ECAT 2001, Helsinki 6 September 2001
Hans-Diedrich Kreft

How to measure human potential and how to use it on smartcards

Historical remarks:
A first version of the topic has been given to the society for mathematics and data processing, Germany Darmstadt on 6. 2. 01 (see [4]).

The Demo-Software which has been used during the lecture for producing the screen shots has been presented to industrial companies on CeBIT 2001, 22.03. – 28.03.2001, Hannover, Hall 23, stand C27. The demo software is contained on a CD attached to the book:

"Das Humanpotential"
ISBN 3-897-142-X
VWF Verlag für Wissenschaft und Forschung GmbH
Postfach 30 40 51
D-10725 BERLIN
Tel. 030-789585-45 – Fax 030-789585-49
www.vwf.de

see also

www.Hans-Dietrich-Kreft.de

Address for further information:
VisionPatents AG
Ecksweg 4
21251 Dassendorf
Tel. 04104 97 0; fax 04104 97 10 99
Office@VisionPatents.com

Literature on the subject by the same author see references page 16.

How to measure human potential and how to use it on smartcards

Contents

Introduction

The focus here is on the measure of human skills and abilities and how it can be used in corporate analysis. I will explain how a measure of skills and abilities – the human potential – can be stored on smart-cards. The practical application of the results to corporate analysis is dealt with and the social insights briefly outlined. For a detailed analysis of the subject see the book ([1]).

Let me begin with a small, humorous anecdote. After many years of work, I proudly named my latest work "Humatics" in an attempt to indicate that it refers to a combination of theoretical physics and theoretical economics on a mathematical basis. It was only finished and I sent it to some – as I believed – competent professors of economics. I received the following letter from one of them: "Dear Mr. Kreft," – the friendly opening by the otherwise unknown professor made me optimistic – "I regret to inform you that I am involved in the field of economics and know nothing about heating systems…". So you know the reason why I renamed "thermoeconomics" into "humatics" which is a composition of "humanism" and "mathematics".

This article, of course, has nothing to do with heating technology but concerns how knowledge can be made measureable and how it can be stored on chip cards in a form safe for humans.

And as could be expected from an inventor, the following provides a glance at a future card application. I believe that we have reached the

same stage with this application as we were at in 1995 with the Comb-iCard (dual interface card).

Human potential H causes economic success

In the following slide it is shown how the success of a company depends on the skills and abilities of its employees.

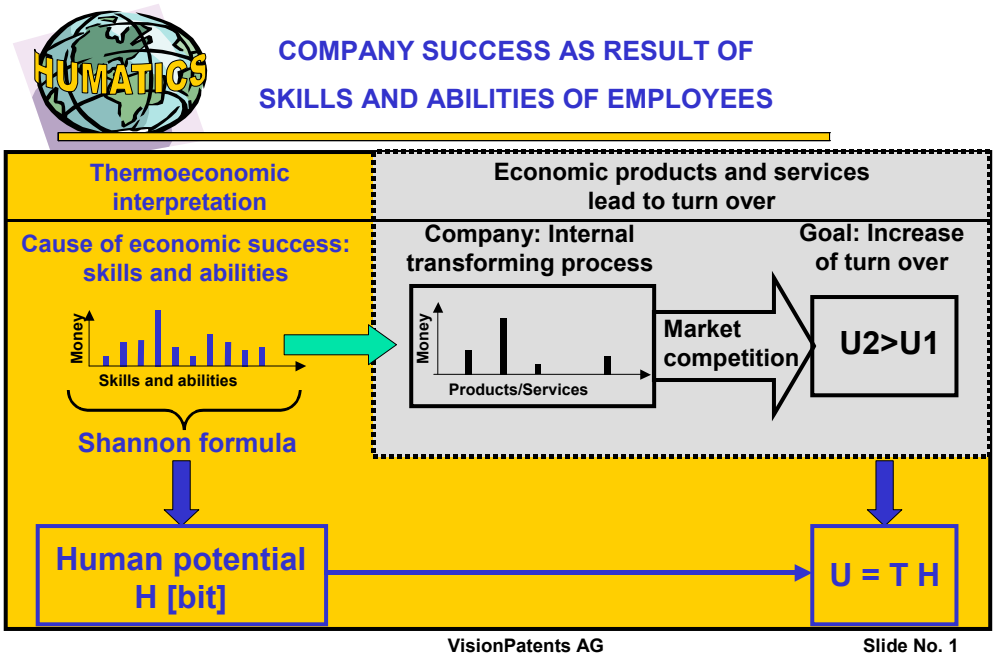


Figure 1: Economic success dependent from skills and abilities

The coloured square on the top right symbolises how the various products and services of a company (represented in a bar chart) have to assert themselves on a competitive market to generate turnover. The thermoeconomic description also includes the workers with their skills and abilities (complete square). This happens as follows: from the bar chart of the evaluated skills and abilities of the workers (referred to as the Q-distribution and shown on the left in Figure 1) a mathematical method can be used (the Shannon formula) to calculate a very characteristic value – the human potential H. H represents a value measured in the units [bit] which stands for the knowledge, the skills and abilities of workers and, of course, of people in general. This value is used to complement conventional company controlling methods and provides completely new insights into economic interactions. This is to be explained in detail in the following.

Q-Distributions

Companies recruit their needed staff in accordance with the required skills and abilities and companies put a value on the skills and abilities in the form of wages, salaries. This already happens in market economies at every job interview. So we can set up the mentioned Q-Distribution by putting for any employee all his/her skills to the X-Axis and add at the Y-Axis the money value which depends from the wages, salaries which are paid for the skills and abilities. Thus the value of skills and abilities can, in principle, be determined by supply and demand (similar to stock exchange prices for companies).

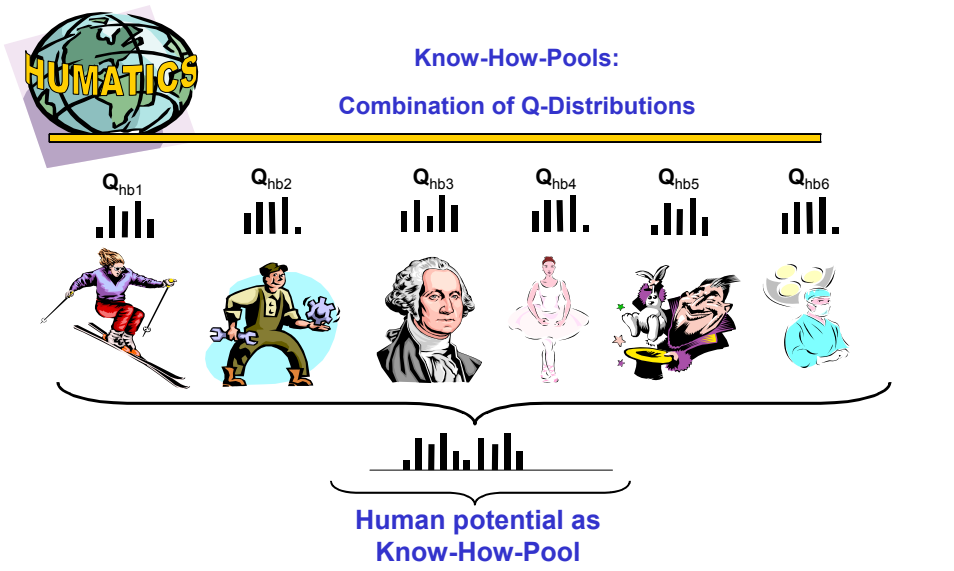


Figure 2: Q-Distributions of human beings

On Figure 2 we see these six different people over each of which there is a symbolical mathematical object, an economic distribution. Figure 2 symbolises the fact that human potentials of individual persons can be added. Know-how pools can be formed in this way. This is the case, for example, in companies or in musical orchestras or football teams.

So, Q-distributions of people clearly contain their evaluated skills and abilities, i.e. their evaluated economic knowledge. Now the task is to derive from these Q-distributions a measurement value which covers knowledge characteristics. This is done using the Shannon Formula (see [2], [3], [4]), as used in communications theory to determine quantities of information measured in bit units). This formula is actually identical to the Boltzmann Formula for the determination of entropy

and forms the basis of the second thermodynamic principle, one of the most important universally applicable physical laws.

If the Shannon Formula (see formula Figure 3 above) is applied to Q-distributions, the result is a value H in bit units, which we refer to as human potential.

For interpretation purposes it is best to use the Shannon Formula in the form: $H = \kappa * ld Ł$. Ł is the number of skills and abilities in the Q-distribution (i.e. the length of the X-axis). This length Ł of the Q-distribution is referred to as the knowledge base of a human being. The value κ (small kappa) is referred to as evenness. Many characteristics of Q-distributions can be determined using knowledge base Ł and evenness κ.

It must suffice here to state the human potential for just a few characteristics of Q-distributions.

High evenness of knowledge

Figure 3 first shows a Q-distribution (upper left distribution) where the money values of the listed skills and abilities are equal, i.e. the individual has no preferences for particular skills and abilities. The mathematical analysis shows that in this case $H_{max} = H = ld Ł$ applies. This result can be interpreted as follows: equally distributed skills result in the highest value for human potential H. This means that the individual has a large, but as yet unspecified development potential of his skills and abilities. This represents a high value for human potential. However, it is not yet clear what the individual is particularly good at, which is characterised by the high evenness.

Another value which is extremely fundamental and new for societies can also be derived from Q-distributions: the distribution temperature T. If we divide the sum of the money values of a distribution M by the value of its human potential H we get $T = M / H$. For the above case of an equal distribution, M is divided by the highest possible value H_{max}, i.e. we receive the smallest possible distribution temperature: $T_{min} = M / H_{max}$ (Figure 3, top right box). This result can be interpreted as follows: if an individual has no preferences, his development potential is high while his distribution temperature is at freezing point. The individual is not managing to derive a particularly high value from his skills and abilities.

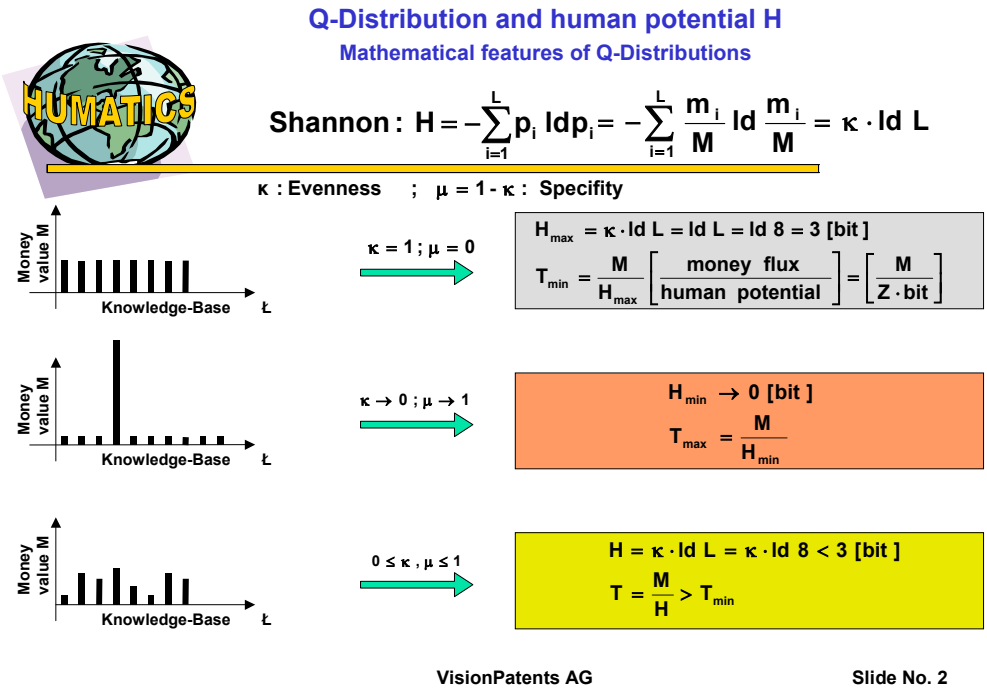


Figure 3: Human potential H of different Q-distributions

In the case of equally evaluated skills and abilities the values of the evenness is $\kappa = 1$. If we form the value $\mu = 1 - \kappa$ (μ: small mu) then $\mu = 1 - 1 = 0$. The value μ is referred to as specificity. Now we can say: an equally distributed Q-distribution provides the highest evenness and the lowest specificity. This corresponds to our normal perception. If someone has a series of skills and abilities which can be equally evaluated, then no specificity is apparent for any particular skill or ability.

High specificity of knowledge

Let us now take a look at the other extreme case where an individual has one particularly highly evaluated skill while the others have a low evaluation. Obviously we can speak in this situation of a high specificity of knowledge. This is shown in Figure 3 in the middle box. For this case evenness κ will be very small (i.e. values near 0 are assumed) while the specificity μ will assume values near to 1. The human potential assumes very low values (with only a single verified skill we get H = 0!). If we take a top athlete as an example for this case, we will find that he will have difficulties achieving top performance in other areas such as music or management. These restrictions presumably apply to top managers just as to master craftsmen, musicians, i.e. for all top performers. Anyone capable of top performance will have problems increasing his knowledge base. This means: the development potential of this individual is very low and this is manifested accordingly in a

low human potential value. In all of these cases the distribution temperature assumes maximum values, i.e. the individual is deriving the best from his skills and abilities.

The values for the human potential of humans will be somewhere between these two extremes. Depending on the approximation to one or the other extreme, we can speak of higher specificity or higher evenness with the corresponding, characteristic temperature values.

Let me be perfectly honest: having spent many years working on the theory set out here, when I walk through the streets of a city I can practically see the many Q-distributions over the heads of the people passing, and I have a sense of the incredible amount of skills and abilities contained therein. And I have strong suspicion that only a fraction of this is being economically exploited. But more about that later when we differentiate between applicative and interpretative human potential.

Economic Success = Stability * Effectivity

If we apply mathematics uncompromisingly to the approaches set out above, we can derive the following formula which is extremely significant for companies: economic success δ is equal to the product of stability S by effectivity E (δ = S * E).

Let us look at Figure 4: the turnover U generated by a company depends ultimately on the skills and abilities of the employees. Only if the employees can create products and services which can assert themselves on the market against other products and services, will a company be successful and able to survive. Because of this reason we write U = T H. This means we put the turnover U in relation to the volume of human potential H. Thereby we get again our measure of an economic temperature T, which is now T = U / H.

I am leaving out some of the finer details here, as I think it is more important to concentrate on the basic principles. We now need to include at least two or three further new economic values to make the following presentation successful.

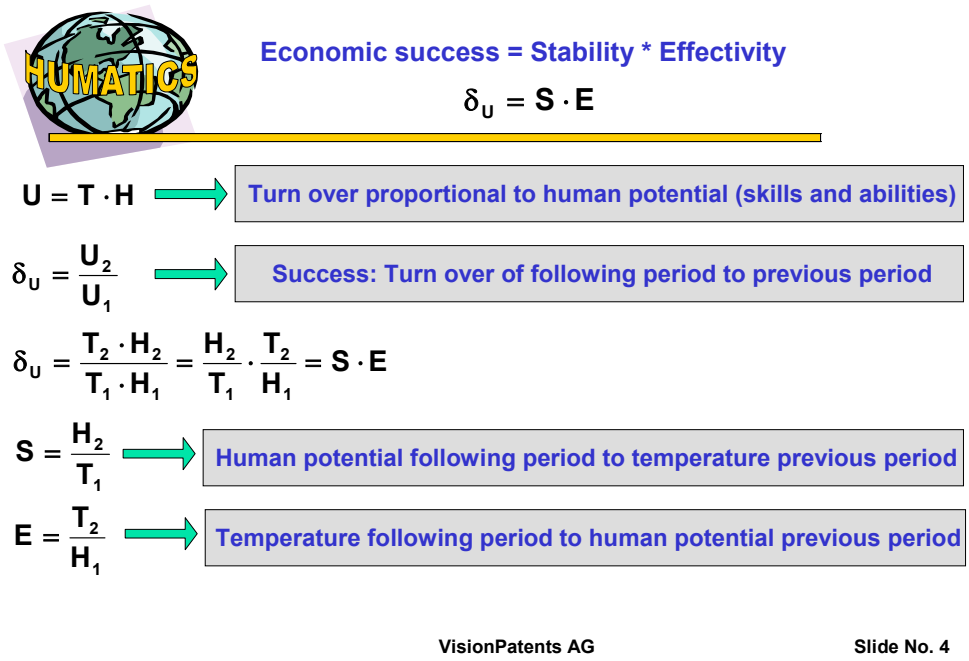


Figure 4: Derivation of stability S and effectivity E

A further value which we are going to demonstrate now is the economic stability S (Figure 4). Stability is the quantity of human potential H_2, available in the current economic period in relation to the temperature T_1 (i.e. competitiveness) of the previous period: $S = H_2 / T_1$. We can say: if a company in a subsequent period with the same competitive output has more skills and abilities (knowledge), the stability in relation to unforeseen competitive requirements must improve. The quotient T_2 / H_1 states the effectivity. If the temperature T_2 of a subsequent period with unchanged human potential H_1 of the subsequent period increases, more competitive success is being derived from the human potential of the staff, effectivity increases (see for example [5]).

Well that's enough theory. Let us look at how it works in practice.

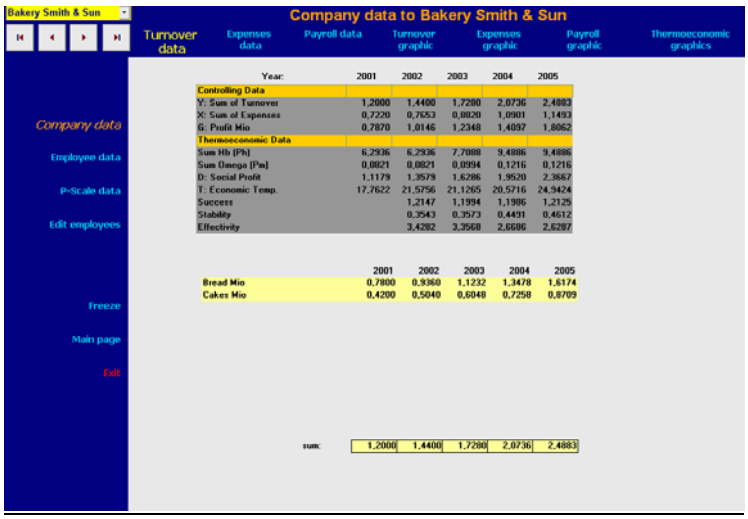
Here on the Smartcards (also known as dual interface cards) we have gathered the human potentials, i.e. the distributions of various individuals. Some of the data of a profit and loss account from companies are stored on the computer. We can now exchange the employees, i.e. their cards, between the individual companies and take a look at how, for example, success, stability, effectivity or temperature and human potential change in the companies.

Figure 5 shows some screenshots which give three examples for the application of the formula "economic success = stability x effectivity. The screenshots are taken from a program enclosed with the book

"Human Potential" (see [1]) and which can be run on every PC with Windows operating system (Windows 95 or higher).

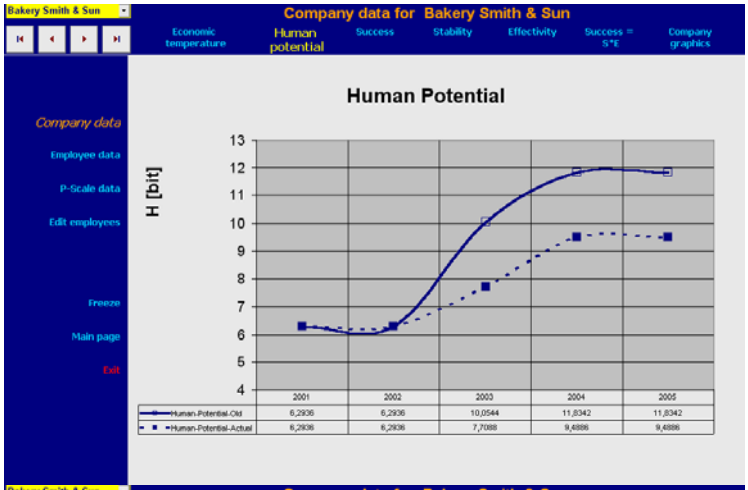
The screenshots Figure 5 show the profit and loss data from two companies (bakery and software company) over a period of 5 years. By changing the skills and abilities of the staff and by exchanging staff between the companies, it is possible to generate a wide range of changes in the composition of the human potential. The data for human potential and the data derived from this such as temperature, stability and effectivity can be combined with the well known data of company controlling. The graphs provide insights into what is happening in the companies which were hitherto unavailable using profit and loss data alone.

The mathematical interactions (economic success = stability x effectivity) make it clear which effects the alteration of human potential can have in companies. On this basis knowledge management may become a main goal of future management requirements.



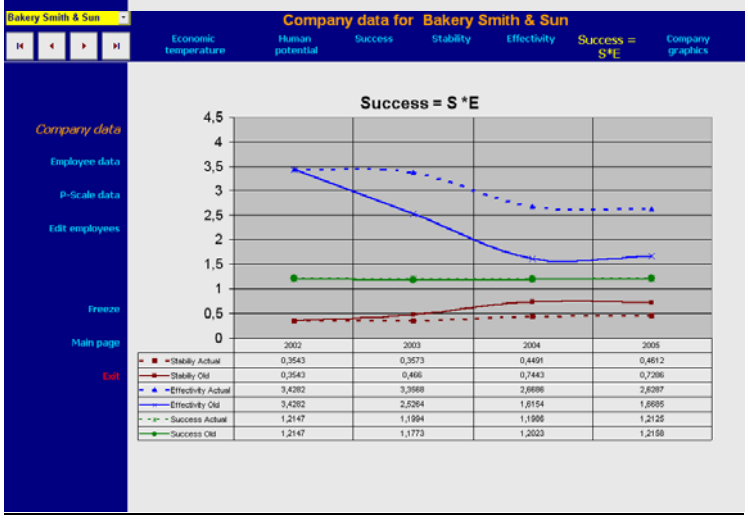
Business Data

The profit and loss data for two companies (software company, bakery) are given. Employee data in the form of skills and abilities are also known. These employee data can be altered.



Human Potential

Here we can see how the human potential (H: in bit units) is reduced in the bakery if an employee leaves the company (in the year 2002). The broken line shows the new human potential curve.



Success = Stability x Effectivity

The economic success of the company remains unaltered owing to the unaltered sales data (green line). The effectivity (blue line) increases, as the success is generated from fewer skills and abilities. The stability sinks, as fewer skills and abilities are available for future success.

Figure 5: Screen shots for evaluating controlling data

I would like to return to the question of the confidentiality of the human potential data on a chip card. Human potentials are personal data (personal profiles) and must be protected. A major advantage of the mathematical concept presented is that nobody needs to know the complete composition of the human potential in an individual chip card. It is sufficient if a company knows which skills and abilities it itself needs. It sends these data to the individual chip card where a check is made whether the correct, matching information is present. If this is the case, the overall value of the human potential is read out of the card for the queried skills and abilities. Nobody knows, therefore, which skills and abilities are present in the card in which combination. The human potential is a summary value. It is sufficient if companies are aware of a certain human potential value H of their employees. All of the corporate analysis methods presented can be carried out with this number alone. A card owner can, of course, also call up his data with the aid of a PIN or password. The data can also be stored in coded form on the card. All of the wonderful security techniques used in health insurance cards and credit cards can also be applied here.

Applicative und interpretative human potential

To work through recurrent tasks we will use the same skills and abilities again and again. On the other hand, most people have a lot more skills and abilities than they need to process such recurrent tasks. If a new, unforeseen task arises, we must revert to that part of our skills and abilities which was not required up to now. The skills and abilities required to process recurrent tasks form the applicative human potential H_A. Skills and abilities beyond this form the interpretative human potential H_I. This is symbolised in Figure 6. The left-hand side shows the Q-distribution of a female skier whose skills and abilities are not sufficient to repair a ski binding, thereby putting her next race at risk. The tradesman and the skier together have the interpretative and the applicative human potential to allow the skier to take part in the next race.

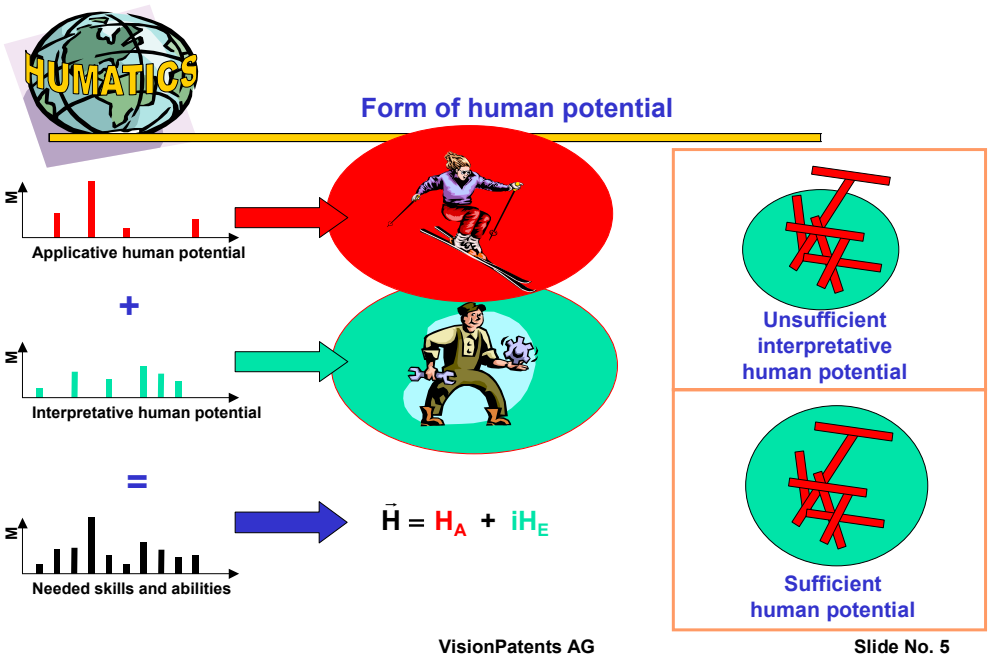


Figure 6: Applicative and interpretative human potential

Applied to a society this means: the economic skills not required today could be important for processing tasks tomorrow. The skills and abilities not economically required by a society are generally referred to as cultural skills and abilities. This makes the value of a broad educational background of the economically active population immediately apparent. A large educational background means a high degree of competitiveness, i.e. a wide range of possible solutions for new problems. This means that it is absurd only to promote those skills and abilities which are economically required today.

Applied to a production process (e.g. VW automobile production) this means: applicative human potential is required in the production halls while interpretative human potential is called for on the management level and in the development departments. It is clear, for example, that inventions are the result of hitherto unfamiliar knowledge.

By way of illustration we can say: the thermoeconomic methods gives us an x-ray view for the analysis of companies.

Further results: Quadratic growth

This last result can be clearly illustrated as follows: assuming that the mean human potential of the people in education and training is above that of the people in production, then greater economic success would obviously be possible if the human potential in production was raised to the level of the human potential in education and training. This is obviously not the optimum situation and can be rectified by adjusting the mean human potential.

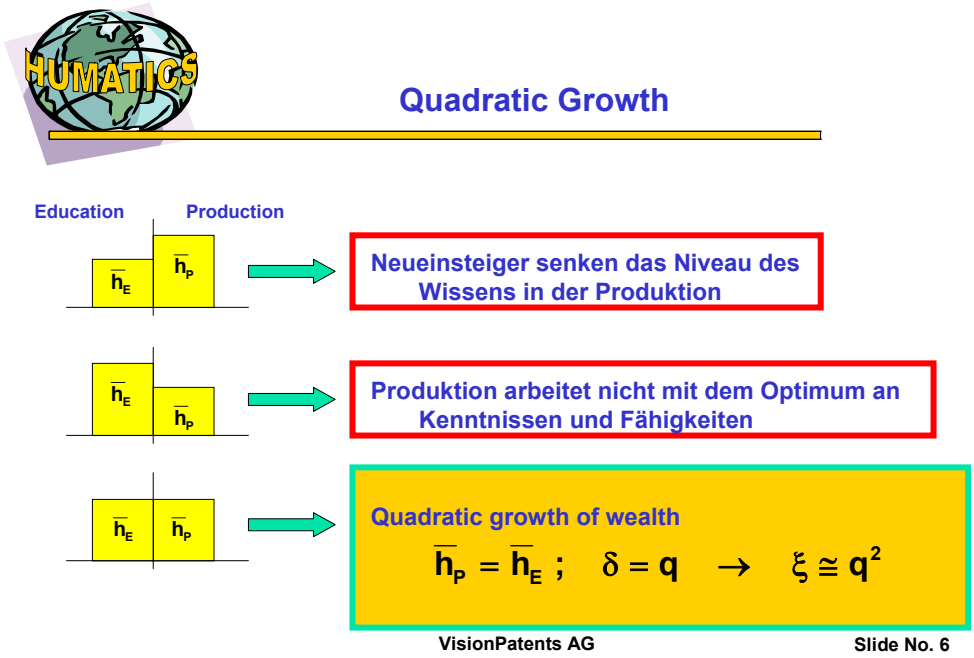


Figure 7: Quadratic growth depending on equivalence of interpretative and applicative human potential

The opposite case is just as unfavourable. If production has the higher mean human potential, people starting in employment obviously have to catch up on knowledge, i.e. they reduce the average human potential in production. This, again, is not the optimum situation.

Apart from the deeper mathematical background, we are now finished.

Social consequences

Now, please do not think that the application of humatics is restricted to companies. Slide 4 gives an overview and suggests representing

the economy in a somewhat different way to that which we are accustomed. On the left hand side we have the production process where products and services are created whose survival depends on the ability to compete on the market. The competitive products generate the income Y. This is one way of looking at it, and the way generally used. Humatics also includes the second side, training and education (right-hand side of slide 4). Skills and abilities are generated here. And what the free market is to products, job interviews and examinations are to skills and abilities. The required skills and abilities are evaluated with the money sum Ω. Ω is ultimately the sum of the money values of the skills and abilities from the P-scale held by the economically active persons within an economy.

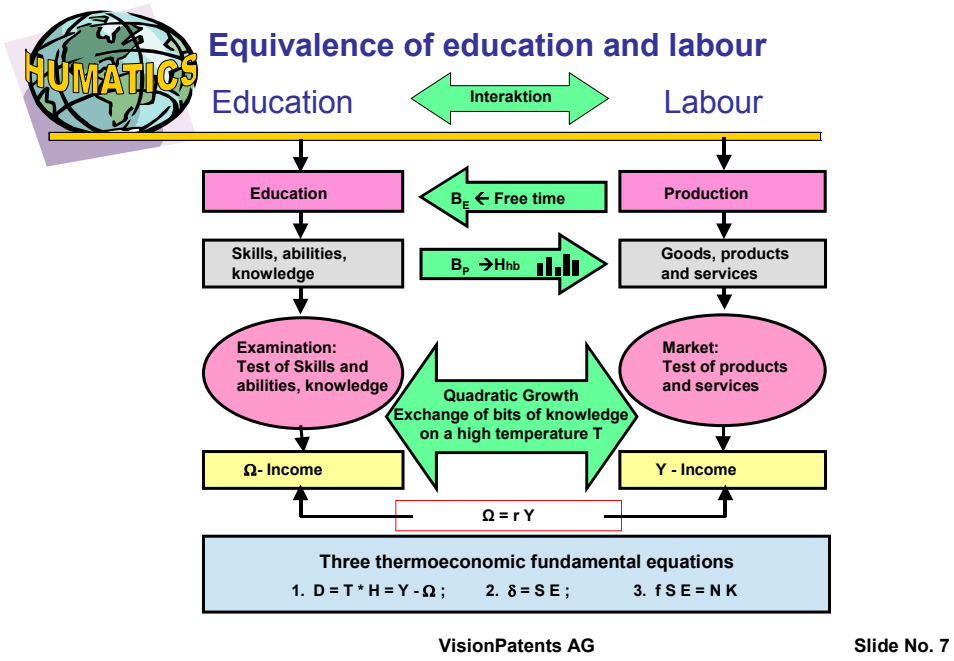


Figure 8: Humatics on a society level

Humatics links the right-hand with the left-hand side (education with production) by setting the social profit (D = Y - Ω) in proportion to the human potential H: D = TH, whereby the proportionality factor between social profit and human potential H is the economic temperature T.

For me personally, the whole roundness and beauty of hmatics unfolds in the centre column of slide 4. Shorter working times release people from production (BF -> BE) who either change to education or are already in education. The education side is constantly providing trained people (BP <- BE) for production which thus remains competitive.

It can be shown (see [6]) that the conventional economic theories are special cases of humatics in which human potential is regarded as constant (H = constant).

Present-day societies endeavour to eliminate unemployment by providing redundant workers with a new job as soon as possible. Humatics shows that, in principle, this is only possible when new skills and abilities are constantly being fed into the economic process. This means that the rationalisation performance of our market economies (i.e. the release of people) is not being used in the optimum manner to renew and adapt the knowledge which the economy requires. Humatics shows without a doubt that unemployment can be eliminated by promoting education.

With these last comments I have now closed the link between the card scene and the world outside. I hope that I have been able to indicate the wide range of applications which humatics will open up.

References

[1] Das Humanpotenzial
Wissen und Wohlstandswachstum

VWF Verlag für Wissenschaft und Forschung GmbH
D-10725 Berlin
Postfach 304051
ISBN: 3-89700-142-X
info@vwf.de

[2] Measurement of human knowledge – A new base of economic theories

[3] A new, independent derivation of the Shannon Formula and application of economic spaces

[4] How knowledge can be measured and stored on chip cards

[5] Humatics: Corporate human potential, new methods of corporate analysis

[6] The completion of economic theories exemplified on the basis of Keynesian formalism

The article [2] to [6] are available under: www.hans-diedrich-kreft.de