Blockchain and its use in financial settlements and transactions
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Hypothesis: risk, like mass and energy, can neither be created nor destroyed. Discuss
[submitted 27 February 2017]
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New horizons on the great Silk Road
Dr Oleg Preksin, vice president of the Association of Russian Banks
Informal learning during periods of uncertainty
An outline of a research project by two major universities on continuing professional development

Fintech and the cyber threat

London’s new National Cyber Security Centre (NCSC) was launched in February to great fanfare and with a major cast list: one queen, two Secretaries of State, the nation’s cyber elite, and a Samsung electronic doll. Her Majesty was presented with the doll by the Centre’s technical director, Dr Ian Levy, to aid a demonstration of how the ‘internet of things’ – including such deceptively benign objects as children’s toys (and fridges, and lightbulbs, and so on) – can form part of the cyber threat to our national security and livelihoods. By the relatively easy process of hacking into the doll’s ‘brain’, Dr Levy’s team was able to take control of a model house inside the centre, heating, lighting, communications, security and all.

Just before the launch, Professor Richard Benham, chairman of the National Cyber Management Centre, had told the BBC that, in his opinion, “a major bank will fail in 2017” because of cyber security breaches. He expanded on this to predict a run on a bank this year because of customers losing confidence following a cyber attack, and suggested that more regulation may be needed. According to him, the UK banking industry is “effectively unregulated on cyber security”.

This is a world of obfuscation and hyperbole, but Professor Benham’s comments struck a chord. Dr Andrew Hilton, director of the Centre for the Study of Financial Innovation, runs some highly regarded roundtables in this arena, notably his monthly Fintech for Breakfast series, now in its third year, and is nobody’s fool for cyber sales hype. “While I retain a certain scepticism about the imminence of cyber Armageddon,” he says, “it is clear that the threat is growing, and that at least some of the bad guys are as well-armed as the good guys. There have certainly been some well-publicised security breaches in recent months, and not all in financial backwaters like Bangladesh and Ecuador. What happened to Tesco Bank may presage bigger, and more damaging, attacks in major financial centres.”

So it is good news that the CISI’s own Daniel Broby, Chartered FCSI, joint author of a timely tour d’horizon of blockchain technologies which opens this issue, has just launched Britain’s first masters programme in fintech, at Strathclyde University in Glasgow.

A long tradition of cyber vigilance

None of this is new to the bright brains at GCHQ, of which the centre forms a vital, outward-facing part. The launch of the NCSC is seen as a new chapter in nearly 100 years of GCHQ’s service to the country. During the War, mathematicians and engineers at the Bletchley code-breaking centre built Colossus, the world’s first digital computer. This was to have consequences well beyond the vital job of codebreaking for which it was invented. Colossus ushered in the era of digital information and computing power. The result: a new Machine Age, every bit as significant as the Industrial Revolution.

The exchange of digital data across the internet, and through the web, has already brought extraordinary opportunities. As the doll demonstration showed at the Centre’s launch, more aspects of our lives become connected to the internet every day, and the next generation will benefit from amazing new possibilities, many of which are yet to be imagined.

But all this progress depends on an infrastructure which is safe, and secure against attack by those who wish to abuse this great invention. The Centre has set itself a high bar: “to make the UK the safest place to live and do business online”, says its CEO Ciaran Martin. “In stepping up to this challenge, we in GCHQ know that this is as great a task as any we have met before.”

The role of education – and people

Education, training and qualifications play a key role. The vision of the UK’s Cyber Security Strategy, published six years ago, was “for the UK in 2015 to derive huge economic and social value from a vibrant, resilient and secure cyberspace, where our actions, guided by our core values of liberty, fairness and transparency and the rule of law, enhance prosperity, national security and a strong society. The fourth objective of the Strategy requires “the UK to have the cross-cutting knowledge, skills and capability it needs to underpin all our cyber security objectives.”

The CISI has a world-leading practical qualification on Managing Cyber Security, and some 20 UK universities have masters programmes that are accredited by GCHQ. This reflects a change in attitudes to the role of people in cyber security. It has become easy to fall into the trap of describing people as the weakest link; clickers on bad links, openers of nasty attachments. Bemoaning the ‘wetware problem’ has become standard fare at times. Now, people are seen as the unsung heroes of cyber security. Mr Martin’s team aims “to put people-centric thinking at the heart of cyber security”.

The coming of vast infrastructure investment

“One should not underestimate the lengthy process whereby the highways and byways of Europe were opened up to human movement and settlement. On the other hand, there is no comparison between the relative ease of travel in Europe and that in the greater continents. Caravans on the ancient silk route from China needed a year or more to cross the body of Asia. Yet from time immemorial any reasonably enterprising traveler has been able to move across Europe in a matter of weeks, if not days.” This is from the excellent Europe: a history by Norman Davies, Professor Emeritus at University College London, and UNESCO Professor at the Jagiellonian University.

If even part of Dr Oleg Preksin’s vision of a new Eurasian infrastructure reality (page 59) comes to life in this generation, then the face of the economic and political world will see a revolution.
Everyone adores infrastructure. “Well-designed projects combine economic needs with environmental sensitivities, they create jobs and provide companies with the opportunity to become more productive,” says Matthew Jordan-Tank, head of infrastructure policy and preparation at the European Bank for Reconstruction and Development (EBRD) in London.

“Global economic growth, productivity and job creation depend in no small degree on the ability to invest in and maintain critical new infrastructure assets,” he adds. So why is infrastructure investment lagging far behind actual requirements? In 2016 the McKinsey Global Institute published an influential study which identified enormous needs: For the period 2016–2030 alone a global infrastructure spend of $49.1tn is needed, with some 60 % of this total needed in emerging market countries.

In a world of continuing low interest rates, institutional investors (and their clients) are hungry for the type of steady, near-guaranteed yields that this kind of investment can generate. It is also in most cases – roads, railways, airports, and ports for instance – appropriate for investors, both private and sovereign wealth funds, from Muslim countries.

While some countries have indeed increased investment in the sector, the overall shortfall is significant, with negative outcomes to global growth. As the report concludes: “If the current trajectory of underinvestment continues, the world will fall short by roughly 11%, or $350bn a year. The size of the gap triples if the additional investment required to meet the new UN Sustainable Development Goals is included.”

“These are mind-boggling numbers,” says Mr Jordan-Tank. In April 2015 the international development institutions launched a paper, from billions to trillions, about the realisation of the UN’s Strategic Development Goals. Infrastructure investments play a core role in this. “Without the private sector this will simply be impossible and it is our view that it is now imperative to increase the level of private sector investment in infrastructure.”

The EBRD, set up in 1991 to support market economies and the private sector this will simply be impossible and it is our view that it is now imperative to increase the level of private sector investment in infrastructure.

Preventing and controlling economic crime

The 35th international symposium on economic crime, to be held in Jesus College Cambridge from 3 to 10 September 2017, is the most extensive and ambitious programme that we have so far attempted. The over-arching theme is simply: who is responsible for protecting us from economic crime and are they up to this important task? If not, then how can we assist them to do a better job – for all our sakes?

These vital issues are pursued in a practical, applied and relevant manner, by those who with the benefit of experience are best placed to do so. The symposium, although held in one of the world’s leading universities and recognising the significance of intelligent deliberation, is not a talking shop for those with vested interests – official or commercial. We strive to offer a rich and deep analysis of the real issues, and in particular, threats to our institutions and economies presented by economically motivated crime and misconduct. We are also equally concerned to offer and assist in developing if not solutions at least better practices based on real experience and application. Therefore, well over 600 experts from around the world will share their experience and knowledge with other participants drawn from policy makers, law enforcement, compliance, regulation, business and the professions. The programme is drawn up with the support of a large number of agencies and organisations throughout the world and the organising institutions and principal sponsors greatly value this global commitment.

In considering how to better discourage and control economic crime, we examine the real threats facing our economies and in particular those facing the professionals who look after other people’s wealth. These threats come not just from criminals and terrorists, but also indirectly as a result of law enforcement and regulatory intervention. We context these risks and the responses not only in terms of the law, but also regulation and especially compliance practice. Therefore in every specialist panel or workshop there is an array of relevant practical experience and expertise.

In recent years the symposium has attracted well over 1,800 participants from over 90 countries. This year will be no different, although, with the support of China, we are privileged to be able to give a special focus in some parts of the programme on its particular circumstances and the impact on the rest of us. As in previous symposia we do not focus on a single issue, no matter how important.

The symposium is not an ordinary conference. It was conceived to fulfil a practical purpose: to promote understanding of the real issues in controlling economically motivated crime and facilitate co-operation and effective action, ideally preventive. Consequently, we make every effort to foster networking and promoting meaningful co-operation.

The annual symposium over the past 35 years has brought together in one of the oldest medieval Colleges of the University of Cambridge, ministers, legislators, senior officials, diplomats, judges, regulators, law enforcement, intelligence and security officers, financial intermediaries, bankers, professional advisers, compliance and risk officers and researchers from around the world. This programme is structured to provide a depth and breadth of opportunity, second to none, for those participating in the symposium to become aware not only of existing, but also new threats, and how best to address them.

The Cambridge Symposium is not and has never been just a conference. It is organised on a non-profit making basis by some of the world’s most respected academic and research institutions with the active involvement and support of numerous governmental and inter-governmental organisations. Those who are concerned to protect and promote the integrity and wellbeing of their national economy, institution or enterprise – or who are concerned to better understand the risks facing business today, cannot afford to miss this very special event.

Professor Barry A.K. Rider OBE, founding director and co-chairman, Cambridge International Symposium on Economic Crime

Jesus College, Cambridge

For further information on the Symposium, please contact Angela Futter, Symposium manager: angela@afutter.co.uk

Learning at the boundaries of knowledge

On page 62 you will find details of a fascinating new research project on ‘informal learning during periods of uncertainty’ which is being led by Britain’s Open University and the University of Regensburg in Bavaria. This builds on an earlier project in Scotland on which the CISI co-operated, which considered how younger people working in finance planned their personal development and continuing professional learning, and at how they could be encouraged to be more self-directing.

This new study will focus on issues concerning uncertainty, highlighted by the current proceedings on Brexit. If you want any further information on this project, or have any comments on the Review of Financial Markets, then please do contact me. We hope you enjoy and are inspired by this edition.

George Littlejohn MCSI, Editor, Review of Financial Markets

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ABSTRACT

Blockchain is the technology at the core of what could become the ‘fintech’ transformation of capital markets. It can potentially facilitate cheaper, more efficient and secure operations. The mechanism behind it is introduced in this paper, as are its uses and suggested areas for future academic research. The paper critically reviews the promise that blockchain and distributed ledgers will speed up financial settlements and transactions. In it we recommend financial institutions evaluate the adoption of blockchain and/or adapt their existing legacy systems to allow for digital clearing over the internet.

Have you ever wondered why it takes three days to clear a cheque, why it takes a ten-minute telephone call, long account numbers and a punitive fee to transfer money abroad? None of these issues need happen, thanks to blockchain technology. This is at the core of the fintech revolution which promises a vision of seamless financial transactions over the internet. The concept is already in beta testing and billions of pounds are being invested in related applications. Some people believe it will transform financial services.

Blockchain was first described by Nakamoto (2008). It is based on a distributed computer architecture and facilitates the sending of digital instructions over the internet. In technical terms, it has what are called network nodes that execute and record digital transactions. These transactions are batched together into blocks before they are processed, hence its name. The blocks are effectively a series of written digital instructions linked together in a chain. This ensures that the contents and order of transactions can be verified. Such an instruction, for example, could contain written code to send money from Bob to Alice.

CONFUSION WITH BITCOIN

The programmed messages in blockchain are used to facilitate financial market infrastructure, payments, and settlements. There is a great deal of discussion in the media, banking circles and academia about the impact this technology will have on financial settlement and operations. A lot of this is misinformed. The concept is often confused with bitcoin, a digital currency that utilises blockchain technology. At the same time, the terminology has a habit of alienating informed discussion by practitioners. This is because financial and technical jargon do not mix well. Academics tend to focus on the engineering and cryptographic challenges. They overlook the complexities of introducing such technology alongside the legacy payment systems that dominate modern banking. This lack of clarity is hindering informed debate and has led to a slow uptake of the new technology despite its advantages.

The concept of blockchain is not as complex as its execution. As explained, it consists of a series of sequenced transactions, grouped into blocks, which are then processed by a network of computers that are digitally connected. In the case of the financial transactions it handles, the transactions may be of the sort normally kept on a bank ledger. In this instance, with a double-ledger entry for each transaction. This method highlights the origin and beneficiary of a payment.

The blocks, meanwhile, are chronologically connected by a series of cryptographic hashes (Damgard, 1990). These are unique secure identifying numbers, which act as fingerprints of the data contained within the blocks. Each block contains the fingerprint of the previous block, meaning that the data in each block can be used to ensure the previous block has not been altered. This fingerprint element is what joins the blocks together, creating a chain.

These chronological blocks can hold multiple transaction records. They are distributed through the nodes of the blockchain network which are carrying out the processing (Decker & Wattenhofer, 2013). In a public blockchain network, anyone may run their own node to process and validate transactions. The blocks are verified by the cryptographic hash which cannot be easily changed or falsified (Peters et al, 2015). If there is a change to any part of the data, the hash will appear to be totally different. The sequence is illustrated in Figure 1 below.

Figure 1: The mechanism of securing transactions on blockchain

The inclusion of the cryptographic hash makes fraud difficult. It is the key innovation that makes a blockchain secure. It solves the problem of the order of previous digital transactions being manipulated by a malicious party seeking to defraud others. Were someone able to alter the order of previous transactions, they could insert a transaction before a payment to another individual, draining their funds. This would result in the latter payment failing, leaving the recipient unpaid. Blockchain eliminates this so called “double spending problem”, according to Hoepman (2007).

The unique hash identifiers in a blockchain will show as being different if any of the transactions within a block are modified or tampered with. Figure 2 illustrates how the hash of a block is used within the header of the next block to verify the history of events. The process of checking that transactions have not been modified is called validation. Buyya et al (2008) illustrate this works within decentralised networks, in other words over the internet. In this way, financial payments can be carried out, with transactions sent and stored on the internet using multiple online validation nodes and participants in the network. Blockchains are therefore sent to and stored on distributed ledgers. There are multiple copies of it kept by multiple parties, and any may verify the records at any time.

Figure 2: Illustration of the chaining of blocks, through the incorporation of the previous block hash in the next block header. This prevents alteration of previous blocks’ contents, and preserves the order of blocks, and therefore transactions.
The reason for the attention afforded to blockchain is that it has the potential to evolve into the next generation of the internet for financial processes. This is because it can facilitate the exchange of assets or information between various parties without the need for a trusted intermediary. Several features of blockchain technology make it particularly attractive. These include the immutability of digital records, and the resulting traceability and proof of ownership. The security and privacy of blockchains have captured the attention of financial market participants. With controlled access to distributed ledgers, financial transactions can be stored on the internet rather than simply on the server of individual banks. This makes them less dependent on legacy systems.

CRYPTOGRAPHY AT THE CORE

Security is at the core of blockchain, and as such can also be used to create digital currency. This is because the cryptographic hashes can not only be used for connecting the blocks but also for confirming the validity of blocks containing transactions. Cryptocurrencies such as bitcoin, litecoin and peercoin use this process, referred to as mining, as the basis of their security. The process of mining is used to ensure that blocks added to the ledger require a predictable amount of work to be carried out. This prevents any one party from dominating the blockchain by having a monopoly over the creation of new blocks. To reward miners, the successful creation of a new block results in the award of some new bitcoins to the miner. The limited supply and proof of work add to the ‘attraction’ of the use of such digitally based currencies. There are a few hundred such cryptocurrencies, called altcoins. Whether any of these will become a global success is debatable, but clearly there is potential for the world to move to a digital currency in the future, now that the technology is available.

Bitcoin was the first blockchain use in currency transactions (Nakamoto, 2008). Bitcoin, as a digital cryptocurrency, is secured by cryptography, rather than legislation, and is therefore operated independent from national or international regulation by governments or authorities, although parties participating in the network may be regulated within their own jurisdictions.

As said, cryptography is one of the core features of blockchain. The other is peer-to-peer networking, explained by Koshy et al (2014). They point out it solves the communication protocol known as the Byzantine Generals’ Problem that was identified by Lampport et al (1982). This is what is termed a logical agreement problem and is based around how multiple parties can reach a consensus without any party being able to mislead the others. In the context of blockchain, the agreement relates to the transactions. Feldman and Micali (1997) demonstrated that by using this protocol, no network user can ‘betray’ others unless more than half of network participants take a control of the network. This is what is termed a ‘51% attack’. This risk is reduced through the distributed nature of the blockchain network, allowing everyone to participate.

One of the advantages of blockchain is that it enables what have become called ‘Smart contracts’ to be encoded within blocks, and executed automatically and impartially by software (Kosba, A. et al., 2016). Train commuters may be familiar with the basic building blocks of a smart contract, as this is similar to how their journey is recorded, or their season ticket validated, when they touch their card on the entrance sensors, as illustrated by Poon & Chau (2001). In effect, a smart contract instructs, verifies and enforces a set of contractual instructions. Koshy et al (2014) meanwhile showed that emerging smart contract systems can now allow mutually distrustful counterparties to safely transact financial settlements without a trusted intermediary.

Another advantage of blockchain usage is that it can potentially reduce operational expenses for the processing of large volumes of transactions, by bringing into effect newer and more modern processes, thereby hopefully reducing fraud. It can have a dramatic effect in reducing operational costs in financial incumbents. Traditional financial incumbents are testing and evaluating blockchain for this rather than its attraction as a decentralised structure. Either way, the technology is becoming more widespread.

In 2015 the earliest adopters of blockchain launched a consortium for blockchain technology named R3 CEV. This consortium has gained momentum and has the goal of applying such distributed ledger technologies in financial organisations. It has focused on daily transactions and the sharing of a common distributed ledger system.

The other key initiative is Ethereum. This was first described in 2013 and was officially launched on 30 July 2015. Ethereum is a platform designed to run smart contracts over a decentralised network of peers. A smart contract in the context of Ethereum is described as “an application that runs exactly as programmed without downtimes, censorship, fraud or third party interference”. The Ethereum project’s mission is to fully decentralise the internet. It provides a platform on top of which anyone can create a decentralised internet service secured by the blockchain. Ethereum makes it easy to launch blockchain-based applications without needing to create a new blockchain protocol.

Blockchain technology allows for a new model of consensus and validation of records/events, ensuring that all participants can reach a compatible and congruent view of previous transactions. The ability to validate transfers or transactions cryptographically provides opportunities for enhancing the security of current trading and settlement platforms. In certain circumstances, such as for high value or priority transfers or settlements, the ability to prove cryptographically that an attempt was made to initiate a transfer at a given time would assist in ensuring the correct relative ordering of settlements, or allow a party to prove the existence of a signed transaction at a certain time, such as to comply with contractual obligations or similar.

THE ROLE OF TIME-STAMPING

The legacy international settlement system is called the SWIFT network. This is not without its security and authentication issues and is becoming very dated. By moving to a model of a blockchain, where transactions are broadcast and validated by others, a more robust security model can be adopted. In that way transfers can be cryptographically verified against the bank of origin. In the event of the transaction being improperly signed, the cryptographic validation will fail, and the other banks will detect this conflict, refusing to honour the transaction, and alerting the issuing bank as to the potential for a compromise of their systems.

One of the challenges of blockchain for banks and financial institutions is that it does not inherently provide accurate time-stamps of transactions. While the blockchain construct gives an immutable history, and verifiable order of events, individual events themselves can only be validated as existing at or after a given point; inclusion within blocks is not guaranteed, and if two rival blocks were produced at the same time, this will result in a clash causing one block to appear before the other. The transactions from the second block will still be included in the network, but may appear at a time later than would otherwise be indicated from their position within the chain.

More generally, within a blockchain, the content need not only be financial transactions of a currency-derived commodity; assets or other property could have verifiable and accountable ownership transfers
carried out within a blockchain. For example, house sales could be carried out on a form of blockchain, allowing government to ensure that all transfers are properly registered and thus that taxes are correctly paid. In addition, such a construct could facilitate interesting future opportunities to make doing business online easier. With such a registry, a user could, in theory, cryptographically prove ownership of their own home within seconds, allowing a lender to offer them a secured loan immediately. Tenancies could be agreed digitally, with a blockchain used to identify ‘rogue’ unregistered landlords, since tenants would lodge their contract and deposit via the blockchain. Unauthorised subletting could be similarly detected.

One fallacy about blockchain comes from the perception that exposing transaction data over the internet is insecure. Blockchains need not be fully exposed to the public. An entirely private blockchain is possible. It could be held between a group of mutually trusting entities such as banks. Alternatively, a hybrid blockchain is possible, whereby anyone may read the blockchain, but only authorised members may append to it, perhaps for transfers of restricted assets. The other fallacy is that it is insecure because unknown and faceless programmers are developing it. This overlooks the power of group software development, which historically has proved superior to single code production, and the ability for anyone to inspect open source code for quality and correctness. Critically, one should also point to both the large data demands of blockchain, as well as the amount of processing power required to create cryptographic hashes and validate the transactions. These two areas, blockchains biggest weaknesses, require further academic and practical investigation.

In conclusion, the security, reliability and effectiveness of blockchain will result in more efficient and cheaper financial transactions. We recommend that financial institutions evaluate its adoption. If this happens, blockchain has the potential to significantly transform banking through new models for the processing of transactions in a distributed manner, rather than the current more centralised approach.

BIBLIOGRAPHY


HYPOTHESIS: RISK, LIKE MASS AND ENERGY, CAN NEITHER BE CREATED NOR DESTROYED. DISCUSS
(submitted 27 February 2017)
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ABSTRACT
The authors imagine the title as an essay question in a final financial examination and use this as a stepping stone to look at issues surrounding risk in financial products, the forms risk may take, and the difference between perceptions of risk and reality. Questions are also raised about the impressions of risk levels that may be conveyed to clients by advisers and wealth managers.

INTRODUCTION
We start with a deliberately provocative statement in the form of a hypothesis, potentially to be disproven, but to provide a focus for clarifying awareness of the risks inherent in financial products. Thus to slightly expand the title of this article:

Hypothesis: for a given level of expected return, risk cannot be created or destroyed, it can only change form, unless a financial asset is bought or sold.

Readers may readily object on the basis that they can quickly see ways of creating or extinguishing risk – and we agree. Other methods of transferring risk include the use of derivatives. However, like many good exam essay questions, the key aspect may not be the final answer, so much as the thought processes and how they are arrived at. Several are explored below. A strong understanding of the many different forms that risk can take is beneficial for portfolio managers, but it is also extremely important that wealth managers and advisers effectively communicate product risks to clients.

CREATION AND DESTRUCTION OF RISK
In everyday life, personal risk can easily be created. Consider if one wants to cross a busy, hazardous road to reach the sweet shop on the other side. Stepping onto the road creates risk, returning to the pavement (or reaching the pavement on the other side) extinguishes that risk.

In the world of financial markets risk is acquired by investing in an asset. Once acquired, the value of an asset will generally have an uncertain future, thus it carries financial risk. The removal of that risk is accomplished by selling the asset, accepting its current price. For the sake of this article, we assume that cash has no risk, although at times history has proved this to not be the case, and a degree of inflation risk is frequently present. This represents a convenient simplification for the current discussion. Alternatively, the arguments could be phrased in terms of additional risk above that of cash.

This explains the appearance of ‘… unless a financial asset is bought or sold’ in the hypothesis, but introduces a suspicious appearance of the word ‘generally’, italicised above. As is so often the case, by exploring one issue with the hypothesis, another has been revealed. Nevertheless, the purchase and sale of assets as a means of taking on or removing risk seems sufficiently fundamental. This would appear to be a useful step forwards.

RISK AND RETURN
The assertion was that once acquired, the value of an asset will generally have an uncertain future. If the word ‘generally’ had not been included as a get out, the reader would surely have countered “but what about the risk-free asset?” or some such, pointing out that some assets have a predetermined value at some future point guaranteed by exemplary issuers. Indeed, such assets might be at least as safe as the cash that has arbitrarily been declared as having no risk.

By including in the hypothesis ‘for a given level of expected return’, we appeal to a generalised risk-return trade-off, whereby riskier assets (whatever that means) are generally accepted to have a higher level of return, a sort of idealised Capital Market Line or risk premium expectation, for example see [1], [2].

Another way of looking at this may be to imagine two financial products which offer the same level of return, but purport to do so at markedly different levels of risk. This raises the question as to why the two risk levels are so different and to wonder where the risk has gone. Does the lower risk product really have as little risk as it claims to? This smacks of ‘if it seems too good to be true, it probably is’ and so raises curiosity, or maybe suspicion, depending on the opinion of the motives involved.

So, we proceed with our thought experiment on the basis of risk ‘for a given level of return’, since it allows us to explore some interesting ideas around the transmutation of risk by financial alchemy.

ELEMENTS OF RISK
The word ‘risk’ is mostly used in a rather imprecise way. Does it mean volatility (here referred to as market risk), credit risk, risk of default, liquidity risk or what? In the current discussion, it should mean all types of risk, both those above and more, and indeed this is rather the point. Risk may be regarded as not having sufficient cash when it is required, which helps emphasise that volatility (or market risk) is hardly a complete measure of risk alone [3]. This is where the transmutation of risk between its different ‘elements’ comes into play.

There are a number of different ways of breaking down risk into its component parts (see [1], [4], [5], [6]). The breakdown below is intended to be illustrative rather than comprehensive. One breakdown of risk into elemental components is as follows.

<table>
<thead>
<tr>
<th>TOTAL Risk</th>
<th>Market risk (volatility)</th>
<th>Credit risk</th>
<th>Counterparty risk</th>
<th>Liquidity risk</th>
<th>Term risk</th>
<th>Other risks</th>
</tr>
</thead>
</table>

In outline, the risks above are market risk as captured by volatility or pricing variability; credit risk that a bond issuer will be unable to pay or be downgraded; counterparty risk that the other party to some agreement will be unable to meet their obligations (often in relation to over-the-counter derivatives); liquidity risk that a would-be seller of an asset finds that when they need to sell, they cannot, or no buyers can be found at a reasonable price; and term risk that an asset holder is locked into their position for an extended period and finds themselves unable to exit should they need to do so. Some of these may be so-called ‘tail risks’ in that they would only materialise under fairly extreme conditions. Of
course, until such time as it is no longer possible for them to occur, this does not mean they do not exist.

Since the above list is not comprehensive, the final element of ‘other risks’ is a catch-all, which would, for example include risks such as currency risk, operational risks and others not listed.

Clearly several of the risks listed are interrelated, for example credit risk and counterparty risk both relate to the failure of a counterparty to meet obligations, although they have slightly different connotations. Similarly, liquidity risk and term risk are related, since a lack of liquidity could arise as a result of being locked into a product for an extended term.

The hypothesis now reveals a slightly sinister aspect; some sorts of risks can be readily measured (and will therefore tend to be visibly reported as ‘risk’), while there are those that are harder to measure. These harder to measure risks can easily become neglected, and potentially swept, invisibly, under the carpet – until of course such times as they are uncomfortably proved to matter after all.

Thus, we are broadly interested in risk for a given level (or expected level) of return and by our hypothesis, ask whether actual total risk levels are indeed similar, even if headline risk numbers (likely only volatility and maybe credit risk) are markedly different.

The visual image is to think of total risk rather like a balloon – on its surface are indicated areas labelled as ‘volatility’; ‘credit risk’, and so on. If a product’s risk balloon (with a given level of return) is squeezed to diminish volatility, the hypothesis suggests that the balloon must bulge out somewhere else, perhaps at ‘credit risk’, or ‘counterparty risk’ – since the air volume inside the balloon is fixed (for the scientists, we assume an incompressible gas inside the balloon).

THE ALCHEMY OF RISK

To support the hypothesis, we now look at some examples which may be informative for the reader and start to draw out some of the less obvious risks of certain varieties of financial products.

Consider three simplified fictitious products, all of which offer similar expected returns, say in the order of mid-single-digit annual returns.

1. A large fund, thoroughly diversified across asset classes and geographical locations.
2. A company offering an actuarially ‘smoothed’ return based upon investment in its underlying large multi-asset fund, with lock-in periods and periodic bonus payments.
3. Investment in a well-diversified portfolio of assets with a guarantee that the value of the investment cannot fall below 80% of the initial investment, potentially for a small premium (which it is assumed does not materially affect the returns).

In the case of the first, the well-diversified fund, there would be a degree of volatility in quoted fund prices, which is market risk. The fund also carries a range of other risks, such as credit risk if it includes bonds, liquidity risk if some assets are not immediately saleable and so on (see figure below).

Turning to the second product. This apparently, being smoothed, may have little volatility. Does this make it lower risk? Not by our hypothesis. So how has the reduction in volatility been accomplished? In the example, the company offering the product has a large underlying portfolio of assets, which, for simplicity we assume as being like the well-diversified portfolio of the first case. The company then puts assets on one side during good times (reducing the investment return), and uses these during bad times to smooth volatility. This depends on the financial strength of the company in question – the investor has replaced market risk with counterparty risk. Even if the company manages the process with a large underlying pool of assets set on one side, this risk is still present in some form. Additionally, the lock-in periods present the investor with liquidity risk (if they decide they need to encash their investment early) and term risk since they must remain invested for suitable periods to receive the bonus payments. The lock-ins and periods required for bonus payments may also increase counterparty risk by keeping the investor exposed to the product for longer than they might have been otherwise.

For the third case, there may be some volatility in the portfolio, as in the first case; but apparently this is capped at 20% downside, since 80% of the initial investment value is guaranteed. But how is this guarantee accomplished? It may be that the sponsoring company uses its own financial muscle (adding counterparty risk), or it could use derivatives to lay off the risk. If derivatives are used, these could be over-the-counter, which means the risk has been sold to a limited number of other market participants (also counterparty risk), or else exchange-traded derivatives could have been used. Exchange-traded derivatives may permit the nearest thing to the ‘destruction of risk’ in this context, because they are guaranteed by the exchange via ‘novation’ – but what this really means

Illustration of the alchemy of risk. Market and credit risk may be apparent, while other risks may be less obvious.
is that the risk of failure has been spread over all market participants – thinly spread if the sums are small, as over many participants – but still there, lurking as risk, and not destroyed.

LIQUIDITY RISK

Now consider a different proposition, a comparison of a fictitious direct commercial property open-ended fund (whereby the fund itself owns physical buildings), with a fictitious multi-asset fund invested in a range of equities and bonds. The multi-asset fund undoubtedly exhibits volatility, seen through daily price fluctuations, with credit risk from the bonds it holds and so forth. Meanwhile the direct commercial property fund appears to have low volatility, suggesting lower risk. But is this really the case? The direct property fund will hold some liquid assets to meet investor redemption requirements, but apart from that it owns buildings. Its prices only change by small amounts because the majority of its assets tend to get revalued either by a surveyor reappraising them, or else when sold. If many investors in this fund wished to redeem their holdings, once the liquid assets are exhausted, the fund manager must sell buildings to raise cash – a slow and uncertain process. Indeed, if the manager becomes a forced seller he is unlikely to realise a good price for the buildings sold. Thus this fund may be low in volatility, but it clearly carries liquidity risk. The risk balloon may have been squeezed around volatility, but the illiquid nature of property means it bulges out at liquidity risk.

DISCUSSIONS BETWEEN CLIENTS, ADVISERS AND WEALTH MANAGERS

The examples above illustrate the important roles that advisers and wealth managers play when communicating product risks to their clients. Many products have been developed that appear to reduce risk, perhaps by reducing apparent market volatility. However, on closer examination these may bear higher risks elsewhere.

In the examples above, even a large well-diversified fund is likely bearing risks that may not be well captured by volatility (eg, credit risk for any bonds held). The other structures, developed to reduce market risk, replaced it with counterparty, liquidity and term risks. In the case of direct property funds, while volatility may appear lower, the limited availability of readily saleable assets in fund portfolios means that this has been obtained at the expense of liquidity risk.

It would be easy for advisers to promote assets with apparently low volatility for the expected levels of return as ‘lower risk’ to clients, however it would appear likely that the lower volatility has been achieved by the assets taking on higher counterparty, liquidity or other risks by way of counter-balance. In these circumstances, it is crucially important that advisers and wealth managers work hard to ensure that their respective client bases fully appreciate the sources of risk taken on, rather than focusing solely on areas where risk may have been reduced.

IN CONCLUSION

As a practical tool the hypothesis seems to have proven quite useful. Really what it does is remind us to explore where the risk has gone, and to help focus our minds when faced with the ‘if it seems too good to be true …’ suspicion. It also helps an investor appreciate that with risk it may be a matter that you cannot avoid it, but that you maybe can choose which kinds of risk you are prepared to accept, if you like ‘you pay your money and make your choice’. Apart from being a useful mindset for portfolio managers, it is extremely important that both of these aspects are effectively communicated by advisers and wealth managers to their clients.

So, on balance, we stand by our hypothesis, provided we are not asked to define anything too rigorously.

Hypothesis: for a given level of expected return, risk cannot be created or destroyed, it can only change form, unless a financial asset is bought or sold.

REFERENCES


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Quintin Rayer, Chartered FCISI, is a Chartered Wealth Manager. He holds a Physics degree from Imperial College London and a Physics doctorate from Oxford University. Quintin has applied knowledge from nuclear and aerospace engineering to areas in finance, working for actuarial and investment consultancy firms as well as a multinational European bank for nearly ten years. Projects have included substantial and innovative development of quantitative fund selection and analysis techniques, risk monitoring and portfolio optimisation, including in-house training for analysts and relationship managers. Quintin has completed the Sustainable Investment Professional Certification (SIPC) with the John Molson Business School, becoming this programme’s first graduate in the Channel Islands and the second in the UK.

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The commitment of global leaders to increase the G20’s GDP annual growth rate by at least an additional two percentage points by 2018 (G20 Leaders’ Communique, Brisbane Summit, 15–16 November 2014), ie, not less than up to 5% growth per annum, up from the present rough average of 3%, is difficult to fulfil even if it is backed by the priorities of the 2017 G20 German presidency – “to reduce economic, social, ecological and political risks and to safeguard strong, sustainable, balanced and inclusive growth through collective action”, to “pursue three aims: building resilience; improving sustainability; assuming responsibility”.1

Today, when the development of the world economy is not keeping pace with expectations, when “alongside stabilising the world economy and financial markets, numerous global challenges are on the G20’s agenda, including geopolitical conflicts, terrorism and migration and refugee flow, as well as hunger, ongoing climate change and pandemic”, when “we are witnessing the rise of uncertainty and anxiety … doubts about the benefits of globalisation and free trade” and “in an increasingly multipolar world, the international community thus also finds itself confronted with the risk of increasing fragmentation of the international economic order”,1 the implementation of the above G20 commitment requires a proactive search for new drivers of global growth and integrity. One such driver is the Chinese One Belt – One Road (OBOR) initiative, which has received great attention and broad support almost everywhere.

The OBOR concept, jointly released in March 2015 on behalf of the State Council by China’s top economic planning agency, the National Development and Reform Commission, and the Ministries of Foreign Affairs and Commerce of the People’s Republic of China (PRC) and entitled ‘Vision and actions of jointly building Silk Road economic belt and the 21st century maritime Silk Road’, provides a great deal of creativity and flexibility to all the interested parties. The framework character of this document, with minimum details and a clear declaration that the OBOR is open to all nations and not limited geographically, is explored by various stakeholders, promoting their vision of this mega project.

For example, the Silk Road Chamber of International Commerce (SRCIC), founded in Hong Kong in December 2016 “to renaissance the Silk Road and to enable business participation in the investment and trade opportunities it offers”, brought together high-level representatives from 39 countries as founding members. The total number of countries represented in the SRCIC is now more than 50. The SRCIC has established five professional committees: on trade; finance; culture; transportation; energy; and seven sub-organisations, including eSilkRoad, Silk Road International Development Fund, Silk Road Think Tank Association, Silk Road Trade Expo Park, Silk Road International Commodity Exchanges, Silk Road International Association of Museums and Grand Beauty International Cultural Art Trading Center.

### INTRODUCTION

The OBOR concept is being discussed between China and Russia at different levels. The leaders of the two states have reached a consensus on tapping co-operation potential and advantages, by intensifying bilateral ties in energy, high-speed railway and infrastructure, aerospace and aviation, manufacturing and agriculture, investment and finance, and other fields. Moreover, both sides have agreed to reconcile the construction of the Silk Road Economic Belt (SREB) and the Eurasian Economic Union (EAEU) with possible participation in joint projects of the Shanghai Cooperation Organization (SCO) member states as well. The accession to the latter of India and Pakistan increases the SCO population to almost half of global total. The combined resources of SCO and EAEU countries are self-evident and both organisations are open to new members who share their fundamental principles.

The SCO decision on the accession of India and Pakistan and simultaneous Brexit announcement indicate the existence of dual trends in Greater Eurasia development – for integration and for disintegration. This shows the importance of an attractive and reliable platform for the idea of a single economic space from Lisbon to Vladivostok and from Helsinki and Archangel to Singapore and Mumbai. This major platform could be formed by a Trans-Eurasian Economic Partnership (TEEP) with a common transport and logistics network as its main pillar. This would add to the OBOR initiative a top-level infrastructure mega project, with virtually unlimited potential for development. Together with the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP), no matter what form they might take in the changing political environment, TEEP might well lead to a common Transcontinental Development Belt (TCDB).
other continents, as well as the proposed Transcontinental Development Belt, are an alternative to the attempts to monopolise all benefits from new technologies and to create the barriers to the broad spread of breakthrough innovation in order to maximise technological rent.

HIGH-SPEED TRANSPORT CORRIDORS

An extensive network of high-speed transport corridors with all the modern logistic facilities across Eurasia form the basis of the TEEP project. The creation of such a network provides the opportunity not just to upgrade the infrastructure for ease of communication, but to secure inclusive and well balanced development in different areas. One of the main routes between east and west in the new Eurasian transport network should be the high-speed Beijing-Moscow-Western Europe transport corridor with its spur lines to the Baltic, Atlantic and Mediterranean states in the west and to the Pacific, south and South-East Asia countries on the other side. Modern traffic arteries should reliably link with the neighbouring states the countries of the EAEU, the Commonwealth of Independent States (CIS) and SCO, restoring to a new level an ancient route from the Varangians to the Greeks and forming a powerful north-south transport corridor. Passing through Armenia, Georgia or Ukraine, new transport routes will help to resolve the existing conflicts, and they should contribute to economic growth almost everywhere. The commercial attractiveness of high-speed railway links from Central Russia through Belarus to Poland and Germany, with possible outlets to Lithuania and the Kaliningrad Region, is clear.

As an example, the 770-kilometre Moscow-Kazan high-speed railway segment has been designed for bullet trains capable of running at up to 400km per hour. This pilot Russia-China joint construction project is expected to be followed by others, with various routes which are shorter than any by sea (Russia can offer the shortest route possible in both cases), but considerably more expensive. However, the existing Trans-Siberian Railway (TSR) utilisation ratio (that is used to deliver cargoes from Shanghai to Brest and further to the EU) is close to its maximum. Meanwhile, several bottlenecks remain in its Siberian and Far Eastern parts. By contrast the utilisation ratio of the other mainland route going to Europe through Kazakhstan and the central and European parts of Russia is estimated by experts to be less then 25%. Improvement in logistics all over the TSR and the removal of bottlenecks should help promote the successful development of all the land routes from China through Russia and Kazakhstan as well. According to the same experts, successful integration of new techniques and technology, including the digital economy, will significantly reduce the costs of land transportation on any routes from Asia to Europe and thereby increase their competitiveness.

Enabling the full capacity of the central route of trans-Eurasian transport and logistics corridor with an upgraded trans-Siberian line does not preclude the development of other routes that may be also commercially viable. One such route, the China-Mongolia-Russia Economic Corridor, provides for the implementation of about 30 projects agreed by all three parties on the sidelines of the June 2016 SCO summit in Tashkent. Another route can go to Russia from eastern China through the Altay directly.

THE FINANCING CHALLENGE AND OPPORTUNITY

It is reasonable to ask: how can such projects and programs be funded and who is able to support TEEP and TCDB mega initiatives financially? The answer lies in public-private partnerships (PPPs) at national, regional and global levels. Likely sources of capital include conventional multilateral development banks (MDBs) and other similar institutions, as well as new ones, such as the Asian Infrastructure Investment Bank (AIIB) or the Brazil, Russia, India, China, South Africa (BRICS) New Development Bank (NDB). Each of these has authorised capital of $100bn. The AIIB, where China, India and Russia are the main shareholders, approved loans of $1.73bn in its first year of operation, from January 2016, to support nine infrastructure projects in seven countries. The Bank started its credit activities with co-financing from the World Bank, Asian Development Bank (ADB) and European Bank for Reconstruction and Development (EBRD). The NDB, which approved its first block of projects in 2016,

expects its lending to double every year over the next two or three years and plans to leverage $10bn in six to seven years. But the development of project financing in the PPP format in the scope adequate to their mandate remains a challenge for both banks. And in terms of budget constraints this is an important reservation.

The Eurasian Development Bank, International Investment Bank and Black Sea Trade and Development Bank, as well as the European Investment Bank and Nordic Investment Bank can all find decent roles in this mega project. Its successful implementation could be promoted by developing some TEEP-related bankable and investment-ready project pipelines on national, regional and global levels.

MDBs can serve as catalysts, attracting private investment for challenging projects and programs by use of guarantees and co-financing, focusing more on their construction phase, which is especially important for infrastructure development. Building up infrastructure project preparation facilities already established by EBRD and ADB, for example, as ‘assembly lines’ for cross-border infrastructure development projects, MDBs can play an invaluable role in the development of Eurasian transport corridors and logistics facilities.

ENHANCING CONVENTIONAL FUNDRAISING

To secure adequate financial support for projects of TEEP and TCDB magnitude, it will be worth enhancing conventional fundraising with some form of special purpose vehicle (SPV). The construction and exploration in the late 19th to early 20th century of the Chinese Eastern Railway (CER), also known as the Chinese Far East Railway and Manchurian Railway, might provide some useful experience, which can be developed to reflect current realities.

The Chinese Eastern Railway Joint Stock Co. (CER JSC) was built with the participation of foreign capital in record time (six years, from 1897 to 1903) in harsh conditions. The railroad was severely damaged during the Boxer Rebellion that swept the Qing Empire in 1899–1901. This multimodal infrastructure project eventually became profitable. The new route provided a shortcut from the world’s longest TSR near the Siberian city of Chita via Harbin (built as the CER capital) to Vladivostok and Port Arthur, with further connections to Beijing, Seoul and other major cities. Management of the project was entrusted to the Russian-Chinese Bank (RCB) established in December 1895. More than 60% of its capital came from four French banks and 15% from the St Petersburg International Commercial Bank, which was under German influence. The Chinese envoy to St Petersburg and Berlin (who later became the first chairman of CER) signed the 80-year concession agreement for RCB, and the CER JSC Charter in December 1896 was approved by Nicholas II.

The concession agreement granted CER the sole right of management over vast areas and this was used to the full. The CER had not just the railroad and the rolling stock at its disposal, but also a variety of production facilities and farmland. The CER also built its own maritime fleet and ran regular shipments to Japanese, Korean and Chinese coastal cities. To finance its development, the CER arranged some 20 bond issues that were taken up by the Russian government and also placed in the markets elsewhere.

THE ROLE OF SPECIAL PURPOSE VEHICLES

To finance the TEEP mega project, even the resources of the $40bn Silk Road fund will not be enough. Loans and investment from the development banks are also of limited application. So there is a need to consider the possibility of establishing as an SPV some specialised mega fund, that may issue international infrastructure bonds with partial state or interstate guarantees, and to register a major management company, inviting world-class financiers and entrepreneurs with impeccable international reputations to its board. The fund with the management company could be domiciled in one of the leading international financial centers (IFCs), such as Hong Kong or Singapore, or Astana, where the IFC is being launched shortly, or even in Russia if the plans for an IFC in the country are finally implemented. Other possible options include the Big Ussuri island on the border with China and the Baltic Peninsula split on the Russian border with Poland. The SPV-issued bonds may be convertible into the shares of the funds themselves or into the shares of the financially supported enterprises, if the respective project portfolio will be attractive enough for the bond owners. This frees the issuer from having to repurchase at least part of the bond issues at their term and makes the guarantees little more than a formality.

Joining the TEEP mega project, through participation in the development of its transport and logistics components, of business circles from EAEU-CIS, BRICS and SCO together with entrepreneurs and investors from Japan, Republic of Korea and South East Asia states, from western Europe and North America will translate the idea of Greater Eurasia Economic Union from the scope of scientific and political discussions to practical actions. Speaking in June 2016 at the St Petersburg International Economic Forum (SPIEF), the then UN Secretary-General Ban Ki-moon outlined “the critical importance of further economic integration and co-operation in this region. However, he noted: “We see countries breaking ties and building new barriers. History tells us that this is not the right direction for Europe. We need to strengthen ties and build bridges, instead of building walls … Let’s work together to make this world better. “The proposed project is designed to build such bridges by facilitating joint work and strengthening mutually beneficial ties. It is hard to imagine another initiative more suitable to fit the bill of “the drivers of economic growth” that the global leaders had in mind when they endorsed in 2014 the G20 Global Infrastructure Initiative (G20 GII) in Brisbane, or when they endorsed two years later in China the new Global Infrastructure Connectivity Alliance Initiative.

All of Eurasia could become a territory of accelerated growth. Sustainable development could be secured by the rational combination and prudent use of its enormous natural resources, production assets, scientific and technical potential, financial and human capital from east and west, north and south. This is the main thrust and the key purpose of the TEEP and TCDB mega projects, in which all interested and committed parties will be welcome.

DR OLEG PREKINS

Dr Oleg Preksin, B20 Sherpa for Russia in 2012–2015, is now a member of the B20 Financing Growth and Infrastructure Taskforce, as well as BRICS Business Council Financial Services Working Group. He is vice president of the Association of Russian Banks (ARB) and has extensive banking experience in Russia and abroad, both in state and private sectors. He was the first Russian director on the EBRD Board, also representing Belarus and Tajikistan. Dr Preksin is one of the founders of the St Petersburg International Economic Forum (SPIEF) and a member of its Initial Organising Committee. He is a member of the Coordinating Committee of the Financial & Banking Association of Euro-Asian Co-operation and of the Eurasian Economic Commission Working Group for the EAEU Integration Mainstream. He is also president of the State of Moscow Academic Art Lyceum Support & Development Fund.
INFORMAL LEARNING DURING PERIODS OF UNCERTAINTY

The CISI is delighted to be involved in a research project on continuing professional development, specifically on ‘informal learning during periods of uncertainty’. This is being conducted by the Open University, Britain’s biggest university, in association with European university partners. For further information and to participate in the research, please contact vasudha.chaudhari@open.ac.uk

RESEARCH RATIONALE

The financial sector in the UK is in a state of uncertainty. Sustaining and enhancing of human capital through innovative professional learning is a priority. However, formal training is not sufficient to help professionals navigate through the uncertainties in the sector. Research suggests that during uncertain periods professionals tend to follow ‘unofficial, unscheduled, impromptu’ ways of learning rather than conforming to structured training. This situation creates several challenges:

- **Challenge 1: Self-regulation**
  Periods of uncertainty are characterised by volatility, uncertainty, complexity and ambiguity (VUCA). Under these circumstances people have to be able to self-regulate their own learning, rather than rely on pre-prescribed courses. The factors that potentially affect learning under these circumstances are unclear.

- **Challenge 2: Support for informal learning**
  Informal learning can be broadly classified into – Self-directed, Incidental, and Socialisation learning (Schugurensky, 2000). According to Cross (2013), 80% of organisational learning falls within these three categories. Yet, less than 20% of learning budget is invested in supporting this. The percentage balance becomes increasingly skewed during uncertain times, as learners look towards informal learning techniques in the absence of formal learning materials, whereas organisations invest more on producing elaborate content to make up for the knowledge gap. Thus, delimiting numeric measures that validate informal learning during uncertain times. This leads to a unique conundrum – on one hand organisations hesitate to invest in learning measures that have limited empirical evidence of effectiveness; on the other hand it is challenging to produce empirical evidence without organisational support.

- **Challenge 3: Intergenerational learning**
  Usually younger people learn from their older colleagues, but in periods of uncertainty everyone is a ‘novice’. Therefore, intergenerational learning may be different. When people self-regulate their learning they may seek help from younger/ less experienced professionals, rather than choosing the conventional routes for support. This may impact the dynamics of intergenerational learning. There is little understanding of how this may impact the informal learning culture within the organisation.

RESEARCH QUESTIONS

1. What are the factors that affect learning during uncertain times?
2. How do these factors relate to learners’ ability to self-regulate their learning?
3. Does supporting informal learning techniques impact learners’ perception of factors affecting learning during uncertain times? If so how?
4. How do informal learning techniques impact the dynamics of intergenerational learning in the financial sector?

REFERENCES


1. VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) – This acronym was introduced by US military to describe the conditions in the post-Cold war period. It has since been widely adopted in the business and strategic leadership literature.

LEARNING UNDER UNCERTAINTY – RESEARCH PROGRAMME

This research programme will generate a number of key outcomes:

- Information about how their learners perceive learning in uncertain times
- Information on the dynamics of intergenerational learning in periods of uncertainty.
- An actionable framework that can be used to scaffold informal learning during periods of uncertainty

RESEARCH TIMELINE

To address the challenges presented in the previous section, this research study will be undertaken in three phases:

- **Phase 1: Identify factors affecting learning and self-regulation patterns during periods of uncertainty.**
  **Research design** – This will be the data collection phase, during which financial professionals will be asked to complete three standardised surveys. First survey will gather data that identifies the perceived factors that affect learning during periods of uncertainty. The second survey will be an adaptation of SRLMQ (Milligan & Littlejohn, 2014) that will measure the self-regulation during uncertain times. The third survey will measure the various aspects of intergenerational activities, such as barriers in intergenerational communication, efficiency of learning approaches, usefulness of co-creative space etc.
  **Time commitment** – Each practitioner participant would take around 30 minutes to complete the three surveys.

- **Phase 2: Creation of framework to support informal learning**
  **Research design** – Based on results from Phase 1, a framework that supports informal learning techniques and accounts for perceived factors affecting self-regulation and intergenerational learning will be created. Research partners from the industry will be actively involved in this phase to obtain feedback on the framework in the form of semi-structured interviews.
  **Time commitment** – The duration of semi-structured interviews will be around one hour.

- **Phase 3: Intervention study that tests the framework created in the second phase**
  **Research design** – Practitioners agreeing to participate in this research will be divided into two groups. Each group will be given a scenario depicting uncertain periods and asked to work on the ethical decision making process. One group would be given the supporting framework and opportunity to collaborate with peers in the decision-making process. The other group will be asked to work out the answers in isolation, without the supporting framework.
  **Time commitment** – Each session will be approximately one hour. Practitioner research partners will be actively involved in the designing the experimental scenarios, and can expect to spend a total of two hours, including preparation and execution.