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21521 Dassendorf

Presentation by Hans-Diedrich Kreft
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Human potential
How knowledge can be measured

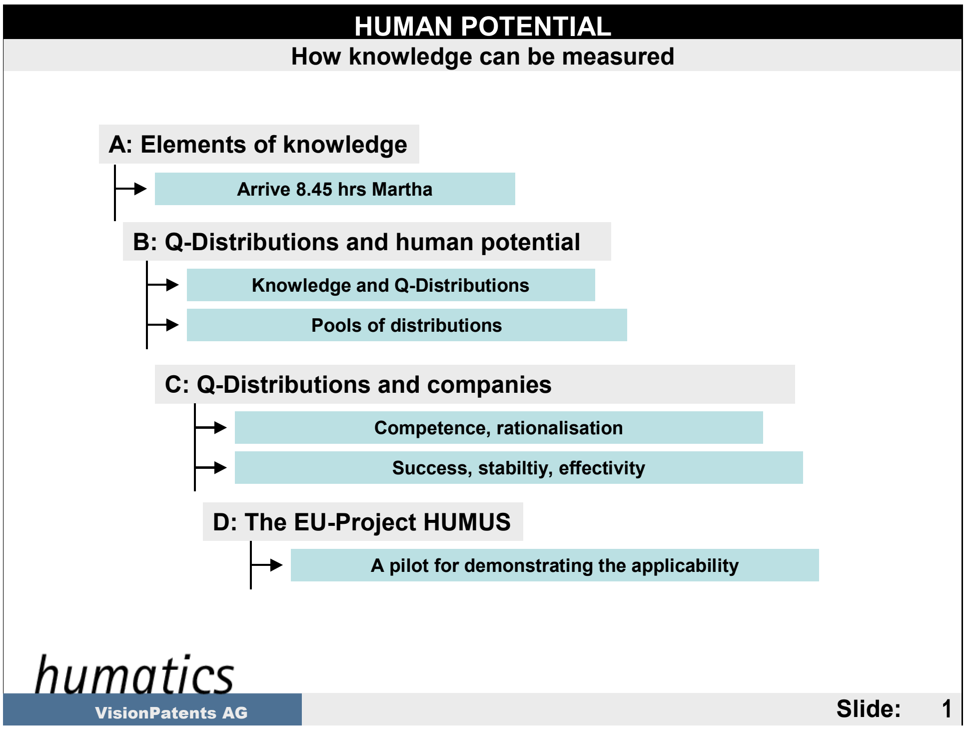
Summary:

A measurement value for knowledge is introduced on the basis of mathematics. This measurement value expands the potential for economic analysis, reveals new interconnections, and defines familiar economic characteristics in mathematical terms. As an example, a mathematical formula for the competence of a company is derived here in an illustrative fashion and the relationships between growth in turnover, stability and effectivity are shown. There is reference to the EU project HUMUS which is aimed at verifying the applicability of the concept presented in corporate practice. In conclusion a number of interpretative comments are made on the significance of the approach for future economic theory.

Contents

A: Elements Of Knowledge

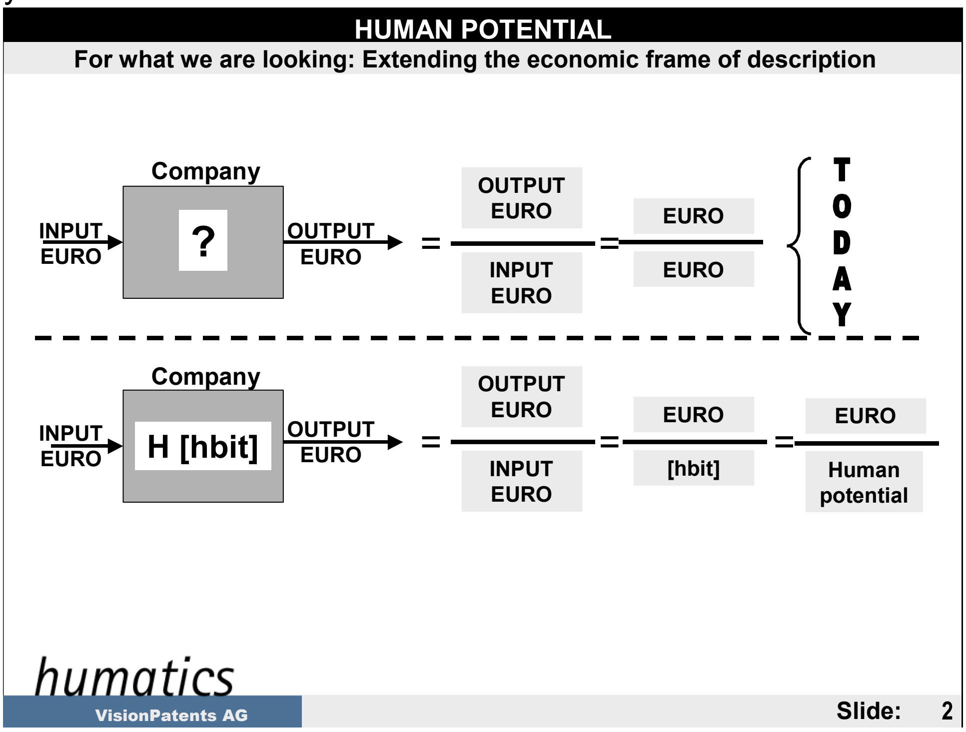
Up to now there was no way of determining precisely how the knowledge of employees determines the success of a company or indeed of a whole market economy. Once the relationship between knowledge and economic success has been uncovered, we have at our disposal what amounts to an X-ray view of economic structures in companies and market economies.



Slide 1 provides an overview of the subject. In section A we will first talk about the elements of knowledge using an example for illustration. In section B we will become familiar with a new class of mathematical objects for the description of economic reality, i.e. the Q-distributions, without recourse to the mathematical formalism which is otherwise necessary. The advantages of the Q-distributions become apparent when we apply them to companies using an illustrative example in section C. In section D I will tell you something about the EU-subsidised project Humus to demonstrate that what we are talking about is not in the realm of esoterics, but firmly based in reality. Indeed, in my opinion, which is shared by a number of physicists and communications scientists, we are laying the scientific foundation here for a new socio-economic science which I have called Humatics – an acronym from Human and Mathematics. Here today we are concerned principally with its application in companies.

The focal point of our observations today is represented in slide 2. In the upper part from left to right we see the typical cause-effect linkage of the input and output models so favoured in economic theory. Goods and services (production factors) are somehow evaluated as input data in terms of money, are then subjected to a transformation process within the company before reappearing on the output side and usually evaluated in terms of turnover. It is practically a characteristic feature of these input and output models that they do not take account of the actual cause of economic output, i.e. people with their skills and abilities. Of course the number of people is important, as are their working hours and the personnel costs, but where do these models refer to the knowledge of the employees? Because this is the case, every mathematical relation between input and output values only represents a relation between money values, goods and services and economic periods. The mathematician would say that the descriptive space of this type of economy is given by a number of people B, an amount of money M, quantities of goods and services X and the economic period Z (1 year or parts thereof). Even the best input and output analysis cannot define any economic reality which goes beyond this descriptive framework (space). This means simply that as long as economics does not have a measure for knowledge and skills and abilities of people, we can never fully assess the economic reality out there in which the skills and abilities of people are asserting themselves in tough, daily, economic competition.

What we need is symbolised in the lower part of slide 2 in the box representing a company.

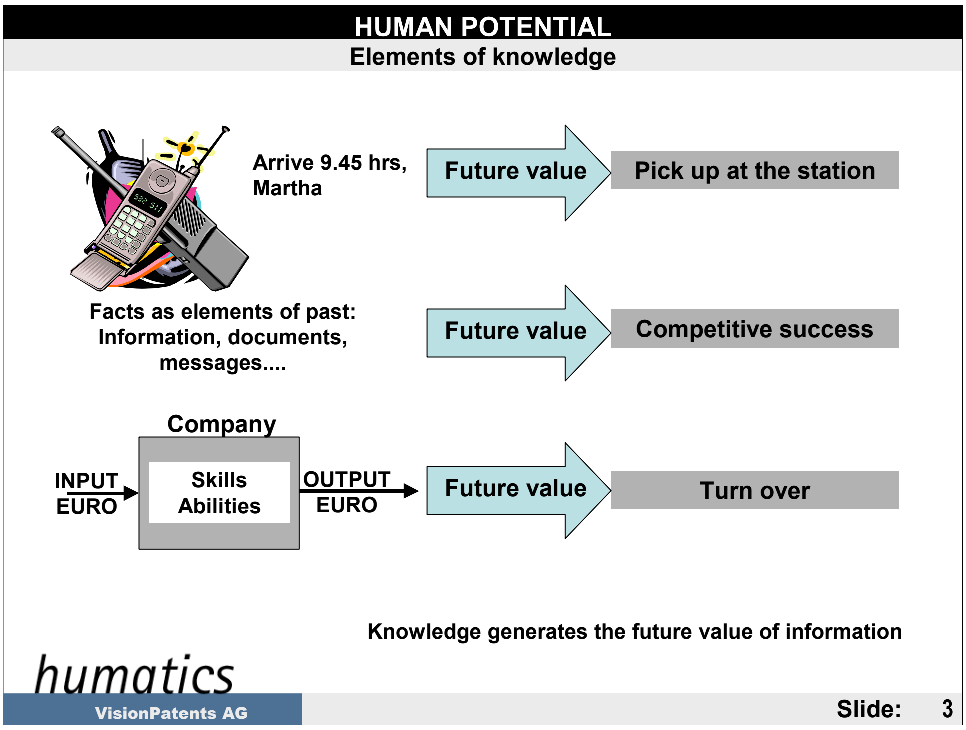


We need a value for the abilities and skills of the people working in a company. We call this value Human Potential H. Once we have human potential as a measurable, i.e. countable, value, we enter completely new descriptive framework, new relationships become apparent. Take a look at the bottom right of the slide: would it not be a good idea to know with which combination of abilities we achieve which turnover compared to our competitors?

In economic reality people do not solve problems by dint of their number. To effectively solve problems, a harmonious combination of the appropriate skills and abilities is required. This is taken into account in the extended economic approach presented here. Skills and abilities are registered in mathematical constructs, so-called Q-distributions and allocated to individuals. This means that anonymous individuals (represented by point sets) are replaced by people with skills and abilities in the economic analysis. This is illustrated later on, firstly we will analyse the elements of knowledge.

Ladies and gentlemen, I would like to introduce to you the elements of knowledge with the aid of a little, seemingly trite analogy. In its core, this analogy can be attributed to the honourable Carl-Friedrich von Weizsäcker whose philosophy lectures I attended in the mid-sixties in Hamburg. In his analogy, Carl Friedrich von Weizsäcker used a telegram for which now, around 35 years later, we can use a text message (SMS).

The updated analogy goes like this: Having travelled to the holiday resort of Costa Fortune a few days in advance of his wife, a man receives a text message on his mobile phone: "Arrive 9.45 hrs, Martha". The next morning the man goes to the train station to save his wife making the long journey to the hotel with her heavy luggage in a taxi.



This little analogy already contains all of the elements which are necessary to define knowledge.

First of all, the text message represents a fact. Facts are elements of the past. They can be documents, measurement values, letters, telegrams, programs, historical artefacts, examination results, certificates, archives with data etc. In all of these cases we speak generally of facts, to which we can allocate a piece of information. Ultimately, facts and information are unchangeable, they are not dynamic, they have nothing temporal except that they are perishable.

In the example of Martha, an action, the trip to the train station, is derived from a piece of information as the second element of knowledge. We make a general assumption here that people can carry out actions on the basis of information. With reference to the fact of information, the corresponding action is in the future. The action derived from the information obviously has a value for the couple, whether it be an ideal or personal value. We are familiar with the value of actions in the economy. They are evaluated in money amounts and appear as turnover or costs.

Of course, our analogy also contains such a monetary evaluation. If we evaluate the taxi fare from the train station in Costa Fortune to the couple's hotel at € 20, the husband's knowledge can thus be evaluated at €20.

Anyone who is interested in more profound interrelationships between elements of knowledge can refer to the book cited in the last slide of this presentation.

We can summarise the results of our analysis here as follows:

Knowledge generates the future value of an information.

It seems simpler to say: knowledge is the future value of a piece of information. But we have to be cautious in expressing it like this. When something is, when it exists, then it is a fact and not knowledge. Knowledge only receives a supposed value in the future. Knowledge is constantly arising, but it has no being. Therefore there is no such thing as certain knowledge. The analogy with Martha shows us this.

The husband is waiting at the station with a big smile on his face and accompanied by his son. Martha, however, does not look so happy. The misunderstanding can be easily explained: Martha, thinking of the many discussions she has had with her husband, wrote the text message to warn her husband not to go to the train station at the given time, as her arrival was intended to be a birthday surprise for their son. As Martha and her husband both know that the son often uses his father's mobile phone, Martha had to keep the message as neutral as possible. The husband failed to realise this. This means that an action and thus a future value was derived from the message which was not intended. Knowledge is never certain.

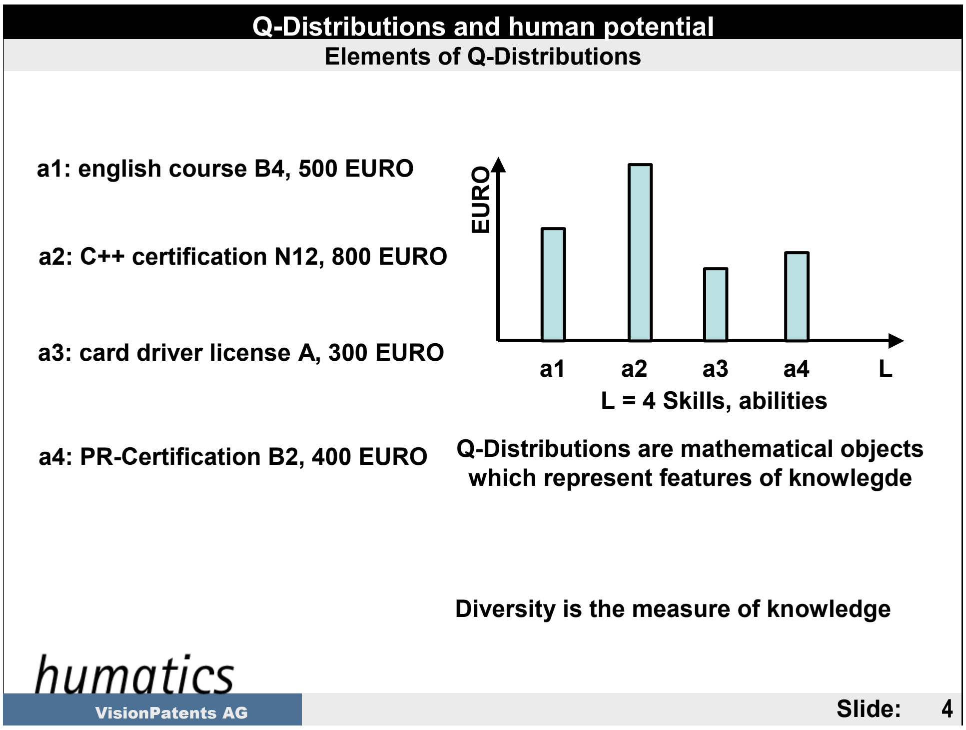
Anyone who derives knowledge from data, information, documents, facts, archives will sooner or later be confronted with the same problem as Martha and her husband at the train station in the second example.

Without going into too much detail, this is perhaps the right place to make some interpretative comments on certain concepts which will have to be clarified sooner or later. Anyone, for example, evaluating company data with even the most advanced program, is generating facts from facts. For even the processed, newly compiled, filtered, compressed facts (data) remain facts (data) which in themselves do not generate any knowledge. In this sense what we often refer to as knowledge management is usually actually data management. The decisive factor, i.e. generating knowledge with relevance to the future from data, is, according to all we know and according to the concept of Humatics presented here, the sole and exclusive domain of the human brain.

B: Q-Distributions And Human Potential

If we want to apply the results of the preceding analysis to companies, we have to answer one question. :

What is the future value of a company?



Well, the question is not difficult to answer: it is its competitive success. The competitive success of a company is reflected in its turnover. For turnover contains all of the sales competitions which have been won, i.e. where a company was successful against its competitors. We can modify the definition cited above for companies and say:

Knowledge generates the competitive success of/from skills and abilities

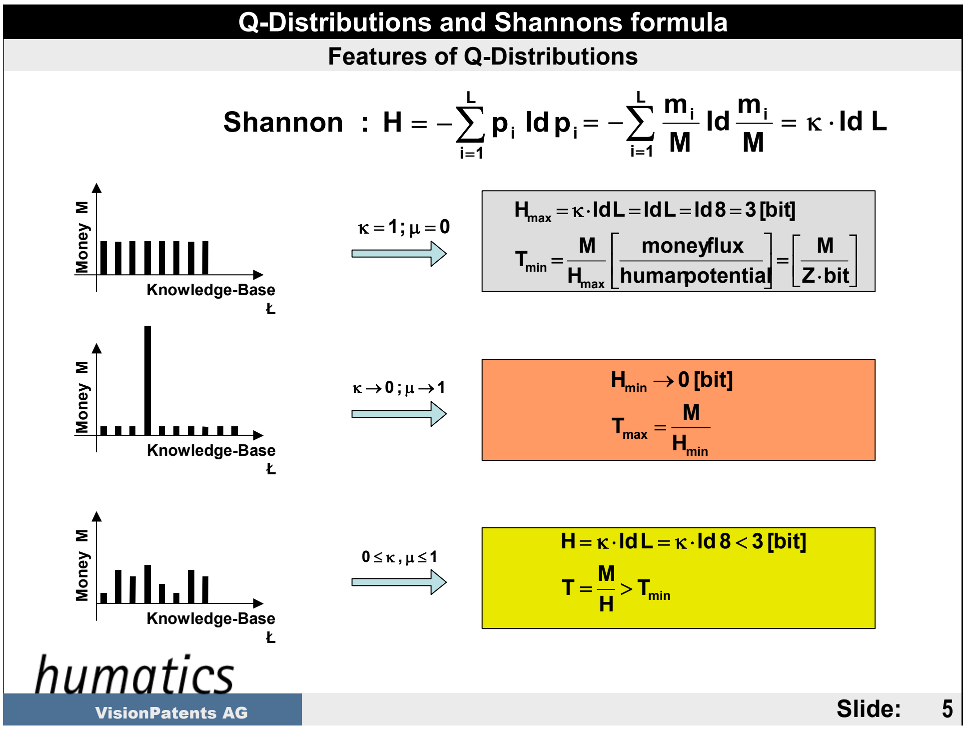
Thus prepared, we are now in a position to derive a measurement value for knowledge in companies.

What needs to be done now is to attribute the turnover as a future value of a company to the skills and abilities in the company. For skills and abilities are the only known facts which can generate the future value known as turnover in a company. This is done in the simplest possible way in the form of a bar chart (slide 4). We thus distribute the turnover over the human skills and abilities in a company required to assert itself on the market against competition. This distribution is nothing new for companies and is carried out already in many different ways. With every recruitment, certain abilities are given a value in the form of salary. Companies, do not, after all, evaluate the colour of a person's eyes, but rather the skills and abilities which can contribute to the success of the company. Companies recruit people in accordance with the skills and abilities required and evaluate these skills and abilities in the form of wages and salaries.

The bar charts generated are referred to as Q-distributions. Q-distributions evaluate skills and abilities rather than just numbers of employees.

But how can we derive from Q-distributions something approaching a measurement value for knowledge? This is where we resort to mathematics in the form of the Shannon Formula. This is the formula behind all of the bit and byte values used in CDs or in the transmission of text messages. It is, by the way, the same formula behind one of the most fundamental and important physical laws, i.e. the second principle of thermodynamics or the Boltzmann-Planck Formula, according to which all order is converted to uniformity, to equality, to heat death and not to chaos as it is sometimes wrongly interpreted

I only refer to these relationships because I find it very reassuring to be able to use such a fundamental and successful formula in the field of economics. I would be less reassured if I had to introduce my own, completely new formula.



The value μ (small mu), which can be calculated from the Shannon Formula for any random Q-distribution is referred to as specificity. Let us look at slide 5 to see what this value μ tells us for special constellations of Q-distributions, i.e. for separately evaluated and compiled skills and abilities.

At the top left of slide 5 we first have a Q-distribution whose money values of the listed skills and abilities are equal, i.e. the individual has no preference for particular skills and abilities. In this case the Shannon Formula gives us the lowest possible value for the specificity μ, i.e. the specificity μ is zero. It stands to reason that somebody who can do everything equally well is not a specialist and possesses no skill or ability which can be evaluated higher than others.

Let us now analyse the other extreme case where an individual possesses a skill which is particularly highly evaluated as well as other skills with a lower evaluation. This case is shown in slide 5 in the middle box. Here the specificity μ assumes values close to the maximum of 1. To illustrate this, let us imagine a top athlete: he will find it difficult to achieve other top performances, for example as a musician or a manager, while continuing to maintain top performance in athletics. The same restrictions apply to specialised employees, i.e. to the wide range of specialised performances required today in companies.

Now let us look at the value H for human potential which we can derive from Q-distributions also with the aid of the Shannon Formula. In the first case, i.e. equal distribution, H has its highest value. We can interpret this as follows: if an individual has many equally evaluated skills and abilities his development or human potential is large. Which of his skills or abilities has the most potential for development is not yet specified. In the second case (high specificity) the human potential is low, the individual has already specified himself and must, in an economy based on competition, do everything to maintain the high evaluation of his specific performance. His development potential, i.e. his human potential is low.

In short, ladies and gentlemen, if the next time you hear the term human potential you can imagine the specialised development potential of an individual and consider that a specialist – such as a top athlete – has a low development potential if he wishes to maintain his top performance, then you have already understood the core of what I want to say in this presentation.

Given the use of the Shannon Formula in communications theory to determine information units, it is perfectly natural to express human potential as calculated here also in bit units. In order to differentiate from the bit units used by computer scientists, control system technicians and communications scientists we refer her to human bits, which we write in the form [hbit].

The values for human potential for us normal people (bottom left of slide 5) will lie somewhere between these two extremes of Q-distributions. As we come nearer to one or other extreme case, we can speak of higher specificity or higher human potential value.

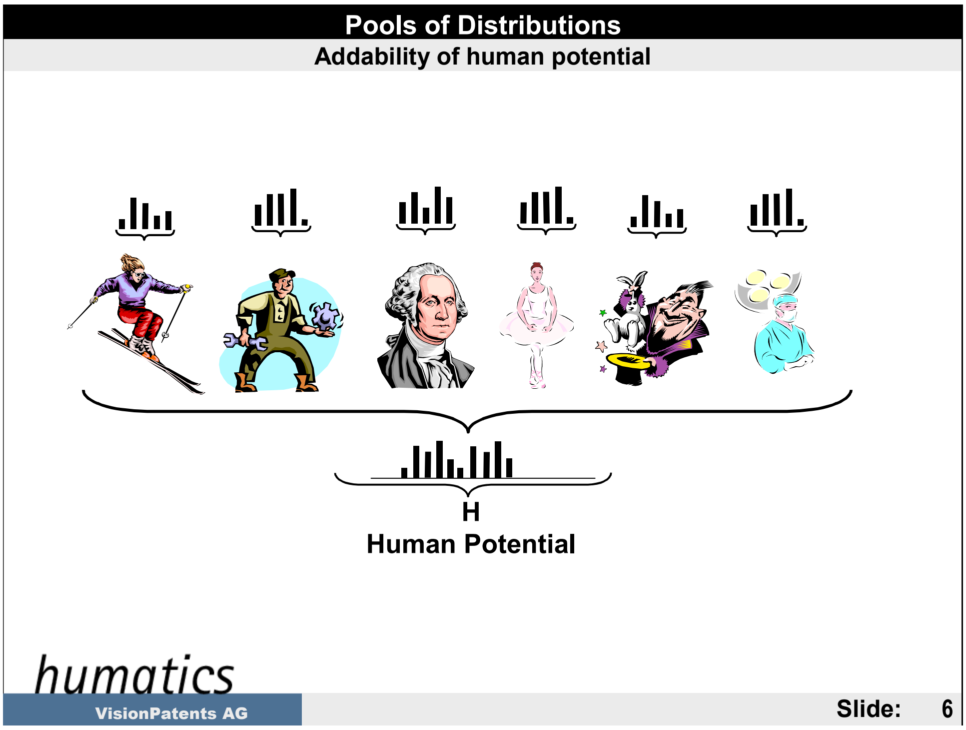
But Q-distributions also contain a wide range of other values. We could, for example, read the number of skills and abilities from their length, i.e. the elements of the X-axis. We refer to this length L as the knowledge base.

And Q-distributions also give us a completely new but extremely important value. If we divide the sum of the turnover proportions of a distribution M by the value of the human potential H we arrive at the value $T = M / H$. We refer to T as the distribution temperature.

What does this distribution temperature tell us?

If a company generates a large competitive success (turnover) from a low human potential value, then the evaluation of the skills and abilities is increased in the distributions of the employees, i.e. T is high, and vice versa. We can say, therefore, that a high economic temperature indicates a high degree of competitiveness. In the case of a specialist, T is increased on two levels. His human potential H is reduced, on the one hand, as shown above. On the other hand, if the specialist – say a racing car driver or a tennis ace – is also highly paid for his specific skills and abilities, then the distribution temperature grows to exorbitant heights. This levels out in companies and we can easily compare the temperature values between sectors.

Perhaps it is easier to understand the concept of temperature in the following way: Instead of thinking of per capita turnover, think of the tiny units of human potential. Imagine that every human bit stands for a unit of turnover. The distribution temperature thus tell us which turnover is achieved per human bit or which competitive success a human bit achieves.

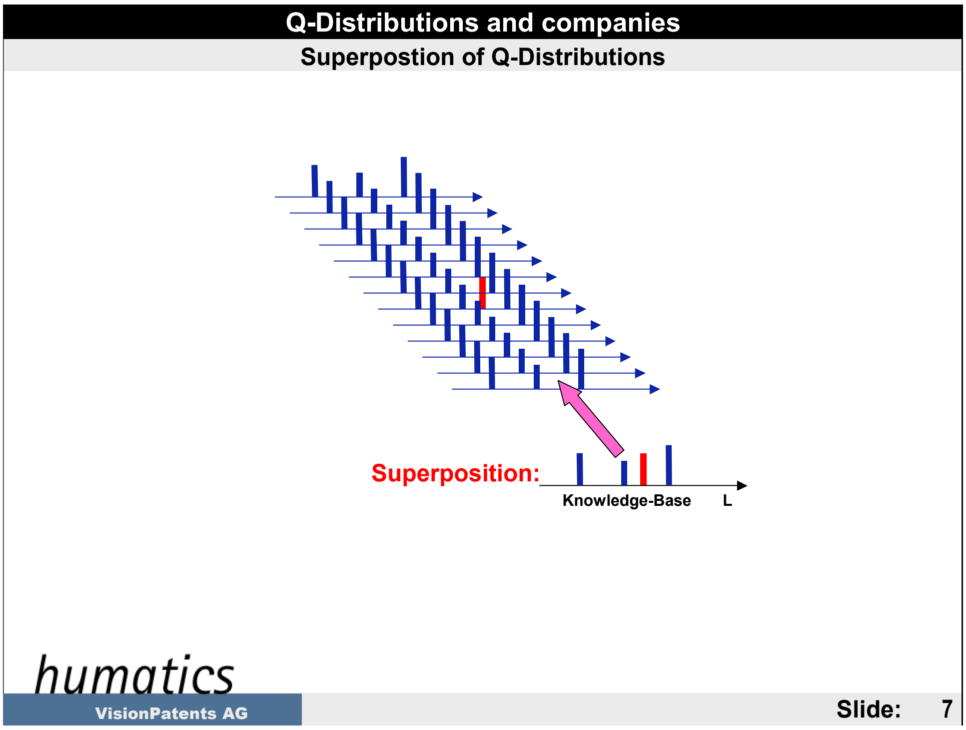


We have already used the addability of the human potential; slide 6 symbolises this again. There it is shown how the human potential of random individuals can be added up.

We now come to an aspect of Q-distributions with unpredictable consequences for economic theory, indeed for our whole insight into economic relationships. Slide 6 postulates simply that we can add human potential values and slide 7 shows that Q-distributions can be superimposed. But there is something very interesting behind this. If we can add Q-distributions, then the mathematical relations between them are correct with mathematical certainty, and I know of know greater certainty than mathematical certainty.

We are fortunate that Q-distributions can be used both to redefine familiar economic characteristics and to provide fundamentally new insights. I would like to illustrate both here.

To get an impression of what superposition means, imagine you are standing where the green arrow is in slide 7 and looking in the direction of the Q-distributions. You will see that all of the equal beams cover each other. You can see the first one, the others are hidden. But wait, the small red beam in one of the many distributions is clearly visible. That is superposition.



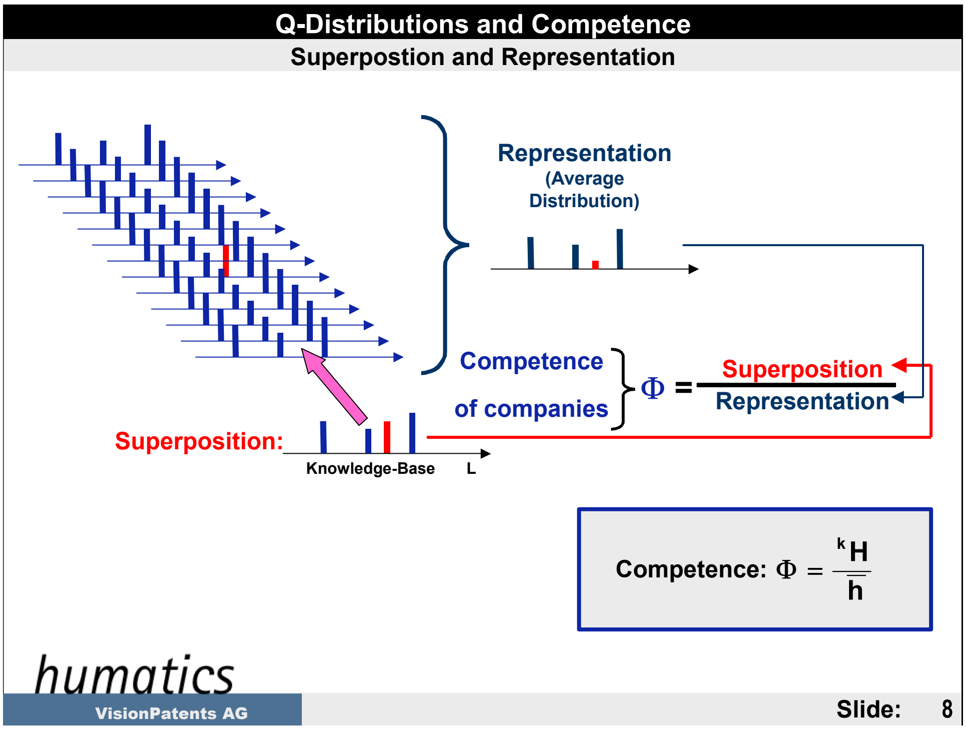
To illustrate superposition we can take an orchestra as an example. If we add up the human potential values of the individual orchestra musicians, this additive human potential H is something like the volume of the individual instruments. In the case of superposition this is the exact opposite. What applies equally to each musician is only counted once. What is different is counted fully in each case. Look at the red bar in slide 7. Mathematically we can now combine additive and superimposed distributions. The interesting question is now: what does this mean in corporate practice? We can explain this using slide 8.

C: Q-Distributions And Corporate Characteristics

When we add up the human potential values of distributions and divide them by their number, we receive something like a representative distribution. This is symbolised in slide 8 by the brace and the blue lettering "Representation". The application of the principle of representation to employees of a company means that we add all of the many skills and abilities in companies and divide this by the number of employees. This results in a kind of symbolic employee representing all of the others.

How we superimpose Q-distributions was already shown in slide 6. The principle is illustrated again in slide 8. At the bottom left of slide 8 we set superposition and representation in relation to each other as a quotient represented by the Greek letter Φ (large Phi).

Now let us consider the case where this one red deviant is not present. Then we receive exactly the same result twice, as a representative distribution and as a superimposed distribution, for their H values. The quotient is 1. This means that an orchestra consisting only of lots of violinists has only one competence, i.e. that of playing the violin. No matter how often we select a violinist at random from the orchestra, the ability is always the same: playing the violin. Let us assume that the red bar represents a pianist. Now we see that the superimposed Q-distribution immediately takes account of this case. In the representative distribution the pianist will, of course, be less easily heard the more violins are playing. If we form the quotient Φ taking into account one pianist, the numerator increases sharply, the denominator only slightly. We receive a value greater than 1 for Φ.

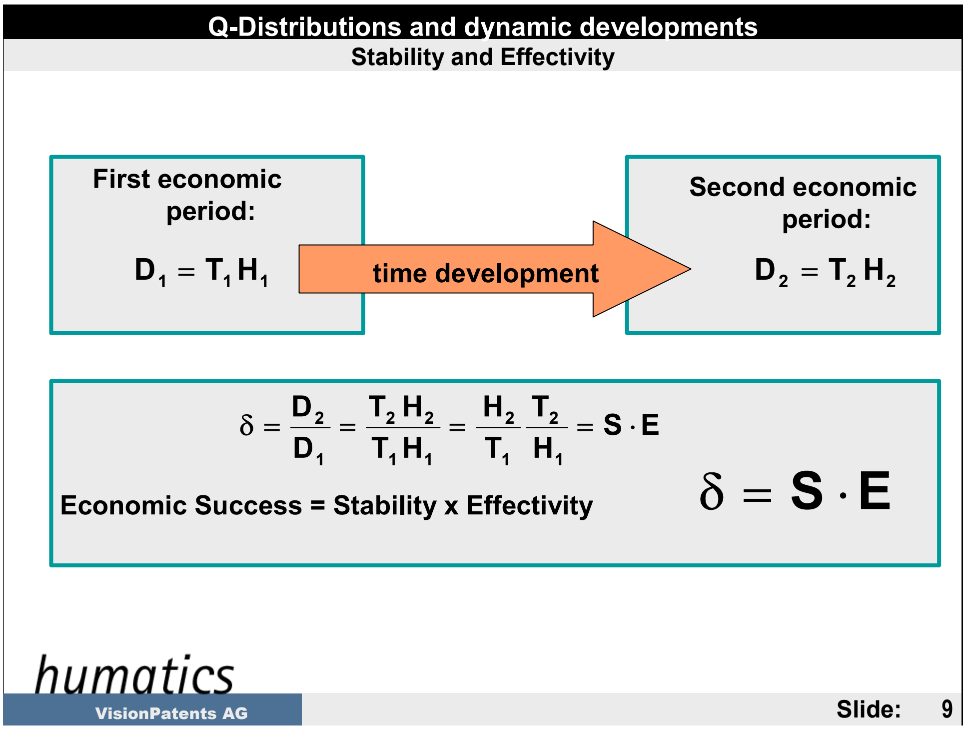


A competence value for Φ greater than 1 can be interpreted in practical terms. The larger Φ is, the more competent the company is in fulfilling varying competitive requirements.

I do not have to tell the business practitioners amongst you what these results mean for companies. Just take a look at what is happening today: companies are rationalising at all costs, the stock exchange shock has had a profound impact and managers are having to explain to investors that they are actually doing something about it. One thing is certain, rationalisation must be carried out in a qualifying manner, i.e. companies do not want to lose the skills and abilities which are as important for competition tomorrow as they are for today. In my experience, the upper management level in companies can at best hope that middle and lower management have made the right decisions. As up to now there was no measurement value Φ for the competence of a company, it was not possible to answer the question as to whether a rationalisation process also had a qualifying effect with any precision. We know now how only one skill more or less among thousands of equal skills can change the competence value of a company. And I am sure that stock exchange analysts will be delighted with this new method of taking an X-ray view of companies. The stock exchange analysts would have seen even before the crash on the new stock market that some of the data as we have derived them here, would have been quite close to unrealistic values.

One could argue that there was no mystery about the concept of competence even before the mathematical interpretation presented here and that what is being set out here is thus not new. Well, we have only reached the point where we newly interpret economic reality. Now we come to the promised new insights.

For the following analysis and the economic insights which can be gained from it, we only need to assume that there is a measurement value for knowledge. It is not necessary to know how knowledge can be measured. Thus economists proceeding analytically would have reached the following insights if they had assumed a symbol for knowledge in purely formal terms and dared to take an approach which assumes that economic success is proportional to the knowledge of the economically active people (U = T H). After all, economists have symbols for savings C, for income Y, for interest I, for wages W etc. and they have no difficulty using linear connection between the symbols.



Our analysis here can take recourse to human potential as a measurement value for knowledge. First we will observe the situation dynamically by comparing two economic periods with each other (slide 9). We put the turnover of a subsequent period U2 in relation to the turnover of the previous period U1 and thus receive, in the familiar manner, a value for the growth in turnover which we will refer to here as δ (small delta). The larger δ is compared to 1, the more money a company has earned in free competition in the new period compared with the previous period, the greater is its competitive success, the greater its profits.

We have to receive some new insights when we integrate human potential in the quotient δ for turnover growth.

The proportionality factor between turnover and human potential was the economic temperature (U = T H). This product is represented in the top left box of slide 9 for the first period ($U_1 = T_1 H_1$), and in the right-hand box for the subsequent period ($U_2 = T_2 H_2$).

In line A of slide 9 we divide the values as shown. First the successive temperature and human potential values are put in relation to each other (T2 / T1 and H2 / H1) and then in the second case they are "crossed" (H2 / T1 and T2 / H1). This "cross exchange" is justified because 2 / 10 by 1 / 4 is exactly the same as 2 / 4 by 1 / 10.

The small alteration of the division in line A of slide 9 has dramatic interpretative significance.

If, in the quotient H2 / T1, the human potential H2 of period 2 is increased compared with the economic temperature T1 of the previous period, there is more human potential per temperature unit compared with the previous period. This means that there are more opportunities for the application of skills and abilities compared with the temperature (i.e. the competitiveness) of the previous year. We can say that stability has increased. From this relation the economic stability is designated using the quotient S = H2 / T1.

If, in the quotient T2 / H1, the temperature T2 of period 2 is increased compared to the human potential H1 of the previous period, more social profit per human potential unit is achieved. This means that more competitive success is achieved with the existing human potential. We can say that the effectivity has increased. From this relation the economic effectivity is designated using the quotient E = T2 / H1.

The result is as follows: the economic success δ is equal to the product of stability S by effectivity E:

$$\delta = S * E.$$

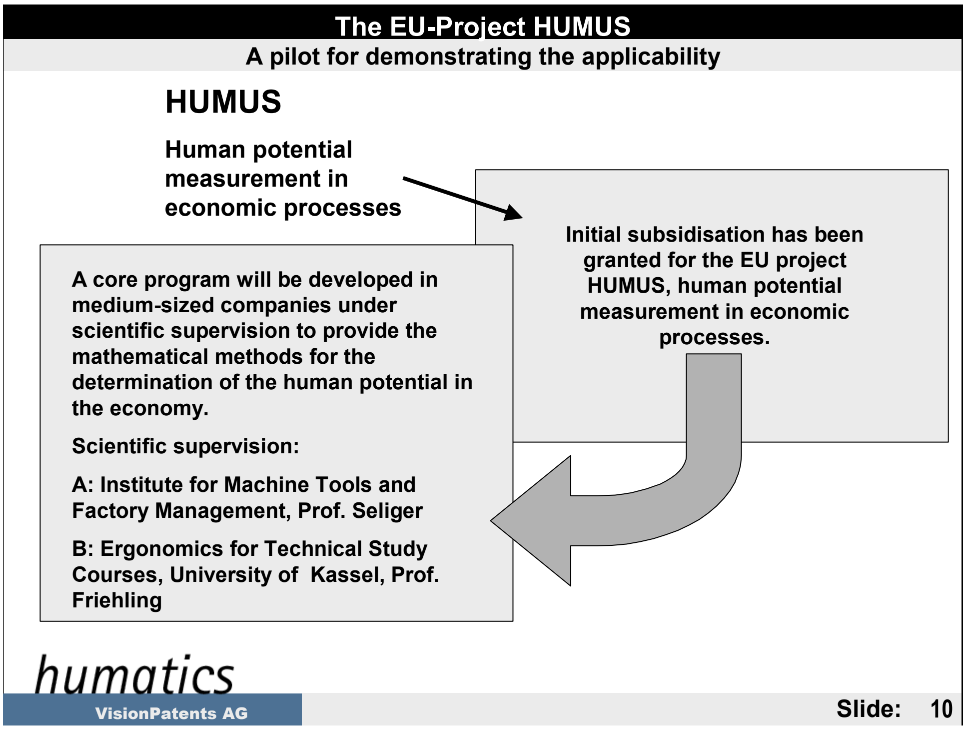
Did we realise that applied economics is such a high wire performance?

Let us illustrate the formula $\delta = S * E$ and using the analogy of a high-wire performer. If he uses a long heavy pole, he can stand firmly on the wire and a gust of wind causes no problem. The stability gained, of course, is at the expense of rapid movement, his effectivity is restricted. If he uses a lighter pole, he can perform beautiful jumps, but a gust of wind will highlight his lack of stability.

To save time, let me just point out here that the measurability of knowledge leads to an as yet unknown wealth of further insights and formulae. It can be shown for example that unemployment can be eliminated by a continuous exchange of knowledge between the education and training sector and the productive sector of a national economy. There are also relationships between income and the conformity of the goods in a company. The more conform the goods of a company are, the higher its effectivity and the more unstable its economic situation etc

D: The EU-Project HUMUS

Initial subsidisation has been granted for the EU project HUMUS, Human potential measurement in economic processes. The composition of a consortium and the elaboration of a pilot project is to be financed. A core program will be developed in medium-sized companies under scientific supervision to provide the mathematical methods for the determination of the human potential in the economy. We are also planning to add two further elements to the program depending on the concrete requirements. On the one hand, user interfaces will have to be developed to meet the respective situation in the company. The input of employee distributions must be kept as simple as possible and the distribution data of employees must comply with data protection stipulations. This suggests that chip cards would be the best way of storing distributions. According to the comments above, it will not be necessary to store employee identifications in distribution pools. It is possible to work with Q-distributions independently of employee allocations. What a company eventually agrees with its employees, which skills and abilities are evaluated by the companies and how, is ultimately a matter to be cleared with the works councils, i.e. with the consensus of the people involved. This will vary from country to country, from culture to culture.



A second point is the integration of existing controlling programs in companies. After all, the turnover data are available somewhere and now they just have to be linked with distributions.

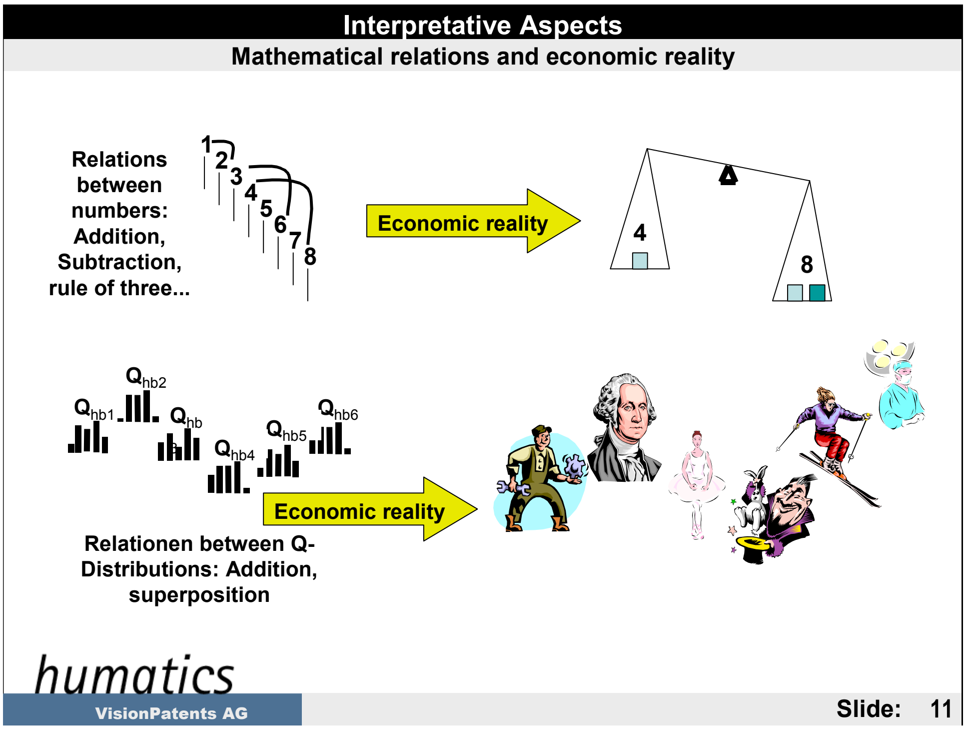
We at VisionPatents AG will only be involved in developing the core and I personally will be mainly concerned with the further scientific development of the project. This means that the door is still open for anyone wishing to become involved in this project at an early stage. Whoever decides early in favour of a presence – or to be more exact, competence – in this new economic discipline will certainly be gaining a competitive advantage.

E: Concluding Comments

In conclusion allow me to deal with some interpretative aspects which may illustrate why I am so optimistic that the concept of Humatics will assert itself.

I could be argued that a lack of precision in the calculation of human potential calls the whole concept into question. This is most certainly not the case. Just as the correctness of the rule of three does not depend on the accuracy of a shopkeeper's scales, the correctness of the relations between Q-distributions does not depend on our current ability to determine human potentials. Thus we can be certain, for example, that the increase in turnover is equal to the product of stability by effectivity (δ = S E).This argumentation also applies to the many other relations in Humatics which I was not able to go into here.

I would also like to explain another train of thought using the analogy of the so successful rule of three. The rule of three applies to the mathematical objects which are numbers and is precise in the mathematical framework of numbers. If economic factors (e.g. money amounts, weights, number of screws etc.) can be expressed as numbers, the mathematical accuracy of the rule of three can also be applied to the economy.



If there are new mathematical objects (in this case Q-distributions) for the definition of economic reality, their mathematical relations can be applied to economic reality in the same way as the rule of three applies. The findings on competence, stability, effectivity and the many other results of Humatics must be seen in this light. Thus the data presented here are of equal "qualitative hardness" as the data in bookkeeping, cost accounting, controlling or general macroeconomic data.

A further argument for the strength of Humatics arises directly from the considerations set out above. The rule of three can be represented as a special case of distributions. After listening to the preceding you can easily understand this. To the extent that we assume all people (employees) have identical skills and abilities we receive identical Q-distributions and we can use these to count just as with point sets (numbers). This, of course, brings us back to the descriptive framework of our familiar economic theory, where the various skills and abilities of people are not defined mathematically. This is also the reason why distributions are easily compatible with existing concepts, for example profit and loss accounting and controlling in general, so that calculation methods used up to now can be complemented and why the core concept set out above makes sense.

A special concern of the author was and is to move economic theory in the direction of an exact science. In principle, the distribution concept describes economic reality in the same way as exact sciences with their mathematical objects attempt to describe physical reality (e.g. centres of mass, atoms, fields etc.). Every economic distribution can be interpreted as a point in a higher dimensional space. In this sense even the most comprehensive mathematical objects for the description of physical reality, the psi functions of quantum mechanics, can be understood as a temporal development of points in a higher dimensional space. Even physics began with centres of mass and quite simple mathematical objects and advanced to the psi function. There is no doubt that economic theory is also standing at the beginning of this brave new development towards higher mathematical structures and the resulting insights.

The value of the concept presented can be illustrated using an analogy. Just as X-ray technology increases the amount of medical information available to a doctor, the distribution concept makes a greater amount of information available to economists (including corporate management). The conclusions drawn by a manager for the future of his company, or by economists and politicians for a national economy from the methods presented here remain open, just as a doctor cannot determine the appropriate therapy from X-ray pictures alone.

In the future, economists, business consultants, management, controllers, company advisers will be able to use the new methods presented here to analyse the internal values of a company such as competence or rationalisation potential and include these values in their corporate analysis in addition to the controlling data. This results in the X-ray view mentioned at the beginning into the knowledge structures of a company or a national economy.

And to conclude, let us return to Martha.

Anyone who recalls the Martha example will say: human potential is a calculated value, a fact and thus cannot be knowledge, which is generated as a future value. Correct! This is why human potential in which turnover is integrated as a continuously changing factor is similar to the fluctuating curve of a stock exchange price. If the current incoming turnover data of a company are directly linked with Q-distributions in the company computer and converted to H-values, a person would have correctly evaluated skills and abilities. Assuming this happens in an instant, then the human potential value calculated for the company would represent a fairly precise value for the knowledge which can be generated from the skills and abilities of the staff. But this human potential value would always lag slightly behind the current economic changes in the reality out there. But this applies to all physical measurement values. As soon as we write them down, a new value already applies.

In real companies it will be of great importance over the coming years to be able to calculate human potential values which do not lag too far behind developments in reality. Ultimately this means that companies must be clear as to which skills and abilities contribute towards success and to what extent.

For further information please see slide 12.

Humanitcs: Further information

Diversity is the measure of humans

Book:
DAS HUMANPOTENZIAL
Wissen und Wohlstandswachstum
Von der sozialen zur fairen Marktwirtschaft

VWF Verlag für Wissenschaft und Forschung GmbH
D-10725 Berlin
Postfach 304051
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info@vwf.de

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VisionPatents AG
Ecksweg 4
21251 Dassendorf
Tel: 04104 97 10 – 0
Fax´. 04104 97 10 – 99

E-Mail:
Office@visionpatents.com

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H.D. Kreft