This practice uses less of the scarce information processing resources than storing every single product characteristic. Moreover, it enables the comparison of alternatives with different attribute sets. And finally, at a higher abstraction level, the decision-making process runs faster. Unfortunately, higher abstraction means loss of information, increasing the probability of wrong decisions.

Olson (1979) concludes that consumers can have inferences that are not directly supported by attributes, but their final choices are based on them. These inferences can be either descriptive or inductive.

Descriptive inferences mean the higher-level interpretation of the original information. Objectively described characteristic of a university, just like the number of publications gives a clue about how “recognized” the university is. The university, being “recognized”, is a very abstract notion and a subjective one as well, because there is no common standard for categorization, so everybody can have a different image about it. Moreover, it is not clear either, what kind of connection is between the two attributes.

Inductive inferences are for compensating missing pieces of information, using existing data. This method has little objective base either, for the relationship between the existing and the missing piece of information is mostly not evident, but it is rather based on individual experiences.

## 3. Quality and higher education

It is not difficult to recognize that when we are generally speaking about the quality of higher education, more of Garvin’s approaches are applied at the same time.

Universities, especially those with a long history tend to use the transcendent approach, saying that the institution is a famous, recognized one, regardless of the statement being true or not, or whatever these notions precisely mean.

Product-based approach is also very common, saying, that the graduates of a particular university are successful at any part of the life.

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<sup>1</sup> Colleges generally provide more practical skills than universities, so they are expected to do so by students as well. Sometimes universities face the criticism of being too much theory-oriented and providing too little practical knowledge, but there is a consensus that delivering practical skills is not what universities are for.

The most common approach that is applied in connection with higher education is the production-based approach, whereby the quality level of service is determined by the conformance to some previously set standards, just as the number of professors, the amount and ranking of published studies, or the content of programs. It is not difficult to recognize, that the accreditation system of several countries, including Hungary and Poland is based on this approach.

The user-based approach is becoming increasingly popular. More and more higher education institutions pay attention to the opinion of the students, and the prospective employers.

The value-based approach is not widely applied yet, although we can assume that in the future it will gain importance, mainly due to the increment in the number of enrolled students.

Whatever characteristics the quality assurance systems focus on, they all use different groups of indicators and standards. According to Kaiser (2003), the main difference between the two notions is that standards usually set a benchmark, to which the actual value of the indicator can be compared to. In the case of quality assurance systems, standards are the lowest level of a particular indicator that is still acceptable. In this sense, the presence of standards in quality assurance system means a serious limitation during the evaluation of the institute's performance. For quality assurance systems are considered to be static as well, only a few standards are used. But there are other problems, too.

Quality as we could observe, is a very subjective phenomenon, depending very much on individual evaluations. Moreover, quality is linked to several other factors as well: first, with the goals of the institution or program, second, with the prior expectations of consumers and other stakeholders. There are implicit means, by which it is possible to estimate how much the observed institution meets the requirements: the educational quality of a university can be labeled as "sufficient", "good" or "excellent". The overall evaluation is a result of aggregating individual opinions which are always subjective. A positive feedback means a conviction that according to the given qualitative and quantitative data, the university is likely to deliver proper quality, while a negative feedback means that this likelihood is low. It is to observe that in neither case is the answer a clear yes or no. The only outcome is that the evaluating board considers one case to be more likely than the other.

There are two other problems with quality assurance systems as well. First, many quality factors are only measurable quantitatively. The educational performance of a lecturer is only measurable by the grades of the students, or may be by a quantitative survey conducted among them. Second, only those factors can be included into any quality assurance system that are measurable quantitatively. But quantification always results in data loss, so objectivity questions arise again (Segers – Dochy, 1996).

In the following section I will demonstrate the limitations of the most common quality assurance approaches. Each approach focuses on a different group of indicators. First, there are approaches that are similar to Garvin's production-based approach that focuses on pre-set standards of several indicators. These are the currently used quality assurance systems. Second, there are approaches that are similar to Garvin's user-based one, that focus on the consumer, namely the students. These approaches define quality education as education that results in the highest student satisfaction possible. Third, there are approaches, which are similar to Garvin's product-based one that focus on the output, namely what knowledge and skills the graduates have and how easily they can be adapted to the ever-changing expectations of the private sector.

### 3.1. Standards and indicators as quality clues

As mentioned before, there is a vast amount of models and approaches which state that conformance to several pre-set standards is the prerequisite of delivering quality education.<sup>2</sup> Most countries' higher education quality assurance systems are based on this concept. It is no wonder, since these indicators are mostly relatively easy to measure, easy to quantify, and are mostly present at any of the higher education institutions.

The use of **financial indicators** in quality assurance systems assumes that higher financial input will evidently result in higher quality. The link definitely exists, though there are some limitations. First, the use of resources must be measured in the same way in every case. Second, the quality generated by the inputs is influenced by the type of education. Third, when doing international comparisons, the compared states have to be approximately equally developed. Fourth, it is a common tendency that financial data (which are easy to obtain) are used for estimating other attributes, even if they have nothing to do with finance. These inductive inferences are obviously imprecise, because the link between the amount of money spent on building maintenance and lecturers' salaries, and student satisfaction is not evident. Fifth, the financial data, compared to the number of enrolled students can also lead to misinterpretations. Due to the ever shorter educational programs (1-2 years) there are more students at a university at the same time than in a traditional education structure (Chevaillier, 2003, pp 107-108).

The use of **input indicators** in quality assurance systems assumes that a certain input structure and level is needed in order to provide quality education, and the better value these indicators have, the higher the educational quality will be. Generally used indicators are the number of students compared to the number of lecturers, or the number of students compared to the number of computers. One of the big disadvantages of these indicators is the possibility of multiple interpretations. A guest lecturer, who shares a computer with a colleague, can be taken into account when it is about the number of lecturers compared to the number of students, but can be neglected, when it is about the number of computers compared to the number of lecturers. Unfortunately, institutions have a drive to be opportunistic, for it is not easy to prove the cheat.

The use of **internal efficiency indicators** in quality assurance systems assumes that institutions that educate many students at a high quality level are efficient. For measuring efficiency, generally the average length of the study, the rate of attrition (the number of dropped out students compared to the number of enrolled students), or the rate of graduation (the number of graduating students compared to the number of enrolled students) are taken into account. It is not clear, however, what the indicators actually mean for the quality of education. High attrition rate can either be the sign of low educational quality which does not enable the proper preparation on examinations, or the sign of an "elite" university, where only a few students are able to fulfill the high requirements. Graduation rate can also be interpreted in different ways. If most of the enrolled students graduate, it does not necessarily mean that the education is of high quality; it is also possible, that the requirements are so low that everybody can fulfill them.

The use of **external efficiency indicators** in quality assurance systems assumes that higher education institutions that release graduates who get a job quickly after graduating provide education of higher quality. For measuring external efficiency, generally the

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<sup>2</sup> Chevaillier (2003) gives an excellent overview about the models and the indicators used in them.

unemployment rate of graduates, the rate of graduates who get a job below their qualification, and the length of work search from the date of graduation are taken into account. No doubt, the choice of indicators has some rational aspects. But it is important to know that all these factors are influenced by the general economic environment. During a recession, even the graduates of the best universities have difficulties to find a job. Or even if they do, many of them will only work below its original qualification. So these indicators cannot be interpreted on their own either, the broader context must be taken into account too.

### **3.2. Student satisfaction as quality clue**

In many higher education quality assurance systems student satisfaction has an important role in determining the educational quality of an institution. No doubt, there is some logical consideration behind this approach. In a college, where the quality of education is high, students should be more likely to be satisfied than in a college where education is of low quality. Many surveys have been conducted to find out what students want so that the institution can give it to them and by doing so, can gain competitive advantage. The reasons of the popularity of this approach are understandable. As more and more students enter the higher education system, the tuition paid by them – either by themselves or by the state – becomes more and more important to the financial equilibrium of the universities. The students have to be lured to the institution, by whatever means. But is the student satisfaction really the most important goal for a higher education institution? The question is not as trivial as it might seem to be.

First, according to Johnson (1983) students are likely to be unable to mention the real factors of their satisfaction or dissatisfaction, because of the high abstraction level, by which they store their overall assessments. It means that even if the institution will have an idea about the students' overall evaluation about the quality of education, it is unlikely that it will learn the real factors that cause dissatisfaction or satisfaction.

Second, students' time horizon at the moment of the survey is very often too narrow for their preferences being applicable to the institution. If we ask a student, what kind of university he or she wants to go to, the answer will likely be: "easy exams", "kind teachers with low requirements" or "no obligatory classes". This is what the institution will learn from the survey. But students' time horizon is generally broader than the one mentioned above, so when deciding for an institution after finishing secondary school, they have more conservative preferences.<sup>3</sup> All in all, most students would never go to the school of their dreams, and if we create the college of their dreams, we'll run out of students very soon...

Third, higher education institutions have other needs to satisfy as the needs of students. It is responsible to the parents, the academic and private sector, and the whole society as well (Little, 2001). Focusing only on one of these, namely the students, will return the universities into the ivory tower, and it will evidently lead to serious problems, soonest on the labor market.

### **3.3. Employability as quality clue**

To avoid the alienation of higher education from the private sector, employment considerations must be taken into account, too. One of the most promising approaches is

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<sup>3</sup> Based on the survey on student preferences conducted at the University of Debrecen Faculty of Economics and Business Administration in December 2006.

the introduction of employability into quality assurance.

There is no common definition for employability. It is not the same as employment rate (which is the number of employed students compared to the number of graduated students). According to the most widely used definition, employability is the possibility by which a graduate student can find a job (Harvey, 1990). This definition can be interpreted in several ways. It is not clear for example, what gives this probability. According to the most common view, it is the result of the student's characteristics and abilities which help to get a job and to remain in it. Knight and Yorke (2003) concluded that employability has four main components: professional knowledge, abilities, self-consciousness and self-esteem, and the ability and willingness to think strategically.

The concept of employability raised many questions. Morley (2001) thinks that it is not obvious that the university should give up its traditional role – the provider of knowledge – and focus rather on labor market expectations. If it does, it might easily lose not only its focus but also its reputation.

#### **4. Scholarship Attribution Model as a Contribution to Enhancement of Higher Education Quality**

Together with educational funding, scholarships constitute important pillars of higher education systems. Although their role is far more important in countries where higher education fees have to be entirely covered by the applicant (i.e. USA), also countries with public financing of higher education (i.e. Hungary, Poland) deal with multiple problems related to scholarship attribution issues. In a reality of limited funding sources the question “who should benefit from scholarships” preoccupies the decision makers. Being more precise, this problem can be divided into following issues:

1. Should we attribute higher scholarships to fewer beneficiaries or lower the amount of money spent per person in order to allow more applicants to benefit of the system? This problem shows the very substance of the matter. In a situation of limited resources there will always be people who will not fall out of the scope. The question is whether to allow less people study at better and therefore more expensive university programs or whether to enhance the overall number of students, education quality being a secondary issue.
2. From efficiency point of view the optimal option definitely remains an individual examination of each application, but we have to remember that efficiency is not the only factor. Such criteria as the fulfillment of national educational goals, social impact of scholarship attribution policy and recurrence of the method in different application cases remain important as well.
3. How to choose from a big number of applicants those most eligible for funding?

The answers for above mentioned issues will contribute to a creation of a decision making model allowing providing a stable framework for scholarship attribution purposes. At the same time they provide the ground for alternatives in decision making model in construction.

##### **4.1 Methodology - the Analytic Hierarchy Process**

The Analytic Hierarchy Process (AHP) is a decision making tool that could possibly help finding and answer for the above or – at least – allow creating a Scholarship Attribution Model. The positives of having a system instead of subjectively biased decision

makers are multiple. First of all, a model provides transparent rules for applicants. Therefore they obtain clear information about the expectations from founder's side. Moreover, clear frames and a transparent method lower automatically the number of appeals of rejected applicants. By using the model, decision makers can also justify already granted scholarships and reject possible fraud accusations by showing the conformity of their decisions with pre – adopted criteria.

When building decision making models, the application of AHP method seems to be the most appropriate at complex multicriteria decision making problems. A certain hierarchy and structure of decision making criteria is required. Additionally, upper hierarchy elements cannot interact with nor influence the lower hierarchy elements (Saaty 2001). The AHP method consists of pair – wise comparisons (evaluations) of suitability of criteria determining the decision making environment (in our case national higher education system) for possibly optimal scholarship attribution between the applicants. Expert evaluations are obtained from professionals specialized in higher education issues.

In our case the main purpose of decision making model construction is to obtain a possibly optimal resource allocation when attributing scholarships to applicants. This constitutes also the main goal of the model in question.

#### **4.2 Decision making criteria**

The decision making criteria for fair scholarship attribution have been divided into three groups, all of which contribute to the achievement of the main decision making goal, which is “Possibly Optimal Resource Allocation at Scholarship Attribution”. The groups in question are: Application Quality, Decision Making Efficiency and Applicant's Socio – Economic Eligibility. Each of criteria groups is composed of various sub – criteria. A brief description of each of them will be provided below

1. Application Quality is a set of criteria related to the documents handed out by the applicant when presenting his/her candidature for a scholarship beneficiary. The analysis of this group of criteria should bring detailed information about the following sub – criteria:

- a) Applicant's Motivation – an analysis of applicant's CV and motivation letter can provide some information about the reasons for which the application has been presented. At times where hundreds of standard motivation letters and CV's are available online one should probably pay more attention to the consistency of presented documents with the funding in question;
- b) Applicant's Personality – a direct interview with the applicant is the best tool to provide the decision makers with information about his/her attitude towards using the scholarship in conformity to founder's expectations;
- c) Extra - curricular Activities – this criterion shows applicant's engagement in non – compulsory activities bringing very useful on – field experience. Special focus should be put on applicant's research related Non – Governmental Organizations and Volunteering Programs;
- d) Grades & Averages – approved data from college and educational institutions can say a lot about former study path of the applicant. Due to disproportions in educational standards, one needs to take into account the rank of data providing institution as well;
- e) References – internal and external references usually provide the founder with a person who possibly could confirm the virtues of the applicant in a direct conversation. This can be a valuable tool for checking the credibility of the data

- presented by the applicant;
- f) Scientific Research & Study Plan are parts of Application Quality evaluation that provide information about the future plans of the applicant, namely on what exactly the scholarship funding will be spent. Very useful criterion for research oriented institutions; it helps them to extract applicants close to their core areas of interest.
2. Decision Making Efficiency points out at the opposite pole of the decision making model in construction, which is the decision maker's side. Simplicity of use and ease of application are very important values for model applicants, both institutional and private. This group is composed of the following sub – criteria:
- a) Decision Making Time is always an issue in decision making processes. Many argue that a pressure of time is a threat to decision making quality, although it is a criterion not to be neglected, especially in institutions that receive a big number of funding requests;
  - b) Fulfillment of National Educational Goals – most funding will offer the applicants an opportunity to develop their research potential at some institution that acts in conformity with National Educational or Research Goals. In case of public institutions this will come from their statutory obligations, in case of private ones – from market demand. Therefore founders will probably need to pay some attention to proposed dominants of regional or national scientific research;
  - c) Recurrence of the Method – one of the qualities of a good decision making model is the possibility of its adaptation to particular decision making processes. This also helps to obtain a certain level of consistency in different funding areas, which allows the decision makers to compare the results of their efforts through various funding programs;
  - d) Social Impact of Scholarship Attribution Policy – a criterion providing information about how the attribution of a scholarship to a certain person or a group of people falls into the scope of social needs of beneficiary society. By maintaining this criterion at a higher level some added value and a positive spill – off effect can be obtained.
3. Last group speaks of Applicant's Socio – Economic Eligibility, which will provide information about applicant's factual economic eligibility for obtaining funds for education. The group is also built of some social factors which could contribute to lowering of disproportions in the division of welfare in the society in question. The group is formed from following sub – criteria:
- a) Conformity of Study Plan with Market Demand / Society Needs – shows whether the applicant's research ideas are anyhow requested by the market or society. We warn future model applicants not to fall into a trap of searching for evaluations of this criterion in the free market only. Therefore the second part – society needs – has been added;
  - b) Eligibility for Other Funding Sources – sometimes other funding sources suit applicant's requests better than the fund in question. In some cases it is also possible for the applicant to have access to funds with lower acceptance barriers. In such cases, if identified early enough, more applications can be evaluated positively because of lowering competition for this one precise fund;
  - c) Environmental Interviews – Local Government Agents can provide the decision maker with important data about social background of the applicant. This can help fulfilling another funding goal which could be lowering the disproportions in

- accession to higher education for young people from defavorised neighborhoods;
- d) Applicant's Parent's Income – applicant parent's tax declarations provide basic information about the income per capita in potential beneficiary's family. There is no need to say that in developed societies sufficient income levels at applicant's family side are a serious argument against granting funding. Nevertheless it should not be the only criterion taken into account when accepting or rejecting funding requests;
  - e) Willingness to Sign a Reimbursement Contract in order to assure funding sustainability in the future. This criterion answers the question whether the potential beneficiary would like to contribute to further maintenance of appropriate funding levels for future applicants. Sustainability becomes a key issue in many funding programs especially in European public sector.

The model has an open construction, which means that – if needed – additional criteria and sub – criteria can be added prior to expert evaluations.

### 4.3 Alternative solutions

Expert evaluations obtained from AHP pair – wise comparison process allow the decision maker to choose from a set of alternative solutions. The optimal alternative choice means that the alternative in question is relatively the closest to all model requirements at once. In other words – it is consistent with the biggest number of pre – adopted criteria at appropriate relevance levels. If i.e. *Eligibility for Other Funding Sources* criterion was evaluated as relatively relevant, but a little less relevant as *Social Impact of Scholarship Attribution Policy* criterion, the possibly optimal alternative solution will not only be conform to both criteria, but also will be a resultant of mentioned relevance hierarchy.

The three problems mentioned at the beginning of the present chapter incorporate the decision alternatives for the Scholarship Attribution Model in construction. Therefore the decision maker will be able to choose from three possible alternative solutions.

1. More beneficiaries, lower per capita funding is a situation when the fund is being divided between a larger group of people which will result in lower funding levels for particular persons.
2. Less beneficiaries, higher per capita funding is the opposite of first solution. Fewer beneficiaries enjoy higher funding levels which allow them to pursue more complex research actions
3. Individual decision in each case seems to be an optimal solution, but in many cases impossible to apply due to time limits, founder's preference towards structured decision making, threat of personal bias of decision makers or decision justification needs.

We have to add that initially all of the proposed decisions are completely equal and none of them is encumbered with any decision maker's preferences. Only the application of the model can give the decision makers an idea about the relevance of each alternative solution in relation to funding institution's statutory goals.

Another possibility of alternative solutions could be application rejection and application acceptance. In this case the model would become a direct tool for particular application assessment. In the presented study authors' ambition is to create a systemic solution, with a larger scope of interest than individual case assessment.

Similarly to decision making criteria, the set of alternative solutions does not have to be the final one. Another decision making alternatives can be added when needed.

Nevertheless we would like to caution the readers against expanding to much the assemblage of alternatives. A bigger number of alternative solutions do not necessarily assure higher decision making quality. It can result even in opposite – in obscuring the obtained results. Therefore we would recommend a high level of consciousness when multiplying the alternatives. It is also necessary to underline that each alternative has to differ significantly from the rest.

#### 4.4 Scholarship Attribution Model

The projected Scholarship Attribution Model (SAM) is a symbolic mathematical decision – making model. Ogryczak (2006) states that this kind of decision making models is composed of a factual sub – model and a preference sub – model. The first one represents all the interdependencies occurring in the decision problem’s environment, whereas the second is being created through AHP expert evaluations which finally lead to the selection of one of the decision alternatives. For a step – by – step process of model designing please refer to Gawlik (2010). In the present paper we will limit ourselves to identification of most important components of the model in question.

Model components can be divided into three groups: First of them consists of parameters external to the model itself, coming mainly from the decision making environment. Those parameters can be both of deterministic and probabilistic nature. The second group is composed of decision variables, namely the possible alternative solutions. The last group is built of variables of state, which attribute particular relevance weights to each of the decision alternatives from the second group. Only a full analysis, including the attribution of weights to each of the criteria can result in effective decision making (choosing one from the existing alternatives).

In our case the model components can be defined in the following way:

1. External parameters:

- a) Deterministic:  $A = \{a_i\}$ ,  $i = \{1, 2, \dots, 6\}$ ;  $B = \{b_l\}$ ,  $l = \{1, 2, \dots, 4\}$ ;  $C = \{c_m\}$ ,  $m = \{1, 2, \dots, 5\}$  – decision making criteria: determinants of Application Quality  $a_i$  (Applicant’s Motivation, Applicant’s Personality, Extra – curricular Activities, Grades & Averages, References, Scientific Research & Study Plan); determinants of the Decision Making Efficiency  $b_l$  (Decision Making Time, Fulfillment of National Educational Goals, Recurrence of the Method, Social Impact of Scholarship Attribution Policy); determinants of Applicant’s Socio – Economic Eligibility  $c_m$  (Conformity of Study Plan with Market Demand / Society Needs, Eligibility for Other Funding Sources, Environmental Interviews, Parent’s Income, Willingness to Sign a Reimbursement Contract)  $k$  – coefficient representing a general number of faulty funding decisions (% value that needs to be empirically stated);  $y_A, y_B, y_C$  – total number of funding decisions that could be taken only on basis of Application Quality ( $y_A$ ), Decision Making Efficiency ( $y_B$ ) and Applicant’s Socio – Economic Eligibility ( $y_C$ ).
- b) Probabilistic:  $d_A, d_B, d_C$  – external disturbances obscuring clear data overview coming from analyses of Application Quality, Decision Making Efficiency and Applicant’s Socio – Economic Eligibility (respectively).

2. Decision variables:  $X = \{x_j\}$ ,  $j = \{1, 2, 3\}$  – possible decision alternatives: more beneficiaries, lower per capita funding; less beneficiaries, higher per capita funding; individual decision in each case.

3. Variables of state:

- a) Main function:  $Y: y = f(x)$  – final effect of decision making, namely scholarship attribution decisions or more precisely an aggregation of all possible combinations of decision variables together with their weights.
- b) Main function's components:  $C_A, C_B, C_C$  – applications accepted after analysis of each of the criteria groups (respectively Application Quality, Decision Making Efficiency and Applicant's Socio – Economic Eligibility) that proved to be correct decisions;  $W_A, W_B, W_C$  – accepted applications that proved to be wrong decisions (*per analogiam*).

The dependencies between mentioned variables can take the form of functions and relations. A function describes a situation when a correct choice of weights of decision variables allows evaluating the relevance of external parameters and achieving an optimal decision – making level - optimum of state variables. Relations occur when values of some variables can be attributed to more than one variable or one set of group of variables. In such cases given variables can represent deterministic or probabilistic interdependencies.

The mathematical form of the Scholarship Attribution Model will be deducted below.

Eq. 1 describes a situation when a variable of state representing a scholarship attribution decision is a function of determinants of each of the three criteria groups (Application Quality, Decision Making Efficiency, Applicant's Socio – Economic Eligibility) and a proper evaluation of relevance of three decision alternatives, namely the weights of each of them (decision variables).

$$Y = y_A (C_A - W_A) + y_B (C_B - W_B) + y_C (C_C - W_C) \quad [\text{Eq. 1}]$$

Eq. 1 – a possibly optimal managerial decision is a sum of weights of all accepted funding applications that proved to be correct decisions ( $C_A$ ) minus all accepted funding applications that proved to be wrong decisions ( $W_A$ ) taken after the analysis of Application Quality determinants ( $.._A$ ) multiplied by the total number of funding decisions taken on basis of analysis of Application Quality determinants ( $y_A$ ) plus weights of all accepted funding applications that proved to be correct decisions ( $C_B$ ) minus all accepted funding applications that proved to be wrong decisions ( $W_B$ ) taken after the analysis of Decision Making Efficiency determinants ( $.._B$ ) multiplied by the total number of funding decisions taken on basis of analysis of Decision Making Efficiency determinants ( $y_B$ ) plus weights of all accepted funding applications that proved to be correct decisions ( $C_C$ ) minus all accepted funding applications that proved to be wrong decisions ( $W_C$ ) taken after the analysis of Applicant's Socio – Economic Eligibility determinants ( $.._C$ ) multiplied by the total number of funding decisions taken on basis of analysis of Applicant's Socio – Economic Eligibility determinants ( $y_C$ ). The weights can be obtained in a qualitative - to - quantitative transposition process through application of AHP method.

$$C_A = \sum_{i,j=1}^n a_{ij} x_j, \text{ where } i = \{1, 2, \dots, 6\}, j = \{1, 2, 3\} \quad [\text{Eq. 2}]$$

Eq. 2. – acceptance of an application taken on basis of Application Quality analysis ( $C_A$ ) that proves to be correct is a sum of weights of all arithmetic products of determinants of Application Quality (external parameters  $a_{ij}$ ) and weights of particular alternative solutions (decision variables  $x_j$ ).

$$W_A = k d_A \quad [\text{Eq. 3}]$$

Eq. 3. – acceptance of an application taken on basis of Application Quality analysis ( $W_A$ ) that proves to be correct is the effect of a random external disturbance coming from this environment ( $d_A$ , i.e. lying in the CV or not being frank in the motivation letter)

augmented by an empirically determined coefficient  $k$  representing a general number of faulty funding decisions. Occurrence of disturbance cannot be foreseen due to its probabilistic nature.

Equations for Decision Making Efficiency and Applicant's Socio – Economic Eligibility can be deducted *per analogiam* and take the following form:

$$C_B = \sum_{l,j=1}^n b_{lj} x_j, \text{ where } l = \{1,2,\dots,4\}, j = \{1,2,3\} \quad [\text{Eq. 4}]$$

$$W_B = k d_B \quad [\text{Eq. 5}]$$

$$C_C = \sum_{m,j=1}^n c_{mj} x_j, \text{ where } m = \{1,2,\dots,5\}, j = \{1,2,3\} \quad [\text{Eq. 6}]$$

$$W_C = k d_C \quad [\text{Eq. 7}]$$

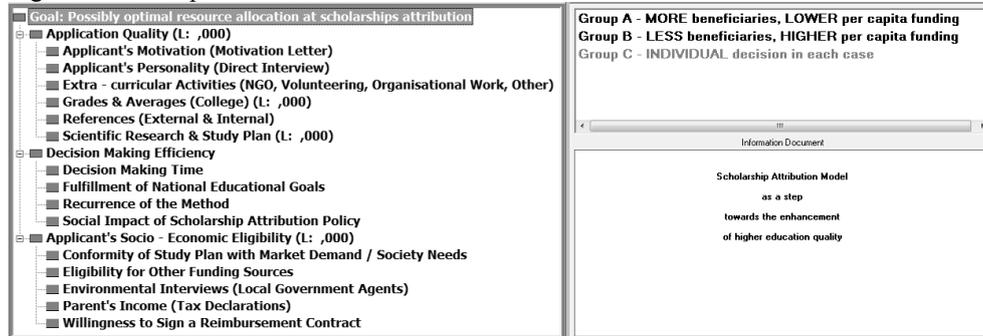
Finally, the mathematical notation of the Scholarship Attribution Model takes the following form:

$$Y = y_A \left( \sum_{i,j=1}^n a_{ij} x_j - k d_A \right) + y_B \left( \sum_{l,j=1}^n b_{lj} x_j - k d_B \right) + y_C \left( \sum_{m,j=1}^n c_{mj} x_j - k d_C \right)$$

$$\text{where } i = \{1,2,\dots,6\}; l = \{1,2,\dots,4\}; m = \{1,2,\dots,5\}; j = \{1,2,3\} \quad [\text{Eq. 8}]$$

A ready – to – use graphical version of the model above, elaborated in *Expert Choice* software, can be found on Fig. 1 below:

Fig. 1 Scholarship Attribution Model



Source: Own elaboration based on Saaty (2001) presented in Expert Choice Software, ver. 11,1,3805

Please note that the figure above is a raw visualization of the SAM without preference statements. Those will be attributed through expert evaluations in AHP pair – wise comparison process with use of the *Expert Choice* software. Expert evaluation results will be published in the future in a separate article.

## 5. Concluding remarks

In the 21st century, there is no doubt about the importance of quality in higher education. It became not only the means of competition, but a widely used buzzword, that

can be used for every purpose according to the user's needs.

First, it is essential to understand what quality means. It is not an easy task, because there are many definitions and interpretations. That's one beautiful thing about quality: should we choose any of these interpretations, to some extent we are right. But we must also be aware of the limitations, our chosen interpretation means to us.

Besides, we must be aware of the limitations that the notion of quality means to the human information processing, and vice versa; if we do not take into consideration our own limits in dealing with quality, we will commit serious faults, which will evidently lead to wrong conclusions.

We must also be aware of the fact that higher education is a very special kind of service, which cannot be analyzed with the tools of quality without any limitations. The multiple consumer side of higher education leads to serious contradictions not only on the level of goals but also on the level of basic principles, just like what are universities for?

Any approach of quality assurance we choose, we must not ever be that confident as to forget that our system will never be objective – mainly due to human reasons – so every result we get requires further consideration.

If we will be all aware of the numerous interdependent limitations in the higher education quality assurance, may be, one day the notion of quality will be used with much more precaution, than it is used today.

The proposed Scholarship Attribution Model could be an appropriate tool to enhance decision making processes when distributing scholarships between large numbers of applicants.

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