Systems Engineering
Prof. Deepu Philip
Department of Industrial & Management Engineering
Indian Institute of Technology – Kanpur

Lecture - 16
Discussion about System Engineering and System Thinking with Professor Ian Angell

Good Morning, today we are lucky to have with us professor Ian Angell, professor from Information Systems from London School of Knowledge. He retired from LSE and now he is a professor emirates, and he is a non-authority in systems engineering, systems thinking, various aspects related to system.

So as part of the endeavour to foster systems engineering, today we will be having an freelance discussion with Prof. Ian Angell on different aspects on system engineering. We can start by disagreeing this, because systems cannot be engineered. A system is introduced into the environment as an engineered installation. It is left there and then all have reckless, it interacts with human activity systems around it.

The system is not, is what it becomes, not what it is intended to be. So you must not think of a system as something that you could plan and control, it does not work like that. So systems engineering have real problems like that. Let me ask you, because this is one of the other view point, I wanted to actually bring part of it, bring forth as part of the discussion, because to a large extent lot of the concepts in systems engineering has been related to military related products.

And to a large extent, the people with the pure systems view point call this engineering installations. So can you a little bit elaborate on that? Just like, can you describe the world in 30 seconds. Think about an observer in the world, and he is looking at an agglomeration of events, a whole mass of events going on. And that observer thinks that he can see structure in what he observes and one of the things he do is that, he puts a boundary around the events.

So what you have is the system and you have the environment, and there is a boundary, which unfortunately is ambiguous, because its path of the environment is also the path of the system. There will be channels through the environment that will send messages from the

system out into the wider world environment, and these channels feedback will come into the system and the system will then change.

Now the problem with this is, there is always an observer. If you change the observer, they will see something totally different. Could you elaborate with an example? The simplest example that I have seen was one given by my good friend, Peter (()) (03:22), who was the professor of system at Lancaster University, who wrote some super books on soft systems engineering. And he says think about, the penal systems, the jails, what the governments think the penal system is.

They think, it is a correction of facility and it keeps bad guys off the street for so many years. But then he said, what do the criminals think, the penal system is, and he says, they think it is a university of crime, they go, young criminals go in knowing nothing about crime and they meet over all old lads teach them all the techniques of criminality.

So you have exactly the same situation, exactly the same events going on. But from one perspective is the correction of facility, from another it is the university of crime. So that is what I mean by the problem of it depends on the observer. The observer of the system is going to define what the system is, there is a choice. There is always a choice, so systems are never objective, they are never absolute, they are the choice of the observer.

And once you set it up, then you have the channels between the systems as you defined it, and the outside world, information goes back and forth. Feedback, because the result of the messages going out from the system engineer environment, has a result. And this comes back and it changes. And that change could raise all sorts of complexities, and so you start off with a very simple installation, and you end up with a horrendously complicated system.

Now one of the prime ideas within systems thinking, is the notion of emergence, when a system get so complex, that you cannot go with it, it creates simplification at the different level. As for as the best one of the best example of emergence is life, okay. You can think of the chemicals, you can take the system of chemistry, what have been around there were, it get so complicated the way every things interact you and the prime evil soup, and suddenly out of the soup pops up life.

But it was not predictable, emergence is not predictable. Emergence of a system is actually not predictable. There is no prediction, so in a way if I make a statement, that a system where you put an installation and it creates sufficient complexity around it, it gets to a point where the complexity matures that it is so complex, that you cannot handle it, something new emergence out of it.

Wow, just look at the interact, it changed the complicated manner and think of the social problems that has come out of it, when it is started, when the world wide web started, it is just a very simple communication device. And now, look at it now, you have got Amazon, a peer in from nowhere to be a huge corporation, eBay. So all of this things, what these individuals did, what the innovation did was to say let us look at the basic installation on the simple system around it.

I mean to say, let us put it into a different activity system. So let us put it in trade, let us put it in auctions, and so the idea was how can I use the internet to run an auction. So different manifestation of the system was being thought. Then of course, the system of the internet includes all of Amazon and so it absorbs, so now the system is even bigger, and the boundary has moved out, and it has absorbed all these, and it is highly complex, so it is uncontrollable.

So that is what I mean by system, it is a dynamic thing. You start off with something simple installation, and then bingo. So one of the things I wanted to ask you specifically is that, because lot of the people who are part of the systems or systems engineering and all other aspect have a general way of saying that, well A plus B gives you C, okay. And from my systems view point how would, because it is mostly people try to linearise things, and the world is not linear and the environment is certainly non-linear, can you little bit, because for the benefit of the people, students, can you elaborate it.

Well, the idea A plus B equals C, okay, of course I agree A plus B equals C. So you stick it out there in the system but before A can meet B with we added A is interfered with Z, B is interfered with QPR, so they do not even exist, any more, when they come together. So it is what we are saying I am going to get C, the answer is no you are not, because something else has happened. And that is the complexity, and so this is the feedback. This is the problem of all research, is categorisation.

How do you categorise the things that you see. How do you categorise the things that are in the system, and the answer to that, it is a choice. How you categorise it and how I categorise it are not the same. They are choices always, and what happens is that somebody who devices an installation, which then convinces the system, convinces the neighbours that this is the way it is, and so they exact it.

So all the politicians accepted the JOs are correction of facility and the criminals are thinking, hahaha, this is where I get a much better skill set. So the way a criminal looks at it and the way a politician looks at it totally different. It is the same things, it is exactly the same, no, no because the system is the interpretation of as well, it is the same artefacts, it is the same events, but totally different viewpoints.

One thing that I actually wanted to ask you, because one of the things that many people not understand clearly is the importance of understanding different viewpoints, especially when comes to the system things and another term that is confusing to lot of people is the interface. And could you give an example where this interface, the importance given to interface has actually made people make a wrong choice or people really do not, people refuse to look at it.

You started by, you said, what did you say at the beginning is? People have a notion normally is that, the system is, lot of the time we cannot understand the system. I do not believe the human brain understands anything. We just describe, and from that description we impose our theories on to the world, or perceptions and we are human systems, okay. And what the human system does through the brain is to impose structure on to the world.

And that world is uncertain, and the interaction of my structure, my theories with the uncertain team develops risk. And this is what you use to deal with the world. Now the people think that risk is out there in the world you just have go to find it, that is what statistician think, you know. There is risk out there, let us measure it. No, risk is something produced in your head. It is produced by the interaction with of your theoretical position, your perspective.

On the uncertainty in the world this then brings back a feedback of observation. This then enters the cognition of the brain, and using memory it develops and varies the theory. And so this is what is going, so you are developing and a notion of risk. But there is no such thing is

understanding. What you are doing with your fear is imposing your structure on the world. Now I wrote a book on the science's first mistake, which talk about the whole problem of a human system.

And what you have actually got a triangle, you have got observation, you have got cognition and you have got memory. And how does the three interact. Now each observer is different, so the triangle is different for every individual. But what the human race, we communicate our perceptions our theories and most people just accept the theories that they have been given. So they do not question it. So science is accepted by everybody as being right.

I do not agree with that, I think science is a delusion. It is very appropriate delusion, because the risk model you get back. If you utility to dealing with the world, and dealing with the world very successfully. But it is not true, it is simply that you developed a risk model, for the time being. But, you see, at the same time look you got science creating atom bombs. So you can end up destroying the whole human race. So that is what I mean by feedback, and so there is nobody in control.

And every system as it operates in an environment creates a pollution, there is always pollution. And so when you are going around the world you got you theories and you see everything as you think it is. But the pollution of the mistakes between your theory and the world, your are waiting deep in all this pollution. And every so often a new follower and there is a problem.

I am using metaphasia, but that is what systems theory do that we use metaphasia. One of the classical example of this is a there is an accident, an airline accident in UK. And where the people were looking into the interface or the so called human computer. When you have got a computer, you will have HCI, Human Computer Interface. And what happens peoples are there at this interface and they do not use their brains.

So there was an example of an aeroplane coming in to west middle-east air port and one of the engines was on fire. And if they looked out the window, they could see that the right engine was on fire. But the screen had been right up the wrong way. So the warning light said the left engine is on fire, which was working perfectly. So what did the pilot do, did he look

at the window and says, no, no the other one is on fire, no, no he just said close down the left engine.

So the right engine was on fire, the left engine was closed down, and the plane crashed on the motor way and killed everyone on board. So that is the American, they have a group looking at psychology. And they call this the Glass Cockpit syndrome, the people are so focused on the glass cockpit, that they do not actually to look through the screen and see the world. And so this is again a systemic problem, you see, what the theory is doing, is forcing a blindness, because when you observe something you have to realise that there are lots of other things that you do not observe.

In order to observe, you have to ignore most of the things. Now if somebody else comes along what they observe would be different, because they will take some other things that you have ignored and throw away some other things that you include. And that is why I got, I am using metaphasia. So I have, there is a very famous German social scientist cum philosopher called Niklas Luhmann, and he says that observation is only possible, because it is impossible, that sounds silly.

But what he is saying is perfect observation is just not possible, because you would be observing everything and you could not cope. So what you have do is filter and so what you are saying is putting filter in not observing everything. So observation is only possible, because it is not possible. And so what you do is you interject a false set of, limited observations, everything is filtered, because again the idea that the world out there sends things into your brain is non-sense, because if that is what happened, we would be swapped.

So what we have to do is we project out a filter, it interacts with the massive stuff in the world. Most of this is guarded and then what comes back is what enters our brain, our cognition and that is the way it works. And so observation is not possible in terms for true observation, but a false observation is possible, that false observation on the structures may have a utility and then that means you can make you way in the world.

It means that you are no longer at the mercy of the arbitrary nature of the environment. So what you have got is a sync for noise, see what a technology does. It is a sync for noise, when

you put the chair on the floor, it means you know that you can sit in it. And so that limits the noise around of what do I do, where do I sit, where do I stand and so on.

So what a technology does is to introduce a sync for the noise in the environment and that then feeds back into your models. And so your model is then fine tuned, that makes them right, just makes them fine tuned. And so depending upon whether it was a chair or something else that was placed, and then you have a question of a glass, I can put liquid in it, because my previous models have told me that. But if I put this on the floor and I am going walk around and I might kicking it, the water then get into the electric plug and the whole thing blows up.

So that is the systemic reality, that if the system is operating within the confines of what was described, then problems do not tend to occur because the noise is observed or you have limited the noise. And but now and again there is a problem particularly statistics, statistics is one of these ways of pretending that you can deal with the world. Now statistics works on the idea of population. So the populations are got, in other words, every subset has the same property as the whole.

Now if I said to you the system of India is the same and if I went to Gujarat or I went to Kerala, what I would find is exactly the same, which is nonsense, absolutely nonsense. So then you got the problem on how do the statisticians then categorise, how do they decide, how to count. So that it is approximating to a homogeneous, so what they have to do is avoid like to play anything where you have sub-systems and a culture is a sub-system.

So they have to avoid the impact of a culture, which will distort any statistical modelling. Now if you are making shoes and you use statistical model, no problem at all, because you do not want to make shoes exact for everyone. Only a rich can do that, so you have to do different sizes and you approximate. Now and in that situation it is not problem because it is more or less okay.

And so when you have got a very sensible way of using such statistics to generate and industry, now I had a colleague who used to talk about the economics of happiness. And then you say, on a scale 1 to 10 how happy are you, which is nonsense, because my answer to all

of this is, if you are going to show me measurements, you have to show me the measuring rod that I agree with.

Now if we are doing shoes, you can show me the ruler and I (()) (22:17) accept the ruler, the centimetres and so on, you know, that is not a problem. But happiness, what is it, intelligence, IQ is nonsense. How can you have artificial intelligence, when we do not know what intelligence is, so what you have got is some very strange salesman, okay that try to convince the people with money that their model of the world is beneficial to them in their industry and then their tax collecting and so on, so on.

They think necessarily so, it may work, but there is no guarantees. And also you can guarantee that some very strange things will happen, some very strange things. And sometimes you might not be able to understand those strange things. You might not realise what is going on. You might not even perceive that this is going on, but you will still have the wrong notion that the system is working as per your model properly.

Because I was in the British Museum and I was giving a lecture in the British Museum on these ideas, and some idiot said but if we have lots and lots and lots of computers connected to one another, then maybe they create a brain, and is intelligent. And I said, oh yes fine, but you will not know what it is? Does your brain cell know what your brain is like. So how will you as a creator of the computer know what the computer brain is like, you have no idea.

So there is no controllable artificial intelligence, it may be there, but you do not even know what is going on. So one other thing actually wanted to, because another reasons with lot of the thing is, you mentioned about, okay, use a measure, but show me the measuring rule. So lot of the time what I have seen in many of these systems endeavours is that people using wrong measures. I mean they might like using the wrong standards, the so called standards or they using the standards.

One classic example is the Mars Orbiter where one lot measured in centimetres and the other lot measured in imperial. When they put the two together, they do not realise and the whole things crashed in flames on Mars. That was so obvious, that there are other much more subtle examples.

Another thing is that we also talked about, like an example, I know you worked a lot on this, because on your previous experience with anti-money laundering systems and every stuff. And in that one of the biggest things that people will save as like , we have the last five years there was a large number of like suspicious cases were being reported. And people used that as a measure of success of the system.

This is classic, this is looking at the numbers, and assuming the number are meaningful. Now what happened in Britain was the, what called as suspicious transaction, so any bank teller if he is suspicious of a customer he has to fill out a suspicious transaction report. And if it is subsequently found that the teller lead through a bad guy, then the teller could go to jail. That is how the system was, that would put the fear into the teller, that was the designer.

Now, what the idiot designer did not realise was that if I am told that if I miss something, I can go to jail, what do I do? I report everything. And then I am swamped with reports and there are sacks of suspicious transaction reports lieing police stations unopened, because there is no man power to actually deal with it.

So that is the systemic phenomenon, you know that the people who designed the system of suspicious transaction reports did not think what perspective would the bank teller have, so totally different. So that is one of the act in the system or whatever the person using the system one of the user of the system, they did not consider that view point.

And it is worse than that, because with the rise of terrorism, and because of the political benefits being involved with the fight against terrorism, many people involved in many laundering said well, our techniques can be used to look at terrorist financing which is nonsense, because money laundering is about cleaning up illegal money. The vast majority of money from terrorist is actually donated by, it is not illegal at all. It is, in Britain the when we have the Irish terrorists, they were all paid for by Irish American ambassador.

So there was no criminal, they used to have parties in Boston, and they collect money for the boys. So how this money laundering techniques help you when the money is legal. And the money laundering is about illegal money being legal actually. So what are the some of the few experience that you have with when you Dionysios Demetis worked in AML system.

That is one of the first pioneer involved in anti-money laundering, one of the first major theoretical work you know.

And tell about 10 years ago most work in anti-money laundering was war stories. There were people giving their experience of what the launderist did. But there was no attempt to try to formulate the theoretical description of what was going on. Now my good friend Dionysios Demetis, he created a theory using systems thinking, using the work of Niklas Luhmann to try to describe what was going on.

And it is quite interesting what he has achieved, when one of the thing is clear is that there is always feedback. Now these systems, these anti-money laundering systems only tend to the little people, they do not get the big guys. So for example you are like to this demonetization is a technique of anti-money laundering. Basically there is lot of money under the beds in India, five hundred and thousand rupee notes.

That was the currency of choice fall under risk. So your government demonetized it you had people with huge sums of money under the beds they were just bits of paper. So they have to get it changed for good money. That means they have to take it to the bank to change. But at the moment they take it to bank, the bank says where did all this money comes from. Could you tell me where this came from? There is an audit trial.

So one of the benefits of demonetization is also forcing people into the legal economy. Now there is far too many minor money laundering cases. The government is not around chasing everybody, because it is not cost effective. You only chase people if return is worth it, because it is very time intensive.

So they going after the big guys, but many of the big guys have already moved into bitcoin, they moved into gold, they moved into works of art, property or the property in Delhi is you know the amount of dirty money has gone into the purchase of property. And then across once the whole arena of dirty money disappears, then you have the problem with the value of the property, because there is no more dirty money to buy property, so the property value is dropped.

So this is systemic again see, this is what happens. It is the same system but we are having two different ways. So some people uses word to a large extend called stimuli, system stimuli, those kind of thing. And it is like people sometimes says I mean what is this stimuli. This is what demonetization is, is a form of stimulus.

The problem is there is no control, and yes there would be many benefits from demonetization. But at the same time there would be a down side, you know, a number of small businesses will go burst, because there is no money in circulation, for them to maintain their trade quiet legally. But nobody got any money, because there is not enough notes in circulation they got a problem. And a number of small businesses go burst.

And this is a systemic effect as well. And so there is always a downside, but in terms of demonetization, you see, this again is not new. When the European Union decided to introduce the Euro, at the year of 2000 something, what they did was basically overnight, no more Mark, no more Francs, everything is Euro and you have to go to the bank to change from your money to Euro.

So exactly in India, you had all these people with money under the bed and they cannot go to the bank because the moment they go to the bank, they get reported. And so what they would do, was to pile their suitcases full of money, notes and drive to Austria, Liechtenstein, and Switzerland. Now the police on security, they used to stop cars and look into suitcases and they find masses of money and they would arrest.

The average take in one of these things was half a million Marks, so that is a lot of money, black money they recovered. This is also systemic behaviour. Because you have a human activity system, you have greed, you have people thinking they have this wealth, which suddenly just disappears, so what they do, they panic, so all of these are human emotions.

One other thing I wanted to also talk about or discuss with you in this regarded is about, for the lack of better term, I am going to use the term, alternatives. The system people always says that when you are looking at the system, always look for alternatives and people have always been like, why do I look for alternatives? Because if I think this will solve the problem, then why do I look on alternatives.

Well, now you must look for alternatives, because the only thing systems have in common is they fail and so you have to find something. All systems fail. That the only thing they have in common, they all eventually fail. And so that is the critical thing you have to be able to be cope when things not going wrong. Yes, of course you have got to have alternative.

And to have alternative, all it means is you have people with different perspectives looking at the system and deciding how to redefine it, how to restructure it, how to think about it differently. So you have to have this sort of flexibility.

And this is classic Darwin, efficiency is bad for business. Efficiency is dangerous. Efficiency is bad for business. Efficiency is insane because if you are efficient, it means that everything what happens is predictable. If anything different happens, there is nothing, you cannot cope with that, because you have no mechanism coping with it. You have one way to be efficient, you have the right one way of working.

Now if something odd happens, then you do not know what to do, then you are dead. Now, in biological terms, you have species that force themselves into a need and then through environmental changes of course, the need disappears and they become extinct. So it is the same with systems. If you are in an efficient system in a particular need, when the need changes, you are dead. So you always have to have this possibility of alternatives of flexibility.

And that is when people say, you know, you never learn from success what you learn from failure. Because what you are doing when failing is trying alternatives and then you learn from the failures. When you think of these posted notes that made fortune for (()) (36:39) that was failure. The guy was trying.

When he was trying to make glue a really heavy duty glue, he put it on this bit of paper to see if it sticks and he just peel it away and then he put it back again and it came away and he did not say, Oh, I failed, I must try something else, he said, there is an opportunity with this. This is a great product. So he failed but in doing so, generated these what you call the posted notes, you know, he generated posted notes and that came from an accident.

And then the whole process became huge million, so you always there is a look. So that person who actually was trying to make glue, but ended up getting something and this is where actually the innovation as well as looking for alternatives, consistently looking for alternative choices and options help you. And particularly if you are in a governmental military environment, you have a problem here.

You will be developing a new technology, which has an application in the military environment, but you also have to develop content as a trace as well. Because the other guy could have the ease and so he could be able to do, find a role, so you have this preversity where if you are developing something, you also at the same time going to develop anti-drone. So the obvious one of this is the drones, that is going to be a nightmare, an absolute nightmare.

You have it once, but have to spend a fortune to actually not too much to produce drones, but to be able to take them up and also maybe to analyse and manage them, yeah, because at this point nobody is thinking about what is going to be the impact of multiple UAV systems running in the operating in the sky. Yeah, well they could get each other and fall and kill people. Yes, and then with the terrorist using the drone to deliver a payload.

And there is no good saying, Oh, we will make drones illegal, something like illegality does not matter to a terrorist. You know, they just send it up a bomb. So there has to be a huge investment in anti-drone weapons. Now, what are the things that you ended up mentioning in your discussion, which is kind of, I think we did not elaborate on this, is about bitcoin, and this topic is being, I know, is being very close to your research and you has had about the block chains and how this new system of authentication and how this new system of having like a maybe a bit rupee or be proposing like alternative financial system.

A financial system, I use the word financial system. Governments around the world are very ambivalent about bitcoins, but they do not see the opportunity. Now, what the bitcoin is done is to create a protocol and plan for. The government themselves can use to create government currency. Now, with bitcoin, the way it works is you have this large network of notes and there is a record of every transaction stored on every note.

There is no central ledger. The ledger is everywhere. Okay. So if you go on and cheat and change a transaction in one ledger, does not do any good, because you are going to change all the others as well. So what that means that all the others have to check, okay. At the beginning, the bitcoin had a very clever idea that you pay it with the check, on my name. Now, as the number of bitcoins get less and how the complexity of the checking get greater, the return for doing the checking reduces.

Now in 2040, there will not be anymore bitcoins. So then you have to ask what happens, will anybody check when they do not get any payment for check. Now there are plenty of other ways of guaranteeing checking other than the bitcoin. Now, one of the ways that I am proposing, which I think the Indian government should think about is to have a bit rupee. This is a new system, which is basically you got set up exactly like bitcoin.

The only difference being that the network. You see there are two people who use bitcoins, two types of people. There is people do with checking and then there is people with wallets, we use them to buy and sell things, okay, so the people with the wallets are like free riders, they put nothing in. They put no working, they just use the coins by itself. Now, they may pay a little to the owners of the wallets, you know.

Now, in order to get the government bitcoin, of course, the bitcoins themselves, the ownership and the wallets are semi-anonymous. There are people who think that they are traceable, but what if a government does it. Okay, where all the checks are government computers. The government has got masters of capacity, so there is no question of will they stop checking because the government says we must keep checking.

So then the wallets, these wallets will be anonymous. You get them from the government, you give your name. So it is an ID. It is very much like an ID card, so you have an electronic money, and you can put money in the wallet and then use it to buy and sell things. Now, why should people do that. Why should they put the money? Well there are two real benefits. The first is counterfeiting is impossible because every coin is traceable back to the point of issuing.

So there will be no counterfeit coins in the system. If the government then says anybody who holds a wallet with e-rupees in, we will give them 3% tax free interest every year. Because

the government spends 8-10% to borrow money. So borrowing money of the population at 3% task free is, is a big, big winner. You know everybody benefits. So it means then that the government could have, and of course they would have a record of everybody who is trading with whom.

So all the office economy is being traced. So it is completely visible to everybody. So the black economy then has to go really underground. Now, they are issuing large sums of e-currency, they can reduce the number of rules and regulation, which is another reason to force people into having these wallets and what they do, they go into a bank and say here is my wallet, could you put x rupees into my wallet and so the money then goes from the bank account into the wallet.

And then you can go around and buy and sell. If you buy hotel rooms, you buy at the motor and the joy of this is if wanted to buy a motor car with cash, it looks suspicious, yes. Because the kind of nowadays within the customer rules from the KYC. So then if you use money like this, then the tellers will inform the government, okay, but now if you have a large amount of money on your wallet, by definition that is legal money.

Because you have already been through the process. It is a guarantee that this is legal money. So you can go and spend cash to buy a car. You do not have to worry is it more than 10,000 rupees or so. It is guaranteed to be genuine and that you earned it legally because how else it would be on the wallet. So there is also some benefits to the government if they set these things up, but if it is not being annoyed with bitcoin.

I do not think bitcoins will survive too long because once the minus finds it more expensive to mine than to, they do not get returns on their investment, then they will stop checking, yes and then of course fraud would be possible. Because the checking stops, then yes. Then change one and if nobody is checking, then that is, you have 100%. Maybe if you, because we talked about bitcoin, maybe people might not know about the notion of what is this block chains.

It is again, bitcoin is one example, okay. Very simple that all of trade is about a ledger, double entry book you call it. You buy and sell, you put debts and credits on the book, okay. So and then on the side you write down what the trade is, okay. Now these ledgers at the moment

stored in a bank with the government. There is only one copy. Now if have a distributed database where copies of that ledger are everywhere, then you cannot change everywhere.

When it is only one ledger, you can cheat and change, because can you trust the banker, not to cheat the ledger. But when it is in a distributed database, then they cannot do it. The only one way to do is to get majority. And also the benefit for that is the cost of making changes is tiny. So every business like insurance, every business that uses the notion of trusted third party has got a problem, because they could be replaced instantaneously.

So what are the things I am interested in is whether for example companies like e-bay or Amazon will be able to compete with distributed systems where you have an auction site, which is distributed, owned by everybody on it. It is not owned by e-bay. So at the moment you have to pay e-bay. Then everybody in the system owns it and you do not pay anybody, then you can do all the deals for free.

So you no longer pay the extra money, so it is a question of how it is prevented and how you could, ways of actually checking back deals. So that still has to be worked at, but there is a lot of experimentation going on, lots of experimentation and is very fascinating. I am going to be looking at some projects that your students are applying with. So I am going to be very interested to see what ideas they come up with.

Because it is going to be huge market, enormous, large amount. The insurance business, the stock markets, all of these things are going to find their nice cozy profit, all the nice profitable rip off of the population is over. So there is no introduce of, some rare funds. So here I am, when people say, you are a gains technology. No, I am not. What I would say is of course, this has got all sorts of potential, but you got to look at it closely, ingesting case there is anything.

Is it like keep on looking for the alternatives. Keep looking for the alternatives, keep looking for problems and this is where a system that has been existing like the peer to peer system or a distributor system, which is already existing in the information system, you are looking at a new viewpoint or having a new user system? But what it coincides was to make the checking simple and transparent, so that there was a lot of checking going on.

How they manage that? When you cannot guarantee that people will do the check, then the system fails, so there are a number of different attempts being made on how to guarantee the checking will continue. And say the best way for doing that is for government computers to do it. Because they have got so many computers mostly standing idle. So these could all be used, doing the checking.

Because all it means is the ledger is stored on the computer and is just checked. So all the transactions are checked. So every time you buy and sell, something the government computers check and they also make a record of who bought it and who sold it. So the market, the products and other things are all legitimate as well. Yeah and also it means if there is a problem where you are cheated, you have got a record of the trade.

So that you have got all sorts of and anybody who cheats, of course, will end up on the records and then you have to be honest or you lose all the business. So there are some very good benefits. Benefits are there, but who knows every system is fraud. Every system has the seeds of its own destruction. So we will see. One thing that is common is all systems will fail. All systems will fail.

Thank you. It is always a pleasure to talk to you. It is always a pleasure to have you here. Time just flies. Time flies. Times flies when you are enjoying yourself. Exactly. Thank you. Thank you.