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The Real Tragedy of the Commons



or How To Really Finance our Future

Abstract

This article aims to initiate a debate that has not taken place in monetary economics thus far. In order to finance and regulate global commons, we traditionally rely on a monetary monoculture. In spite of all the intellectual and mathematical scrutiny devoted to the topic, the debate ultimately boils down to austerity or stimulus, to regulatory and redistributive efforts. None of the official academic positions really address the nature of the monetary system itself and its negative impact on sustainability, and thus fail to provide an answer to the question of how to really finance our commons and our future. This is exemplified in the current debate on the so-called Sustainable Development Goals (SDGs) endorsed by the UN in 2015.

The present text aims to provide arguments for a parallel, optional, complementary green quantitative easing in order to overcome these constraints. This argument goes beyond regulatory efforts and co-financed redistribution. The advantages of implementing this or a similar mechanism are manifold: firstly, it can be implemented in a fast and targeted manner and is relatively cheap. Secondly, it would have an anticyclical, anti-inflationary and resilient impact on our trading and payment system. Thirdly, it builds on findings in systems theory, thus avoiding the tedious discussion between the different schools of economics. Fourthly, it addresses findings in the life sciences (neurobiology and clinical and social psychology) in order to provide a match for real human behavior (beyond the homo oeconomicus). Fifthly, it addresses the magnitude, volume and significance of the global challenges ahead. In short: The real tragedy of the commons is based on a new kind of thinking on how to design a monetary ecosystem to make the world a better place.

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1. Introduction: G. Hardin, T. Kuhn and the paradigm shift

According to Thomas Kuhn,¹ paradigm shifts happen when too many anomalies occur within an academic field, scientific discipline or societal context, or when an increasing number of irregularities cannot be sufficiently explained within an existing scientific paradigm. This requires a change both in mindset and in the *modus operandi*, that is, both in the way we think and in the way we deal practically with the challenges ahead. The three most prominent challenges we are currently facing are increased inequality, unemployment and ecological disaster management.² The aim of the present text is to demonstrate that an economic paradigm shift in Kuhn's sense of the word is required in order to finance commons. And this implies a change both in our way of thinking and in our way of doing things.

In 1970, Garret Hardin published a seminal paper on the tragedy of the commons.³ He came to the conclusion that any good that cannot be sufficiently excluded from private use is a common good, and will eventually be either overused or neglected. This triggered several decades of debate, culminating in the Nobel Prize in Economics awarded to E. Ostrom.⁴ Today, the discussion is far from over: the current Sustainable Development Goals (SDGs)⁵ are raising the issue again, as most, if not all of these goals fulfill the characteristics of a common. Here again, the question arises: when a good, a right or a service causing a free-rider effect is either overused or neglected, how can a sound and safe financial incentive be guaranteed?

This concept of commons is an established component in both economic literature and current social debate. Any good that cannot be sufficiently excluded, leading to free-rider and moral hazard effects, becomes a common good. Commons in this sense can be categorized in two major groups: firstly, ecological commons such as air, water, land, and biodiversity, and secondly, so-called social goods such as the right to education, access to healthcare and information. Such social commons then take on the character of human rights.⁶ In both cases, humans should have access to these goods and services and each individual should enjoy equal access to them; therefore, they should be financed, by and large, through the community as a whole. Whereas there is a general consensus on the definition and the social impact of commons, the opinions on how to finance them differ.

The present paper argues that the *real* tragedy of the (global) commons, including social and ecological commons, is not the free-rider problem; the problem is not their excludability. A common is a common is a common, as fresh air will stay fresh air and a human right to dignity,

shelter, healthcare, food and education will remain the same, regardless of the historical epoch and regardless of the dominant economic paradigm in place. We must adopt the economy to the nature of the commons, not the other way round. The *real* tragedy is thus that these commons are encountering an economic reality (and especially a monetary system) that does not take sufficient account of the benefits of common goods. It is not the commons themselves, but the misalignment of the monetary system that is unable to contain, mitigate, encourage and unleash the economic potential of each of these commons for the good of humankind. The thesis is therefore: if we had a different monetary design—in particular a parallel optional currency system (explained in Section 5)—mainly designed to promote commons, humanity would start benefiting from their huge potential, enabling us to live in a more sustainable, more peaceful and fairer world.

It is not for a lack of alternatives, nor for a lack of intelligence that we are unable to establish a different monetary system; rather, it is because of the way we think, perceive and make decisions in a complex world. It comes down to a psychological property distinguishing between linear and parallel thinking.⁷ It is not left or right, Keynesian or Austrian, Marxist, institutionalist or behaviorist economics that will determine a positive outcome to the issue of how to finance our commons, but rather the way we think and perceive the world. In other words: if we seriously took into account the empirical evidence of systems theory, neurobiology, and both clinical and social psychology, we would start considering a completely different monetary system.⁸ Rather than following the paradigm of economic growth first and redistributing part of the revenue through taxation, fees or philanthropy to finance commons second, this paper argues in favor of designing a parallel optional monetary system that matches the nature of the global commons.

Before we explain this mechanism in detail, we first need to look at the significance and limits of the conventional argument on how to finance our commons in greater detail. We will then present new, innovative findings from systems theory and psychology to provide a theoretical and practical background for our argument. Based on this, we will explain and provide evidence to support the idea of a new parallel optional monetary system that will enable and unleash the full potential inherent in the commons.

2. Significance of and limits to the conventional approach

Traditionally, three options have dominated the economic discussion on how to manage our commons: the first is that we privatize all commons and thus solve the challenges of any liabilities associated with them by turning commons into private goods. The second is that we manage common goods as restricted to a defined community, turning them into club goods or cooperative goods, and thus solve the biases that commons create through limited membership, avoiding overuse. The third option is to allow public or state authorities to regulate the usage of commons through laws and entitlements, including co-financing their properties through tax, fees, charity or philanthropy.

The conventional debate on growth and wealth

The debate on how to finance our commons is closely connected to current economic debate. We can identify at least nine approaches seeking to answer the question of how to stimulate the economy in order to create enough wealth for this to be redirected to finance our commons. The following table provides an overview of the most prominent scholars and their arguments.⁹

Proponent	Position	Argument
Larry Summer (2015)	Secular stagnation	High savings and low consumption lead to low mass aggregate demand, leading to low growth rates, low interest rates, high unemployment and a high tendency towards deflation.
Alvin Hansen (1938)	Demographic bias	Aging (mainly in Europe, Russia and Japan) is leading to lower mass aggregate demand and therefore to lower growth rates.
Robert Gordon (2016)	Supply-driven approach	The lack of real technological innovation is causing low growth stimuli, reducing the leverage for distribution and wealth.
Barry Eichengreen (2014)	Human capital theory	Low public investment, mainly in education and on-the-job training, is causing low growth rates.
Ken Rogoff (2015)	Hyper-debt cycle	Following the 2008 crisis, states are overindebted. Ongoing deleveraging and credit restrictions prevent agencies from investing in the future.
Richard Koo (2014)	Balance-sheet recession	In the aftermath of the 2008 crisis, corporate/state balance sheets are overindebted, preventing them from investing in future markets. Premature budget constraints are prolonging this process.
Paul Krugman (2012) G. Friedman (2016) Friedman-Romer-Romer debate	Neo-Keynesianism	Declining aggregate mass demand requires a skillful intervention in the form of an expansive monetary policy and fiscal expansion. The controversy here is whether the stimulus is only short term or causes positive long-term effects.
James Galbraith (2015)	Structural Keynesianism	The lack of mass demand requires the institutional design to be strengthened, mainly through 'big governance', including social security systems, trade unions and progressive taxation; raw material price volatility, dependence on fossil energy and technologies replacing jobs are causing a further decline in growth rates.
John Foster & Robert McChesney (2012)	Marxism/Communism	The tendency towards global monopolization and financialization is what is causing stagnation in demand, growth and jobs.

Table 1: The conventional debate on growth and wealth

There are robust empirical, theoretical and intellectual arguments for each of the perspectives. If readers have the time and intellectual courage to dig into this complex debate, they may either become frustrated because the opposing positions cannot be reconciled, or they may end up with some kind of halfway position in which the results to be expected are suboptimal, expensive and inefficient forms far removed from any Pareto-optimal allocation. All of the abovementioned arguments share a threefold bias: first, none of the positions explicitly consider the Sustainable Development Goals (SDGs); second, none question the structure of the financial and monetary

system itself; and thirdly, all of the abovementioned positions use the same psychology. At its core, the intellectually complex discussion boils down to the controversy of *stimulus versus austerity*. We believe that this has to do a psychological issue: linear, perspectival thinking versus parallel thinking.¹⁰ As mentioned above, if we take findings in neuroscience and psychology into account, we can see that humans have access to at least two forms of thinking, decision-making, problem-solving and perceiving the world and managing its challenges: a linear form and a parallel form. But before we explore these two forms, we first have to answer the question: what are the specifics of how the commons are generally and traditionally financed?

When it comes to achieving more growth and more wealth through either more stimulus and or more austerity, the current debate is dominated by two further aspects: the first refers to the amount of *regulatory effort* needed in the international trading and payment system in order to achieve more power and control over the system. This is about—to use a popular image—putting the toothpaste back in the tube. The second concerns how and to which extent we intend to transfer and *distribute wealth to social and ecological projects*. This procedure, well-known from the Marshall Plan, is a kind of ‘end-of-pipe’ financing and will be described below. Regulatory efforts and financial redistribution features are related, but can be described separately.

Putting the toothpaste back in the tube: regulatory efforts

Since 2008 in particular, efforts to regulate the international payment and trading system have gained momentum. Most, if not all academic and political attention has focused on regulatory efforts that seek to avoid, prevent and manage future crises. There is general agreement that financial crises, especially idiosyncratic ones, cannot be predicted, and that systemic crises require additional regulatory effort to insulate the real economy from these more intrinsic perils.

There is a wide range of literature and political debate on this matter, going beyond the scope of this text. It covers aspects such as greater transparency and accountability within the system, increased sound regulation, international cooperation and reinforced institutions, Basel III (plus), the recapitalization of the IMF, a shift to more macroprudential police tools, and more surveillance strategies such as early warning exercises, mutual assessment programs (MAP) and peer reviews. This debate also refers to a variety of contributions on a different set of risk assessments, like market-to-model versus market-to-market, the so-called ‘too big to fail’ argument, bonus programs

for top managers, the impact of bail-in strategies along a liability cascade and contagion effects (from stock owners to borrowers to clients to the taxpayer),¹¹ and whether rating agencies should serve as a public good and so on. This list is not complete and not fully updated, as regulatory efforts since 2008 alone would fill a volume of some 35,000 pages.¹² The argument on regulatory efforts is more general and fundamental: is regulating the one monetary system currently in place the best way to achieve a maximum of output with regard to resilience, efficiency and sustainability?

Regulatory efforts always tend to be behind the curve, despite their ability to adapt to historical events. What if all these regulatory efforts produce a false sense of control over manifest reality? What if all these preventive regulatory efforts fail? What if regulation of the given system is a suboptimal, wrong approach, like trying to put toothpaste back into the tube, making the overall system even less resilient to future adverse shocks? If we cannot predict idiosyncratic and random crises and events like black swan effects, but want to stop them from becoming systemic risks, then regulating the given system may produce only limited results. In Section 5 we explore a new mechanism that can operate like a shock absorber to provide an answer to some of these questions.

End-of-pipe financing: redistributive measures

The most commonly advocated form of financing our commons is so-called co-financing, which constitutes the core argument in most, if not all economic theories on financing social and ecological commons. Co-financing has the following rationale: goods and services freely traded on the market are taxed and this revenue becomes the main source of finance for common goods. In this widely accepted view, commons are secondary and subordinate to the activities of the free market. Only when the market generates sufficient yields and liquidity and the political will is strong enough can common goods be financed. For example: if a pig farmer wanted to set up a business with 1000 pigs in a rural area, providing jobs for 30 workers and supplying pork to the region, the communal authorities and the media would see this as an innovative investment that deserves to benefit from tax breaks and other state support. But if a nonprofit organization wanted to establish a nursing home for 100 children suffering from parental neglect and educational deficits, where 80 co-workers would find jobs and dozens of additional small and medium-sized firms and hundreds of additional families would benefit, and where the exactly same amount of money is invested as in the pig farm, the project would instead be considered a cost to and burden

for society. This is surprising, given that we know that investing in early childhood has a return on investment (ROI) of 1:10 to 1:15 for society as a whole.¹³ The pork business model will never achieve this ROI and has several negative externalities besides, such as increased water consumption and a negative impact on human health.

This co-financing strategy is a form of end-of-pipe technology, well known in engineering science: we first implement a technology, lifestyle or economic activity that is damaging our environment (polluting fresh air, for example), then add a filter at the end of the process (i.e. at the end of the pipe) in order to avoid too much damage. The co-financing strategy follows the same rationale. The economy grows, we take a certain amount of money (through tax or fees) from the added value chain, and finally distribute it to social and ecological projects.¹⁴

Co-financing strategies' historical roots lie in the Marshall Plan created after the Second World War, which has been imitated several times over the last 60 years.¹⁵ In each case, a defined volume or ratio of gross domestic product (GDP) was donated to a specific goal, encouraging economic growth, increasing income and wealth and integrating the region into a larger whole.¹⁶ Such initiatives function best when the whole international trading and payment system is reliable and stable and provides a constant increase in economic growth. In our current situation, where the currency and derivative markets are highly speculative, offshore and offsheet transactions (8-14% of the gross domestic product, equaling 3 trillion USD) have become a normal procedure and banking, state and currency crises occur repeatedly (not to mention unregulated dark pool, high frequency trading und shadow banking), co-financing and transfer payments constantly encounter an unstable system and incorrect price signals.¹⁷

Traditionally, the corridor of net transfer payments lies between 0.5% of GDP on a global level, 1.5% on a European level to slightly over 2.5% on a national and regional level.¹⁸ Section 4 will demonstrate that if we want to get the empirical figures right, none of these strategies will achieve the required volume or the pace needed to cope with the challenges associated with the SDGs.¹⁹ Before we proceed, however, we have to clarify two crucial but usually ignored findings.

3. Two missing parts: systems theory and psychology

On systems theory: efficiency and resilience

The challenges we are facing can be compared to the difference between a captain and a ship designer. A bad captain can damage any ship. However, a bad design can make a ship unsafe at any speed, so that even an excellent captain would have difficulties sailing safely. In short: the design matters.

To transfer this image to our economic context: while monetary policies, adequate regulation, increased transparency and banking management are undoubtedly important, there is a flaw in the monetary system's fundamental design that causes it to fail constantly despite appropriate interventions. Thus the crucial question is: *what are the variables that keep a monetary system stable, sustainable, reliable, viable in the long term and shock-proof at the same time?*

Findings in systems theory that deal with complex, open, flow network systems where reciprocal causalities predominate²⁰ can help us to identify such variables. A key finding is that any complex flow system is sustainable if—and only if—it maintains a crucial balance between two equally essential but complementary properties: its *efficiency* and its *resilience*. Efficiency is measured in throughput/volume per time unit; resilience is measured as interconnectedness or diversity leading to the ability to recover from a disturbance, an attack or a change in the environment. These are the two most important variables that keep a system stable, sustainable in the long term, and shock-proof.²¹

Both variables are intertwined: a system's resilience is enhanced by greater diversity and a higher number of pathways (or connections) because there are numerous channels of interaction to fall back on in times of trouble or change. Diversity and connectivity also play an important role in throughput efficiency, but have the opposite effect: efficiency increases as diversity and connectivity decreases.

When too much emphasis is put on efficiency at the cost of resilience, diversity is sacrificed. This will automatically result in a systemic collapse, crisis or catastrophe. The opposite is true as well. If too much emphasis is put on resilience at the cost of efficiency, the system will not be viable either; it will become stagnant.²² Such findings have already revolutionized a wide range of fields, including geophysics, engineering, demography, ethology, biology, medicine, acoustics, and

electronics. The power grid, airline security measures, nuclear power units, and agricultural monocultures versus biotopes are further examples.

Furthermore, as a complex flow system becomes more efficient, it tends to build up a kind of self-organizing momentum that eliminates diversity as it gradually streamlines the process. In general, increasingly efficient systems tend to become more directed, less diverse and, consequently, more brittle. The increase of monopolies in the world economy reflects such a development. The point being made here is profound and has wide-reaching implications for all complex flow systems, including our global economy. Since resilience and efficiency are both necessary but pull in opposite directions, nature tends to select those systems that have an optimum balance between the two.²³

Applying systems theory to finance: instability explained

If we look at the monetary domain from a systems theory perspective, we see that we currently have a worldwide monetary monoculture in which the same type of exchange medium is put into circulation in every country: a single national currency created through bank debt, improving efficiency, enabling firms, states and private households to invest and trade whatever they want, irrespective of the potential damage generated by these investment or consumption patterns.²⁴ Such a monoculture leads to a brittle and unsustainable system. The structural solution needed to give sustainability a chance, albeit totally unorthodox, is to diversify the given design, offering a higher degree of resilience in order to channel and process liquidity into the real economy and target economic decision-making towards a desired goal. In short, we need to think about a monetary ecosystem.²⁵

The rationale of such a monetary ecosystem, described in this text, follows a different logic than the conventional perspective does. It is not primarily about additional stimulation, expansive growth and redistributing wealth through taxation and fees, nor about implementing a different technology, nor about increased regulatory effort or transparency. Rather, it is about introducing a monetary incentive that is optional and runs parallel to the given monetary system, generating additional liquidity, trying to meet unmet needs within a different design, and enabling agents to operate in a different way.²⁶ This provides the necessary back-up system that we have in place for any information technology but not for the financial realm. Once in place, such a mechanism could steer

our society in the desired direction, towards more sustainability, more jobs, more social cohesion and less instability and less disaster management.

The hundreds of systemic crashes that have occurred over the past 40 years demonstrate that the system is inherently unstable and has significantly overshot the optimum balance between efficiency and resilience. For example, the post-2008 crisis revealed that growing to the point of becoming ‘too big to fail’ should never be allowed to happen. Despite this, in the USA, the ten largest banks now control over 40% of the market, compared to less than 30% before the 2008 crisis! Taking into account the number of debt (186), state banking (96) and currency crises (180) that have occurred since 1975, considering the consecutive output losses, direct and indirect costs, the additional debt burden and fiscal costs, the pre-post gap for the pension system and the default for ecological projects, designing a parallel currency system would make our world more efficient and resilient at the same time, and would definitely make it cheaper.²⁷

With all these findings in hand, we can now predict with (almost) 100% certainty that more systemic crashes will occur in the near future. This lack of resilience in regard to interconnectedness or the lack of a back-up system will leave the world economy, future generations, nature, developing countries, tax payers and citizens—including the ‘winners’ in our monetary system (if there are any)—with increased efficiency and thus a much higher bill to pay than testing and applying a more balanced approach to our international trading and payment system.

If W. McDonough is right that “the need for regulation is always a sign of a faulty design”, it is the faulty design that determines the negative outcome rather than its users or agents. Findings from systems theory offer us the empirical and theoretical framework for how a monetary system should be designed in order to achieve greater balance, greater sustainability and reliability, greater control and a greater capacity to steer our economy.²⁸ The following graph illustrates the systems dynamic beyond the given controversy of economic schools:

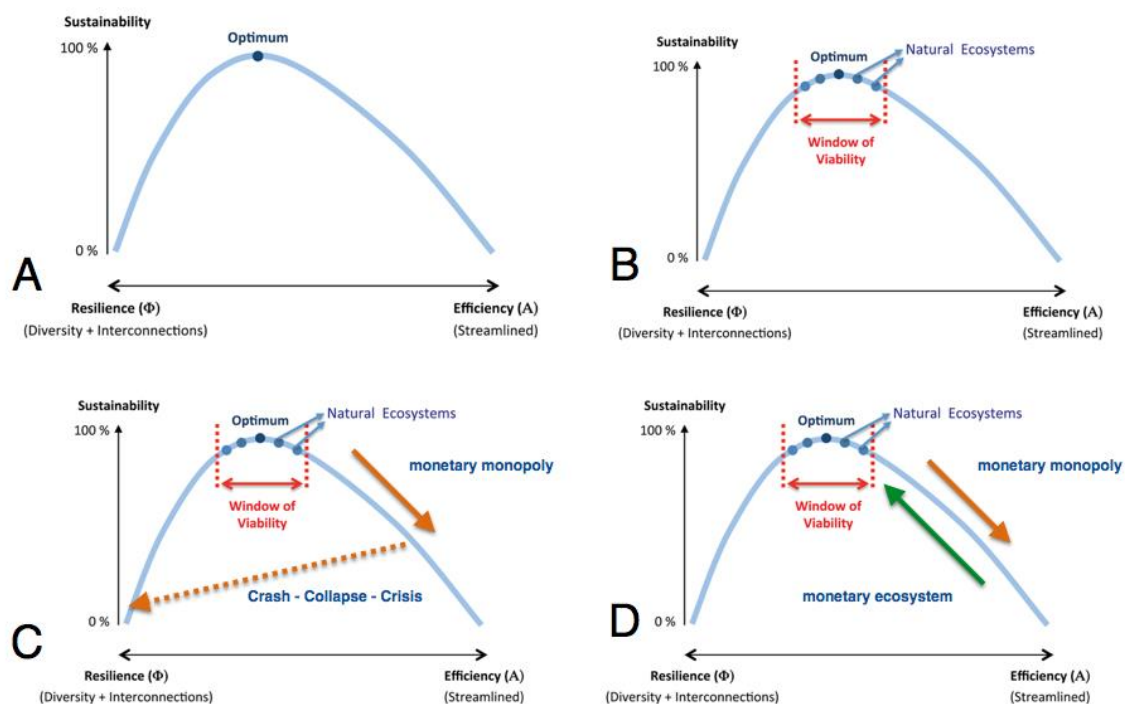


Table 2: Sustainability from a systems theory perspective

A: Sustainability curve mapped between the two poles of efficiency and resilience. In nature, resilience is accorded more importance than efficiency and the curve is steeper on that side of the graph.

B: In the real world, all networks corresponding to natural ecosystems operate around the optimum point within a specific range called the ‘window of viability’.

C: Regulatory efforts within a monetary monopoly will tend to overshoot the window of viability towards more efficiency, sooner or later leading to a crash, collapse or catastrophe.

D: A parallel, optional complementary money system will realign the international trading and payment system towards the required window of viability, enabling a higher degree of resilience.

In other words, a more sustainable financial system requires a 'just-enough' mechanism, and not too much of either efficiency or resilience. The stability of any open network flow system requires a minimum of diversity ($n > 1$). This is true for the international trading and payment system, too. In most human-designed systems, and certainly in the monetary domain, we have been concerned only with efficiency, and have therefore tended to sacrifice resilience unduly. In short, poorly connected networks are fragile, brittle and may collapse when they encounter an unexpected challenge, while overly connected networks tend to become stagnant. Banking and currency crises, state failures, increased market concentration (monopolies), deflationary tendencies, chronic unemployment and increased costs for disaster management are symptoms precisely of such a faulty design.

If there is one lesson we can learn from nature, it is that it does not select for maximum efficiency only, but for an optimum balance between both efficiency and resilience.

Two ways of thinking: dual mental processing and the divided brain

There is a second area of research besides systems theory that applies directly to our field of interest. Traditionally, we have believed that the way we think, reason and conclude is a given. But it is not.²⁹

Neuroscience and clinical psychology teach us that thinking does not equal thinking. There are different forms of thinking.³⁰ Compelling empirical evidence shows that humans have at least two ways of thinking. This is true for the 'brain' and for the 'mind'. Both resonate with the general principle in biological selection theory first described by Charles Darwin.³¹

At first glance, these two ways of perceiving the world, managing problems, evaluating challenges, paying attention and so on are rooted in the properties of our two distinctive cerebral hemispheres. Why did evolution provide us with not one single brain, but two partly separate ones that are interconnected via the so-called corpus callosum? One of the main reasons evolution has favored this form of asymmetry or lateralization lies in the fact that both hemispheres operate and perceive the inner and the outer world differently, providing the human species with two potential modes of thinking. Both of them partly operate in parallel, partly inhibit one another and partly are interconnected, with each offering a different view of the world, oneself and the other. In both cases, the difference is less *what* they do rather than *how* they do it and process the world. The left hemisphere gives us the capacity for focused attention, logical and analytical thinking, reducing

complexity and emphasizing facts and frameworks over contexts and individuals. The left brain has a tendency towards self-reference and relative autonomy that overrides the right hemisphere, potentially leading to a dysfunctional balance between the two. By contrast, the right hemisphere offers a more integral, whole and fractal view on the world; it is more metaphorical and contextualized, parallel processing predominates, and perception is guided by the relation to the external, real world. This specialized division of labor is crucial and humans synchronize and synthesize both halves permanently, increasing their flexibility and adaptability and therefore their chances of survival. If one hemisphere comes to dominate the other, this has a significant impact both on the individual and upon society as a whole. The following table gives an overview of the divided brain:

Left Hemisphere	Right Hemisphere
Focused, narrow attention, reductionist	Broad attention, integral, looks at the whole, fractal
Explicit, verbal and literal, representational	Implicit, nonverbal, nuanced, metaphorical
Closed systems, perfection, neglect of complexity, abstract	Tolerates and acknowledges ambiguity, diffuse and contradictory information
Logical and analytical, thinking in terms of dichotomies	Contextualized, living embodied entities
Sequential, dogmatic, rule-following	Parallel processing
Good at processing predictable, narrow, isolated events	Good at processing new and unique events
Manipulative, interventional, practical utility, fixing things, surveillance, regulatory	Observational, descriptive
Self-referential, autonomous	Connected to the outer real world
Types, categories, facts, generalities, frames, references	Unique, individual meaning, particularities, multiple perspectives
Sticking to mistaken conclusions, path dependency, confirmation bias, rigid	More flexible, adapting to new experiences, changing, detachment
Serving function when balanced with the right hemisphere	Mastering, commanding function when balanced with the left hemisphere
Tends to respond to positive feedback through reinforcement	Tends to respond to negative feedback and balance it out

Table 3: Features of the two hemispheres (see I. McGilchrist, 2009)

To explore the world, we need devices that are detailed and linear *and* fuzzy and holistic. This asymmetry must offer some sort of selection advantage to our species, otherwise humanity would not have been able to survive with such a complex anatomical device.

Such findings are supported by a vast body of clinical research, initiated by Daniel Kahneman and colleagues, which refers not only to the ‘brain’, but also to the ‘mind’, operating on two systems (called system 1 and system 2).³² This dual mental processing property has the inherent selection advantage that humans have access to two completely different perspectives on the world, on problem-solving and on themselves. Both perspectives have their advantages and disadvantages and both systems are interconnected, meaning that in order to operate at their optimum, a flexible use of each system is required.

In system 1 mode we operate intuitively, automatically and implicitly. Decisions are made quickly, associatively and context-specifically; they are fast and integral, and holistic and parallel processing predominates. Here, a lot of information can be processed, but the results are less accurate and fuzzier. Most information in the brain and the mind is processed in parallel. Creativity, humor, ‘Gestalt’ perception, and complex problem awareness are examples of system 1 mode.

In system 2 mode we start allowing more focused, linear, analytical reasoning, leading to slower, discursive thinking. The effort required is greater, the capacity of the working memory is reduced, and the results are path dependent. From an evolutionary perspective, this is the younger system. The advantage is that we end up with accurate, precise results. They are not wrong, but remain incomplete as they have to be embedded in the more complex context within which decisions are made.

In complex, life-threatening situations, humans need the mental ability to focus intently on a situation and also pay attention to the overall situation with regard to side effects, feedback loops, externalities and so on all at the same time. In humans, the capacity of the two systems is greatly enhanced by and located in the prefrontal cortex.³³ When we start thinking in such a systemic, integral, holistic manner, our perception will change as a result, and furthermore our personal gravity of consciousness will shift towards a more integral perspective.³⁴ The following graph offers an overview of the properties of both ways of thinking.³⁵

System 1	System 2
Unconscious reasoning	Conscious reasoning
Implicit	Explicit
Automatic	Controlled
Low effort	High effort
Large capacity	Limited capacity
Rapid	Slow
Default process	Inhibitory
Associative	Rule-based
Contextualized	Abstract
Domain-specific	General
Older in evolutionary terms	More recent in evolutionary terms
Nonverbal	Linked to language
Includes recognition, perception, orientation	Includes rule-following, comparisons, weighing of options
Modular cognition	Fluid intelligence
Independent of working memory	Limited by working memory capacity
Emotional and associative	Logical reasoning
Parallel	Serial

Table 4: Aspects of parallel (system 1) versus linear thinking (system 2)

Apparently, nature did select for an asymmetrical and lateralized, dual-processing way of perceiving the world and oneself. This means: almost all mental properties are located in both hemispheres (emotion, language, cognition, motivation, thought) and in both systems. However, *how* the world is processed is different in each.

System 1 and system 2 and the two hemispheres are not identical to one another, but they reflect a basic principle that can be applied to economic science: we need to access both modes in order to fully balance out the capacity of our brain and our mind.³⁶ Both can inhibit one another reciprocally, generating a dysfunctional dominance of one over the other, and they can be balanced according to demand.

In the following, we would like to apply these findings to the current discussion on how to finance our future. This application is not of academic interest only, but has fundamental societal consequences. One of these is that if we process everything through the left hemisphere and predominantly through system 2, we remain unaware of the full potential humans can apply to solve problems. This means that as long as we are not tapping into the full potential of our brain and of our mind—just using just half of it—we cannot expect to solve global problems of such complexity as global warming, poverty, or simply providing enough jobs, public infrastructure, education and health for the majority of the people on this planet. In other words: the world as seen through the lens of the left hemisphere or through linear thinking has a substantial bias; it is an incomplete and lop-sided representation, providing only suboptimal solutions. Pareto-optimal solutions require not a different market system, nor more governance and state-driven institutions and interventions, nor more regulatory efforts and different forms of disruptive technologies, but a new way of thinking.³⁷ Misinformation, anxiety, time pressure and stress reduce our capacity to integrate and make use of both systems, leading to false conclusions and consequently suboptimal solutions.

Thinking within a paradigm shift, we should first apply system 1, offering fast, high-volume, fuzzy results but integral information, considering all possible solutions, risks and challenges. Once the path is set, system 2 can kick in to provide more detailed and accurate information on how to solve problems. To provide a more concrete image: just imagine a mother bird, trying to feed her offspring. Relying only on system 2 could result in her death and the death of her chicks because she might be eaten by a cat while focusing on the worm (system 2) and not considering the overall potentially dangerous situation (system 1).

For the present text's field of interest—the future of financing the commons—linear, sequential and left-hemispheric thinking has the following consequence: within a given economic value chain process, humanity is left with a limited, end-of-pipe procedure that eventually dedicates and distributes 0.6-2% of GDP to SDGs or commons. Here, we have to be economically productive first and then can redistribute the 'leftovers' to social and ecological projects. What if we started thinking in a parallel way? We have become trapped within the idea that linear, sequential thinking is the only way of mental processing. However, in order to survive and successfully adapt to a complex, non-linear system, the properties of both hemispheres are required.

4. Financing the commons: getting the figures right

So far we have explored the conventional way of tackling social and ecological challenges. We introduced findings from systems theory that offer a different view, in which the optimum of any sustainable pathway lies between the efficiency and the resilience of a given system; and we elaborated upon the full mental capacity of the human brain and mind, distinguishing between linear and parallel thinking. This puts us in a more appropriate frame of mind to evaluate a mechanism that will allow us to transform towards a more sustainable future. When considering how to finance our commons, we need to look at the figures and data through which we have to operate. There are three issues to consider: the ‘lock-in effect’; the ROI on commons compared to state bonds and S&P values; and an estimate of the required volume, exemplified by the Sustainable Development Goals (SDGs).

The lock-in effect

Lock-in means we are bound—more or less—to following a specific pathway, even if we can see that the pathway violates our values and is unsustainable, unhealthy and unfair. The five most important lock-in effects are:

1. We are currently subsidizing our worldwide fossil fuel supply with over 500 billion USD pre-tax every year and generating ten times higher post-tax costs for society as a whole (including social costs). Over 90% of all products and services in the overall value chain of our global economy depend on fossil fuels.³⁸
2. We spend over 2 trillion USD annually on defending ourselves against ourselves and our enemies, involving millions of jobs, sustaining ongoing warfare and asymmetric wars across the globe.³⁹
3. We have a financial system that causes inherent instability. This is extremely expensive, requiring 3-5% of our GDP in direct and indirect costs (over 2-3 years) to partially restore, reshape and stabilize the system so it can fulfill its function of serving the real economy (risk allocation, intermediate function, maturity transformation). These costs are borne exclusively by present or future taxpayers. This money is then not available for social and ecological projects.⁴⁰

4. There is a global debt burden of over 230 trillion USD (1/3 public, 1/3 households and corporates and 1/3 financial sector) that crowds out alternative investments and prevents, creates a backlash against and postpones real investments. In OECD countries, the debt to GDP ratio doubled between 2007 and 2009.⁴¹

5. We have a shadow economy comprising at least a third of our world GDP, including money laundering, trafficking, drugs, illegal financial transactions. The shadow economy is deregulated but interconnected with the conventional sector (financial sector and real economic sector), pulling the world economy in the wrong direction.⁴²

This leaves very little leverage for the global community, regulators and politicians to finance, stimulate and modify our shared growth trajectory towards greater sustainability, fairness, better jobs and a healthy and fulfilled life for over 80% of the global population.

The return on investment approach (ROI)

A well-established method of evaluating future investment is the return on investment strategy (ROI).⁴³ Historical data from the Federal Reserve database⁴⁴ provide the following empirical findings on the arithmetical average of Standard & Poor’s 500 versus three months and ten years of treasury bills respectively.

	S&P 500	3-month treasury bill	10-year treasury bill
1928-2015	11%	3%	5%
1966-2015	11%	5%	7%
2006-2015	9.03%	1%	5,00%

Table 5: Return on Investment S&P 500, 3-month Treasury bill, 10-year Treasury bill

This shows that private and state bonds generated a revenue of 5-10% per annum on average over one hundred years. We can compare these data with the evaluation of the return on investment in common goods exemplified by the Sustainable Development Goals (SDG). These include 17 goals

(mainly commons such as maternal health, poverty reduction, global warming, biodiversity issues etc.) provided by the Copenhagen Consensus.⁴⁵ Several Nobel laureates have been involved in producing the evaluations of this think tank, coming to the stunning conclusion that the SDGs have an arithmetical average return of 1:15 per annum, which is up to 100 times larger than the S&P values or returns on treasury bills.⁴⁶ The challenging issue is that commons are non-excludable, causing free-rider effects, and therefore society as a whole benefits once the commons are in place.⁴⁷

If global commons have such a high proven ROI and private and state investment does not, then two further questions arise. First: what is the estimated amount needed to fully cover all SDGs worldwide? And second: what is the mechanism required to implement their full potential? Could it be that the fault lies not with the commons themselves but with the chosen monetary system, which systematically prevents us from meeting unmet needs and unleashing the full potential that common goods can offer for humankind?⁴⁸

An estimate of the required volume

In September 2015, the world agreed upon a map for humanity's future up to 2030. The 17 targets of the Sustainable Development Goals (SDGs) formulated in this map will replace the Millennium Goals.⁴⁹ This consensus was reached through the UN's largest consultation and review process in history. Hundreds of surveys, expert groups, panels and hearings took place, and millions of citizens were engaged in population-based questionnaires contributing to this agenda. With the SDGs, the world has provided itself with a map charting its course for the next few years with the aim of living in a more just, more sustainable, more prosperous and more stable world. However, this commitment does not come cheap. For example, an additional 30 billion USD are required annually to finance the climate pathway over the next 15 years.⁵⁰ The transition towards a more cyclical economy would cost Europe some 100 billion USD over the same period. According to International Energy Agency forecasts, decarbonizing our power grid would require 20 trillion USD up until 2035. The overall costs for all SDGs are estimated at around 4-5 trillion USD per year in public spending, investments and direct aid. According to the United Nations Conference on Trade and Development (UNCTAD), there is an annual investment gap of at least 2.5 to 4 trillion USD.⁵¹ Despite this global UN consensus on the goals, there is less clarity on how to finance this agenda

towards greater “dignity, prosperity, justice, partnership, planet and people” (Ban Ki-moon 2015). However, if we fail to discuss where the funds are going to come from, the SDGs will basically be stillborn. In short: where will the money to make this huge global shift come from?⁵²

If we consider the most optimistic scenario in which the world economy grows at a rate of 2% per annum over the next few years and we dedicate (through a political process) 1% of world GDP to SDGs, we end up with roughly 750 billion USD a year.⁵³ However, this does not match the estimated volume needed to finance SDGs, which require an investment and aid strategy six to eight times higher. And we have to achieve these goals much faster than assumed.⁵⁴ It would appear that the conventional approach is one scale too small and one gear too low. Then again, withdrawing 6-7% (4-5 trillion USD) of world GDP (75 trillion USD) every year—even if done in a smooth and subtle way—from the market economy and steering it towards the SDGs is economically irrational and would create the largest economic recession the world has seen in modern times.

The question is: what would a mechanism that allows us to manage the lock-in effect, shift the global economy towards a more sustainable future, overcome our linear, sequential thinking and transcend the traditional co-financing strategy look like? And how can this mechanism be designed without neglecting systems theory criteria and findings in psychology?

The short answer is: it should be a collective, pre-distributive, parallel monetary mechanism, reconciling free market economy and state interventionism, allowing agents to make economic decisions that operate in a relatively fast, targeted, resilient, sound and anticyclical manner, where a critical mass can be attained within a matter of months. Such a mechanism that takes account of the differences between the ROI of commons on one hand and private and state investments on the other would be able to change the course of the world economy. It is described in the following section.

5. A new mechanism that can change the world

There have been a wealth of proposals on how to reform and stabilize the existing international trading and payments system, most of which focus on increased regulatory effort, transparency, rigorous taxation or replacing the given system by an alternative—for example, the Chicago Plan in the 1930s, the introduction of gold standard, or its abandonment in the 1970s. These proposals also include current regulatory efforts, such as greater transparency and accountability in the system, increased sound regulation, international cooperation and reinforced institutions, Basel III (plus), the recapitalization of the IMF, a shift to more macroprudential police tools, more surveillance strategies such as early warning exercises, MAP and peer reviews, as mentioned above.⁵⁵

In each of these reform efforts, the monetary monoculture remained and indeed remains untouched. Historically, there has been never any real exit strategy, any real change in monetary policy, or any real governance, only detailed technological questions that fit into the given paradigm of a single monetarily designed international payment and payment system. Even the idea of the three-currency building block (USA, EU, ASIA) did not alter this rationale. While creating a new system is an intellectual challenge, it is much more challenging to take the given operating system and evolve it so it is able to cope with the challenges ahead. It is somewhat like operating on the heart of runner in an ‘Iron Man’ competition while he is actually running.

In the following subsection, we first identify the conventional channels through which monetary regulators operate, including alternative channels discussed in the research. Then we propose a new mechanism for financing our commons, and finally discuss further challenges and consequences arising from that mechanism. It should be noted that the mechanism described needs to meet the criteria found in systems theory (efficiency and resilience) and psychology, so as to better mimic and match both nature and human beings.

How to get it done: finding the right channels

Recent history has shown that the conventional quantitative easing (QE) mechanism has limited leverage to ensure real investment in the real world.⁵⁶ Traditionally, central banks and monetary

regulators have used various channels in an attempt to ensure that the liquidity generated reaches the real economy effectively. Such channels include the ‘banking credit channel’: commercial banks can lend cheap money and offer cheap credit that households and firms can use to build houses, pay for a college education or set up construction sites. Then there is the ‘portfolio channel’: this channel explains the effect of money creation through central banks buying state bonds. These bonds increase in value and decrease the cost of the interest rate, which in consequence encourages rational investors to choose alternative strategies to state bonds. There is also the ‘signal channel’: conventional QE signals to the real economy that interest rates will stay low, which should encourage investors to consume or reinvest in productive assets. Another channel is the ‘wealth channel’: QE measures lead to increased stock-exchange and real-estate values. As 40% of stocks belong to the upper 5% of society (as in the UK, for example), this cohort will consider itself wealthier and consequently consume more, which will then stimulate the economy through ‘trickle-down effects’. A ‘fiscal channel’ follows the argument that buying state bonds increases their value and decreases the cost of interest. These reduced costs for the interest rate leave the public sector with greater leverage for additional public investments in education, healthcare and so on. Finally, there is the ‘interest-rate channel’: low interest is a general incentive to invest in the economy with cheap money.⁵⁷

None of these channels are wrong. Empirical evidence proves that each of them has worked historically in some cases. But none of these channels provide empirical evidence of a causal link between the amount of money created and the amount that finally reaches the real sector.

A number of proposals have developed this traditional mechanism further.⁵⁸ The core argument here is that the QE mechanism should itself stimulate the real economy via a democratic mandate. This can happen through three alternative channels: firstly, as a ‘citizen dividend’, where the additional money is given to private households either directly or via tax reductions, stimulating consumption. Secondly, the money is given to the public sector, stimulating public infrastructure (education, security, health). Besides this ‘public channel’, there is another third channel. Here, the money is given to NGOs, SMEs or local community bodies. All these additional channels would create additional jobs and additional tax revenue; they would reduce expenditure on social security and pensions and create more wealth. As both central banks and governments are public bodies, wins and losses equal out on both sides.⁵⁹ For the UK, the potential benefits have been measured: the Bank of England generated 375 billion pounds through QE post-2008. This additional liquidity stimulated the real economy with eight pennies per pound—meaning 92 pennies remained in the so-

called FIRE sector (Finance/Insurance/Real Estate).⁶⁰ The ‘trickle-down’ was a mere eight pennies! If a different channel had been used, for example one of the three mentioned above, each pound would have generated 2.8 times as much revenue. The difference between the conventional and the alternative scenario is a factor of 35. This means that simply changing the channel can create 35 times more from the same amount of liquidity. In light of these figures, it makes sense to take a closer look at the channels available. In theory, 10 billion pounds distributed through one of the alternative channels could have created an additional 300,000 jobs for the UK by now.⁶¹ Our approach builds on these findings, yet differs substantially from the conventional and the alternative QE described above.

An optional, parallel, complementary QE: steering towards a green future

We could look at this matter from a different angle. Currently we are demanding economic growth first in order to redistribute parts of it to co-finance the commons second. This is not wrong, but it is relatively inefficient, leading a suboptimal allocation of goods and services, as this approach does not take the entropic sector, negative social and environmental externalities, or the shadow economy into account. If we take 4-5 trillion USD as the rough figure required to “make the world a better place”, we might have to consider doing it differently.⁶²

If the major monetary players and regulators (IMF, WB, CBs, UN, governments) were to launch an annual 4-5 trillion USD QE that is linked primarily to commons, the whole situation would change.⁶³ Let us call it a complementary QE (QE-^{COM}) or a QE-^{SDG}, created first and foremost to reach the SDG targets the world has just signed up for. However, a different design and purpose than that of the conventional mechanism (QE-^{CON}) is required. This comprises several additional features and runs *optionally and in parallel* to conventional QE.

The QE-^{SDG} is 100% electronic. No cash will be available, which makes it trackable and recordable and limits access to the shadow economy for money laundering and tax fraud. Governments decide to accept this form of liquidity as official tender, including for the payment of taxes.⁶⁴

The QE-^{SDG} is bounded: in contrast to the QE-^{CON} mechanism, the purpose of the QE-^{SDG} is investments in SDGs only. This restriction of the investment portfolio by and large avoids the

liquidity trap. Bounded liquidity is injected into the real economy directly, and consequently steers society towards greater sustainability.

A ‘banned list’ guarantees that the money is only spent on issues that are healthy, fair and sustainable. While it is difficult to identify a list of positives, it is much easier to come to a consensus on a negative list. This would, for example, exclude drugs, guns, prostitution, human trafficking and so on, but would allow firms, governments and households to cash in their wages for anything else.⁶⁵

In practical terms, a QE-^{SDG} would feed into several additional channels in order to ensure that the money steers society in the desired direction. The following table summarizes some of them:

Complementary Channels	Explanation
Citizen dividend	Citizens benefit from a tax reduction in the conventional monetary field. This reduction is replaced by green USD or green Euros, enabling them to target their consumption towards a greener future.
Advanced market commitment (AMC)	Binding contract by public authorities offering guarantees for a product for a future market once successfully developed (e.g. vaccines).
Private-public partnership (PPP)	Most SDGs operate at the interface between private and public interests, for example upstream financing with mezzanine products (output oriented).
SMEs, NGOs, IGO's, communal public authorities	Instead of leading staff being in charge mainly of raising funds, the expertise of 1 million NGOs worldwide can be put to use directly by offering them green dollars.
Institutional building channel (IBC)	Building governance is key for all SDGs and global commons. Green QE can target civil society (universities, the press and healthcare) as well as administration (communal tax authorities, land registries, sewerage).
Remittance channel	Remittance, which already reflects double the volume of official development assistance (ODA) globally, could benefit from additional green liquidity. The money goes directly to the poor and the places on the planet that need it most.

Table 6: Some complementary channels to ensure sustainable development

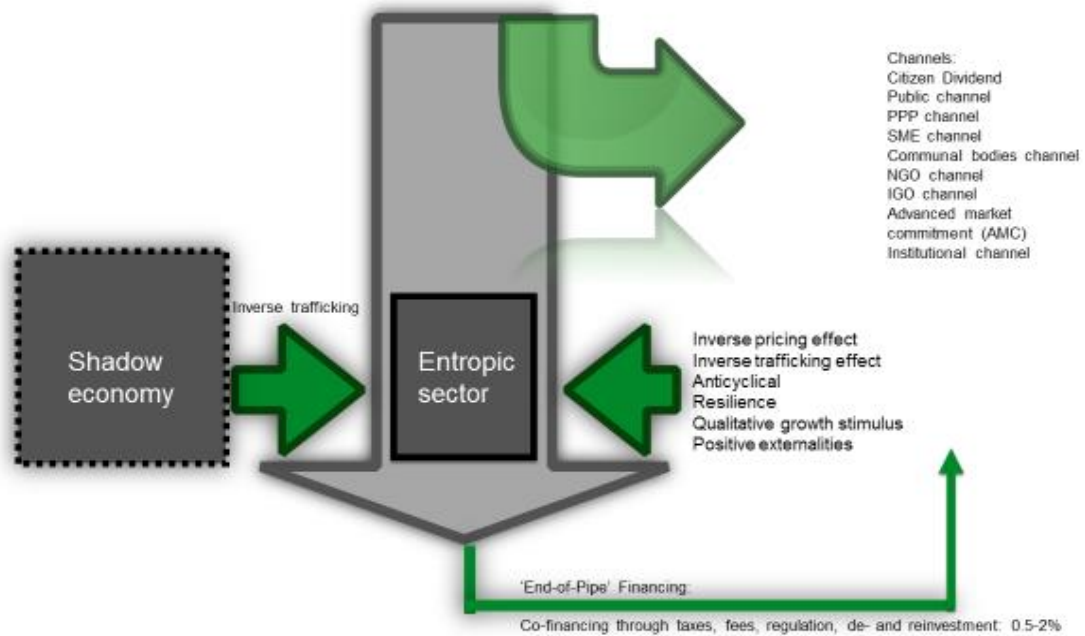
The abovementioned examples differ from the academic literature and public discussion in that the additional green liquidity provided runs in parallel to existing channels, increasing resilience and steering society towards a more fair, peaceful and sustainable future.

Two examples serve to clarify this argument. Within the spectrum of the SDGs, private bonds are suitable for investing in and financing large projects in agriculture or electromobility, but are unsuitable for most other SDGs, as these SDGs are non-excludable commons. A vaccine against Ebola or the Zika virus, for example, is not profitable for conventional corporations. Revenue will only be generated after years have passed, and as soon as the disease is under control demand for the vaccine vanishes. Of course there is a public interest in having the vaccine, but the public sector is overindebted. Green QE is a political tool and provides long-term interest from which all agents (public, private, nonprofit etc.) benefit.

A similar rationale is true of other projects, too: while the public sector, lacking tax revenue or ODA, is unable to drill millions of wells, create thousands of kindergartens, set up first-aid medical centers and establish hundreds of universities and colleges in sub-Saharan Africa or subsidize several hundreds of dual vocational training centers in Northern Africa, within a green QE perspective all such projects suddenly become rational, as the liquidity provided is targeted at and earmarked precisely for such projects. The additional jobs created in the region will increase additional local wealth and will reduce negative externalities. The lack of such investment will lead to forced immigration to Europe, reduce educational standards and make water-borne infectious diseases more likely, leading to losses in future productivity.

Such a green QE is not about ‘eating the rich’, but about ‘transforming the world into a better place for all’. A QE-^{SDG} is a pre-distributive, proxy mechanism, guaranteeing that human behavior and decision-making are steered directly towards greater sustainability. It is a mechanism from which both the rich and the poor benefit directly and indirectly, reducing negative externalities. It should be noted that this contrasts with the conventional view on transfer payments, which is redistributive, not pre-distributive, operating like an end-of-pipe technology like a filter trying to clean polluted air. In the traditional perspective, we generate unspecific, expansive growth in a first tier and then battle with regulatory efforts and transfer payments systems (fees and taxation) to generate enough money to finance ecological and social projects in a second tier. Never—neither historically, mathematically nor politically—have we achieved the volume required to fully invest in our

commons. Before we demonstrate the predicted consequences of such a mechanism in more detail, the following graph provides a systematic illustration of green QE.



Graph 1: A green, parallel, optional QE: Firstly, a green QE would create new green jobs, allowing people from the shadow economy to shift over into the green domain (inverse trafficking). Secondly, it would reduce negative externalities and downsize costs within the entropic sector (inverse pricing). Thirdly, a green QE would reduce the pro-cyclical tendencies of a monetary monoculture in money creation, interbanking, credit lines and real investment (anticyclical); it would stimulate qualitative growth pathways, generating positive externalities through different channels. It should be noted that this mechanism does not disregard or reject conventional regulatory efforts or redistributive schema, but broadens the perspective.

Further consequences and challenges

What are the further consequences and challenges of a mechanism such as that described above? The following table summarizes additional impacts of a complementary, parallel and optional green QE mechanism:

Green complementary QE	Impact/explanation
Liquidity trap	In a globally deflationary situation in which we lack 4-5 trillion USD for SDGs annually, a QE ^{-SDG} offers additional liquidity in an intelligent design. Instead of providing liquidity through the standard protocol, which failed to provide credit to the private sector, bounded direct investments* in green and social projects can ensure that the liquidity reaches the real market.
Debt trap	Most countries are overindebted, with little to no leverage for funding additional ecological or social projects. The additional liquidity ensuing from QE ^{-SDG} will trigger the green and social investments most countries lack.
Inverse trafficking	There is less need for people to earn an income through drugs, crime and human trafficking. Regional resource wars and forced immigration will be reduced and employment in the 'green sector' will reduce the attractiveness of terrorist movements for unemployed young people. A green QE can create 300-500 million new jobs.
Shadow banking	The earmarked electronic procedure ensures that shadow banking (offsheet and offshore) will dry out in the long run, stabilizing the world economy, regulatory efforts, transparency and monetary policy in general.
Positive externalities	Generally speaking, with each transaction green QE produces positive externalities, creating a win-win situation for both private business and public interests.
Market allocation and efficiency	Additional bounded liquidity will reduce the efficiency of any economic transaction, as there are two pathways for processing economic activities instead of one. However, these forms of parallel processing will render systems more resilient and shock-proof, despite the loss of efficiency. In short: there is a net gain to be derived from a parallel system that stabilizes the overall system.

Green growth	Our conventional growth process, measured in units per GDP, will change. Long-term investments in socio-ecological projects and an increase in labor intensity are two of the most prominent impacts of a QE ^{-SDG} , shifting our growth paths towards a more green, balanced and healthy planet.
Employment	Green QE can create additional jobs, meeting unmet needs and unleashing human potential in society, and decreasing collateral or defensive costs (lost output, crime, reduced physical and mental health, family breakdown, social exclusion).
Anticyclical	Whereas traditional QE has a pro-cyclical impact upon money creation, the interbanking sector and credit lines to the real economy, a green QE can operate anticyclically as such investments are optional. Any time a bust or deflationary pressure looms, the green channel can provide safe and sound liquidity.
Anti-inflationary	A 4-5 trillion USD additional stimulus will create an inflationary pressure on price levels. However, any dollar spent through this 'green' mechanism will reduce costs in the conventional economy in the so-called entropic sector.* This 'inverse pricing' effect will reduce the price level (wages) in sectors nobody really wants: crime, forced migration, human trafficking, ecological disaster management, unemployment, poverty are just some examples, as human activity is invested in a greener and more socially just world.
Corruption/illicit transactions	Drying out shadow economy activities: there are unregulated markets in which firms/investors provide bank-like services and maturity transformation through alternative tools (SPV, SIP, hedge funds, repos, etc. equal 60-70 trillion USD). An electronic-based green QE can make a substantial contribution to avoiding corruption (e-government).
Currency stability	A currency created through a parallel green QE would be backed up by long-term sustainable tangible assets, making such a currency less volatile.
Bank runs and market panic	Both banking and the market become more trustworthy without the need for additional regulatory efforts, as green investment provides sustainable and tangible assets.

Distribution	Socioeconomic distribution through taxes, fees or philanthropy is politically volatile. Once a new political party is in power, or the donor changes his or her mind, needed socioeconomic projects are abandoned. A parallel green QE remains a stable source for financing our future.
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Table 7: Further consequences and challenges of a green, parallel QE

We are psychologically trapped within the idea that there can be only one monetary system, providing a single, specific form of liquidity for all purposes, pretending that the power of allocative distribution is most efficient. We are also trapped within the idea that the ongoing increase in efficiency is the most appropriate way to achieve greater sustainability.

If we start looking at the world from an SDG perspective, we see that the world is vastly deflationary, meaning there is nowhere near enough available and appropriate liquidity to finance these unmet needs. In numbers, we lack around 4-5 trillion USD every year to make the world a better place. However, the conventional way of creating this liquidity is restricted due to the liquidity trap and the debt trap, providing little to no future additional leverage. An additional but different design of liquidity running in parallel is needed to cope with the SDGs.

An additional advantage of a QE^{SDG} is that it would work on different scales: locally or regionally as well as globally. The stimulus thus created could be adjusted and scaled up according to the investment plan and unmet needs. We could start with local and regional projects identified as SDGs and scale up. Such a procedure does not require global governmental consensus to start with. With a QE^{SDG} , we can begin to rethink the relationship between society and the monetary system. Money will eventually serve people and not the other way round. The QE^{SDG} is like a lifeboat in stormy weather, or like bicycle stabilizers.

In other words, in the Anthropocene,⁶⁶ where everything is connected to everything, we as a species do not know when, where and to which degree we and our children will be affected by negative externalities. This differs from the past, as we do not have a real exit option, a Plan B or a reset button to press, but are trapped within planetary boundaries.⁶⁷ This changes the way we can create the wealth of nations. The economy of commons requires a new rationale: for any agent in the profit, public, and nonprofit sector, additional investment in commons is rational, as in a connected world everybody can benefit from positive spillovers and rebounds. Co-financing and transfer

payment efforts are relatively inefficient, too low in volume and too slow to guarantee these payments.

The mechanism introduced above has the magnitude, volume and power not only to meet the global challenges, but to transform our global economy towards more positive externalities and greater justice, peace and sustainability. Each attempt to manage and organize our economic transactions through a monopolistic money system⁶⁸ is irrational economically speaking, as the costs of the inherent instability of the financial system, the costs of the entropic sector and the misalignments of the shadow markets cannot be corrected sufficiently, causing permanent negative spillovers. And none of the three (instability, entropic sector, shadow market) come cheap. The opposite is true: taxpayers, consumers, citizens in developing countries, future generations and our planet are going to pay the bill. How long can we afford this traditional monetary monopoly?

6. Final discussion

We started this article with Kuhn's paradigm shift. A paradigm shift happens when increasing irregularities and anomalies occur that cannot be explained within the given paradigm. Such a situation requires two major changes: a change in mindset and a change in the *modus operandi*. In this reading, the old paradigm is the monetary monoculture with only linear and sequential thinking, and the new paradigm is a complementary monetary system with linear *and* parallel thinking, allowing us to combat and manage anomalies and irregularities such as chronic unemployment, increased ecological damage and the widening of the income and wealth gap through different channels.

Nature teaches us that life tends to optimize within a window of opportunity between efficiency and resilience and does not maximize its output. And the life sciences teach us that the human mind adapts to nature most successfully when we have access to two ways of thinking, perception and problem-solving.

In a nutshell

The mechanism described here is not a distributive mechanism, in which the (inter)national trading and payment system is taxed and the revenue subsequently transferred to social and ecological projects. We identified this procedure as linear thinking. The mechanism described here is a pre-distributive one. It offers an optional, parallel and complementary channel or algorithm for solving future problems and simultaneously stabilizing the existing system *before* market mechanisms or state interventions have taken place. We identified this as parallel thinking. It is a mechanism that acknowledges and appreciates the advantages of the two main economic schools: market-dominated versus state-dominated or, in other words, austerity versus stimulus. It acknowledges free market allocation, risk assessment, competitiveness and regulatory efforts, such as accountability or transparency in a neoliberal sense. It also acknowledges the interventional aspect of any state-dominated economy in a Keynesian sense by providing a selective tool to discriminate towards commons, encouraging bounded investments through an electronic-based, earmarked QE process that is fast and targeted. Through this parallel and optional process, which can be scaled up and

down according to regional requirements, a global sum of roughly 5 trillion USD annually would be injected into our common future. The scale of the solutions needs to match the scale of the problems ahead. The solution is not taking around 300-500 billion USD a year extracted from the given market system to provide a living for 80% on this planet; a sum around ten times larger is required.⁶⁹ This procedure would reduce the negative impact of shadow banking and the black market economy with regard to the stability and resilience of the international trading and payment system; it would reverse pricing away from disaster management, the entropic sector and negative externalities, towards a greener, fairer and more sustainable future. And through a proxy mechanism, it would steer labor away from the unregulated and risky shadow and black markets towards more stable and forward-looking jobs. And finally, as a complementary system operating in parallel and anticyclically to the given one it would make monetary policy and regulation more sound, transparent and resilient.

To conclude: it is not the fault of the commons that they are chronically underfinanced within the current monetary system; this is the result of an inadequate alignment of the economic system with the nature of commons. This means that we have to design a system that fits the nature of commons and not the other way around to optimize their benefits for humankind. Commons do not fit into our conceptual framework, therefore we neglect and overuse them, damaging our community.

The proposal of a green, optional, parallel QE mechanism as described in the present article is able to respond to this dilemma, allowing the full potential inherent in commons to unfold for the benefit of humanity.

The real tragedy of the commons revisited

The real tragedy of the commons is therefore not the free-rider problem, moral hazard or their non-excludability, but the fact that we are managing them through a trading and payment system which does not discriminate towards the nature of commons. Accordingly, the real tragedy of the commons is not economic, nor political, but psychological. This paradigm of linear thinking, in which financing the commons depends on a prior growth process, is economically irrational and Pareto-suboptimal, as the positive externalities a parallel green QE process could generate are not available for the private or the state sector.

Inefficient academic rituals

From a game theory perspective, the well-known ritual of debate between neoliberal and Keynesian arguments (between austerity and stimulus) is relatively unproductive, intellectually exhausting and economically inefficient. Identifying the smallest common denominator will lead to a suboptimal solution. Instead of repeating the debate over and over, it would be more fruitful to identify the unquestioned commonalities that both parties rely on, of which the monetary monopoly and linear, sequential thinking are undoubtedly two.

The world we live in is profoundly shaped and limited by the dominant monetary system. This system is not neutral with regard to decision-making: it is basically a hidden device conditioning our future. In its current monopolistic version it operates antagonistically towards any form of sustainability. However, it is not a given! What is required is a shift in consciousness that balances out system 1 and system 2 and/or the left and the right cerebral hemispheres, and systemic thinking instead of silo thinking as described in this text. The mechanism of a parallel green QE has the potential to change the world.

This necessary paradigm shift requires an academic and public debate that not happened thus far, and it is hoped that the present text will set this debate in motion.

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Tables and graphs

Table 1: The conventional debate on growth and wealth

Table 2: Sustainability from a systems theory perspective

Table 3: Features of the two hemispheres (see I. McGilchrist, 2009)

Table 4: Aspects of parallel (system 2) versus linear thinking (system 1)

Table 5: Return on Investment S&P 500, 3-month Treasury bill, 10-year Treasury bill

Table 6: Some complementary channels to ensure sustainable development

Graph 1: A green, parallel, optional QE

Table 7: Further consequences and challenges of a green, parallel QE

Further reading

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- 1 T.S. Kuhn, *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1962.
 - 2 P.A. Hall took up this idea, applying it to economic and policy procedures, differentiating between first-, second- and third-tier changes. In this explanation, first-tier simply reflects normal policy changes, second-tier moderate changes and third-tier a paradigmatic shift. P.A. Hall (1993), 'Policy paradigms. Social learning, and the state: the case of economic policymaking in Britain', *Comparative Politics*, 25(3), pp. 275-296.
 - 3 G. Hardin: *The Tragedy of the Commons*. *Science* 162 (1968), pp. 1243–1248
 - 4 E. Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* [2]. Cambridge University Press, Cambridge. 1990, ISBN 0-521-40599-8; Ostrom was awarded the Nobel Prize in Economics in 2009.
 - 5 <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>
 - 6 What is often missing from this list of commons is that the international trading and payment system is also considered a common good. Central banks and regulators have the function of providing tools that can create greater stability, safety, and sound regulation, of providing liquidity and operating as a lender of last resort. These are all functions the free market system cannot provide; see also Stuart McIntosh (2015), *The Redesign of the Global Financial Architecture: The Return of State Authority (Rethinking Globalizations)*. London: Routledge.
 - 7 D. Kahneman, (2011) *Thinking, Fast and Slow*, Farrar, Straus and Giroux, ISBN 978-0374275631.
 - 8 Within a Pareto optimum, any investment in a common good (free-rider and non-excludable) is a form of good will, pro bono or charity made to appease guilt, whether it is financed through fees, taxation or philanthropy, causing suboptimal allocation and inefficiencies as underfunded commons lead to suboptimal yields in the private and state sector.
 - 9 See B. Eichengreen, 'Secular Stagnation – a review of the issues', in: Teulings, Coen; Baldwin, Richard, *Secular Stagnation: Facts, Causes, and Cures* (London 2014) 41-46.; J. Foster; R. McChesney, *The Endless Crisis. How Monopoly-Finance Capital Produces Stagnation and Upheaval from the USA to China* (Monthly Review Press: New York 2012). J. Galbraith, *The End of Normal. The Great Crisis and the Future of Growth*, Simon and Schuster, New York 2014; Friedman, Gerald, *Response to the Romers*, published online February 27, 2016 (2016b), <http://dollarsandsense.org/Friedman-Response-to-the-Romers.pdf>; Gordon, Robert, *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War* (Princeton University Press: Princeton 2016); A. Hansen, *Economic Progress and Declining Population Growth*, in: *American Economic Review*, 29/1 (1939) 1-15; R. Koo, *The Escape From Balance Sheet Recession and the QE Trap* (Wiley & Sons: Singapore 2015); P. Krugman, *Four observations on secular stagnation*, in: Teulings, Coen; Baldwin, Richard, *Secular Stagnation: Facts, Causes, and Cures* (London 2014) 61-68.; L. Summers, *Demand-Side Secular Stagnation*, in: *American Economic Review: Papers and Proceedings* 105/5 (2015) 60-65; K. Rogoff, *Debt supercycle, not secular stagnation*, *VoxEU* (April 22, 2015); <http://www.voxeu.org/article/debt-supercycle-not-secular-stagnation>;
 - 10 Here, psychologists refer to the so-called 'confirmation bias': we simply reconfirm what we already know, find only what we see and see only what we have already done in the past. Some scholars call this bias one of the most powerful and misleading forms of thinking and concluding. See: P.C. Wason (1968), "Reasoning about a rule", *Quarterly Journal of Experimental Psychology*, Psychology Press, 20(3): 273–28, doi:10.1080/14640746808400161, ISSN 1747-0226, PMID 5683766 or M. E. Oswald, S. Grosjean (2004), "Confirmation Bias", in Pohl, Rüdiger F., *Cognitive Illusions: A Handbook on Fallacies and Biases in Thinking, Judgement and Memory*, Hove, UK: Psychology Press, pp. 79–96, ISBN 978-1-84169-351-4, OCLC 55124398
 - 11 In particular, the bail-in regulations effective since 2016 have generated a new liability cascade, which is new for the banking system. Traditionally and historically, banks have been saved by governments when they got in trouble. Following 2008, the governments have little to no leverage to do so because of increased public debt. The new bail-in strategies basically affect billionaires and ordinary people with small assets in a similar manner. They are both sitting in the same boat and will potentially lose their wealth when the next crisis occurs. New technologies beyond the given banking intermediaries (block chain) and alternative investment strategies (tangible assets) will be a rational and expected consequence of these bail-in regulations.
 - 12 S. Giegold, U. Philipp, G. Schick, 2016 *Finanzwende, Den nächsten Crash verhindern*, Wagenbach Berlin; and the updated literature within this text.
 - 13 See <https://heckmanequation.org/resource/the-heckman-curve/>

14 Any co-financing scenario faces a twofold dilemma: in a situation of a market equilibrium, where allocation is already Pareto-optimal, each intervention or redistribution generates suboptimal results. Alternatively, if the market is not yet fully optimally allocated, then every intervention leads to an even higher deterioration of the given equilibrium. In both scenarios distributing liquidity towards commons, benefits for the private sector will be disproportionately low. However, the more the commons are fully financed, the more both the private and the state sector can benefit from their positive externalities. How this would work and how the twofold dilemma can be overcome will be explained in the following sections.

15 The Eastern enlargement of the EU, the integration of East into West Germany and Germany's 'Marshall Plan' for Africa are such examples.

16 The historical Marshall Plan (European Recovery Plan) had a volume of 13 billion USD in 1948. 10% of this was invested in Germany. As of today, the volume would be 10 times larger. Meaning out of the 130 Bill USD, the transfer sum would be 13 Bill USD.

17 Just as a reminder: at the 1992 Earth Summit in Rio, the global community decided to invest 0.7% of global GDP in foreign development aid. Apart from some Scandinavian countries, no country has been able to achieve this ratio in the last 35 years.

18 In its extreme form, redistribution is called the Robin Hood effect. If we consider the wealth of 2000 billionaires (each having 1 billion USD), that they have generated that wealth over one generation (30 years), and that there are 7 billion people on the planet, we arrive at the following equation: $2000/7/30=10$ USD per capita per year over 30 years. This means that in a world where wealth were more equally distributed, each human could go and get him- or herself one extra fast food meal per year for 30 years. Or, to put the argument the other way around: a premium of 10 USD per capita per year is the cost of each human being living in the world of Bill Gates instead of a socialist dictatorship. Asymmetries are not always bad, especially when they occur above the minimum wage and basic living requirements.

19 The general counterargument is 'better than nothing', meaning it is better to transfer 0.5% of GDP than nothing at all. As true as this argument is, it is irrational in economic terms, because the cost of not financing the commons will be higher in the long run. Brunnhuber, Stefan (2015): How to Finance our Sustainable Development Goals (SDGs): Socioecological Quantitative Easing (QE) as a Parallel Currency to Make the World a Better Place, *Cadmus*, Vol. 2, Issue 5, 112-118.

20 A good summary of intertwined causality is provided by E. Laszlo, *The Systems View of the World: A Holistic Vision for our Time* (1996). For a definition and implications of mutual causality, see J. Macy, *The Dharma of Natural Systems: Mutual Causality in Buddhism and General Systems Theory* (1991).

21 In other words, insights into a system's behavior do not require even more refined modeling, as it is the case with linear models or Big Data correlation. This is in line with the epistemic principle of W. of Ockham known as Occam's razor: simpler explanations are better and preferable to more complex ones, as they are easier to test.

22 It should be noted the relationship between efficiency and resilience is not a metaphor, but a rule or law of any open-flow network system. We copy or mimic the dynamic of natural systems and apply its optimum to the societal system, expecting the highest outcome possible.

23 The exact balance varies depending on the system under investigation. Therefore, we propose a working definition of sustainability as the optimum balance between efficiency and resilience.

24 E. Beinhocker, *The Origin of Wealth: Evolution, Complexity and the Radical Remaking of Economics* (2006), where the author demonstrates the fallacy of modern economics being misclassified as closed systems.

25 Currently there are over 2500 complementary, parallel currency projects in operation worldwide. None of them have any macroeconomic significance, but they all demonstrate that the system works: from B2B, Lets, local barter, to regional money, B2C, C2C etc., they all have a social, sectoral or ecological target built in and are able to solve concrete, local problems. For example, the Bristol Pound is a regional currency with an exchange rate of one to one with the British Pound. The mayor of Bristol is paid completely in this currency, a fact that seeks to demonstrate at least two aspects: users can pay local taxes with the Bristol Pound, and the wealth created in the region stays in the region. The payment of taxes is crucial to any money system, as it closes the loop between state, households and corporate sector. This holds true for the proposal of a green QE in this text as well.

26 A. Haldane and R. May, 'Systemic Risk in Banking Ecosystems', *Nature*, Vol. 469 (20 January, 2011), where the authors state that "homogeneity breeds fragility" and a financial ecosystem requires "system-wide characteristics of the network" (pp. 351-355).

27 The power of extremely unlikely but harmful events is well described in N.N. Taleb (2007), *The Black Swan: The Impact of the Highly Improbable*, Random House, ISBN 978-1400063512, or *Antifragile: Things That Gain From Disorder* (2012) Random House: anti-fragility is

more than resilience, as a system that is exposed to shocks not only resists, but improves through the exposure to volatility, randomness and stressors. This means that a system improves in performance through antifragile features. In this understanding, a parallel green QE is an antifragile feature. In finance, this is known as the Barbell strategy: “A dual strategy, a combination of two extremes, one safe and one speculative, deemed more robust than a ‘monomodal’ strategy; often a necessary condition for antifragility” (p. 428).

28 B. Lietaer, C. Arnspenger, S. Goerner & S. Brunnhuber 2012/2013: Money and Sustainability: The Missing Link. A Report from the Club of Rome – EU Chapter, Axminster: Triarchy Press

29 From an evolutionary perspective, this is a result of a developmental process in which analytical, logical, critical, perspectival, ego- or self-centered thinking is the product of an ontogenetic and phylogenetic procedure. In short: the mind evolves and this process is not random, but follows predictable steps and stages. There are volumes and volumes of empirical evidence proving that this applies to all properties of the mind (motivation, cognition, affection, learning, sensorimotoric, kinesthetics, spiritual, social etc.). One of the core findings is: ego- or self-centered thinking is not the last evolutionary step. There is more to come. Psychologists sometimes call these states of consciousness integral, holistic, transpersonal, post-conventional or transrational. See K. Wilber 2000, *Integral Psychology*, Boston: Shambhala or S. Brunnhuber, 2016, *The Art of Transformation (Die Kunst der Transformation)*, Munich: Herder).

30 See J. Dewey *How We Think* (1910), Southern Illinois University Press, Carbondale, Illinois or W. Byers (2014) *Deep Thinking, What Mathematics Can Teach Us About the Mind*, WScP.

31 Darwin, Charles (1859). *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (1st ed.). London: John Murray. ISBN 1-4353-9386-4. Retrieved 24 October 2008.

32 D. Kahneman, (2011) *Thinking, Fast and Slow*, Farrar, Straus and Giroux, ISBN 978-0374275631.

33 See: https://en.wikipedia.org/wiki/Prefrontal_cortex

34 It should be noted that system 1 and system 2 are not identical with the right and the left hemisphere. They do however demonstrate a general finding which can be usefully adopted to finance: a dual processing or asymmetrical, lateralized entity with two, optional subsystems that interact with one another, each offering different features for problem solving, is superior to a monoculture, one-brain or one-mind feature. See I. McGilchrist (2009), D. Kahneman (2011) and N.N. Taleb (2012).

35 It should be noted that the present text will show that green QE responds to basic findings in psychology showing that positive reinforcement seems to lead to better results than continuous punishment or aversive incentives. It is simply easier to steer behavior through positive than through negative reinforcement. Each time something has to be corrected, the agent has to change the course. By contrast, the reward mode is more attractive and motivational, exerting more effort towards achieving a specific goal. Each time a green dollar or Euro is invested, each agent can be sure that he or she is contributing directly to a better future. Positive reinforcement therefore enhances the probability of a specific desired behavior, event or result. Historically, see I. Pavlov and F. Skinner; W. Schultz (2015). "Neuronal reward and decision signals: from theories to data". *Physiological Reviews* 95 (3): 853–951. doi: 10.1152/physrev.00023.2014. PMC 4491543. PMID 26109341. The carrot is more effective than the stick!

36 Most thinking happens within a given, conceptual framework and most (if not all) scientific discoveries occur when this rule-based conceptual thinking is questioned and transcended. Irregularities, ambiguities, anomalies and paradoxes are dissolved and new connections and insights become visible. W. Byers calls this state “deep thinking” (2015): opposites and irregularities can be contained, and complementarities, fractal correlations, creativity and new learning occur. When we replace outdated technologies but our thinking remains the same, and when we change our government but our thinking remains the same, these new technologies and this new government will be just the same as long as our consciousness stays the same. A change in consciousness towards greater mindfulness, grace, grit and detachment allows us to regroup and dissolve some of these ambiguities and generate a new paradigm, a new thinking and a new way of managing problems.

37 Misinformation, anxiety and time pressure prevent us from integrating both systems, leading to false, suboptimal results. The more complex a challenge is—and living in the Anthropocene is such a challenge—the more humans need to access both systems. In an era of paradigm shift, the most efficient way to deploy the two systems (and respectively the two hemispheres) is to first apply system 1, which is fast, fuzzy, non-linear, contextual and holistic, in order to evaluate the main strategies, risks and challenges ahead. Once they are identified, system 2 is more appropriate to re-evaluate, analyze, focus and dissect the next sequential and linear steps.

38 O. Edenhofer (2015) King Coal and the queen of subsidies, *Science* 18 Sep 2015: Vol. 349, Issue 6254, pp. 1286-1287, DOI: 10.1126/science.aad0674

39 <http://www.globalissues.org/article/75/world-military-spending>

40 [http://nowandfutures.com/large/SystemicBankingCrisesDatabasewp12163\(imf\).pdf](http://nowandfutures.com/large/SystemicBankingCrisesDatabasewp12163(imf).pdf); or B. Lietaer, C. Arnsberger, S. Brunnhuber (2012, pp. 57).

41 See the IMF blog: <https://blog-imfdirect.imf.org/2016/10/05/big-bad-actors-a-global-view-of-debt/>

42 On the shadow economy, see M. Hassan, F. Schneider (2016) Size and Development of the Shadow Economies of 157 Worldwide Countries: Updated and New Measures from 1999 to 2013. *J Glob Econ* 4: 218. doi: 10.4172/2375-4389.1000218; on shadow banking see IMF, (2013) "International Monetary Fund. Retrieved 2013-02-18; on the informal sector, System D (-Debrouilliard) see Neuwirth, Robert (2011). *Stealth of Nations: The Global Rise of the Informal Economy*. New York: Pantheon. ISBN 978-0-375-42489-2.

43 The methodological background justifying the comparison of the ROI of global commons with S&P 500 or state bonds lies in D. Kahneman's so-called "reference class forecasting" effect: humans have the tendency to be overoptimistic with regard to the future and to miscalculate risks, certainties and probabilities. Costs, risks and time effort are chronically underestimated, whereas positive gains are overestimated. Here, we tend to follow the so-called 'confirmation bias': we see what we know and reconfirm what we have done in the past. External evaluations and 'out-of-the-box' perspectives can broaden the spectrum and reset and objectify overall risk and investment strategies. B. Flyvbjerg, Bent (2008). "Public Planning of Mega-Projects: Overestimation of Demand and Underestimation of Costs". In Priemus, Hugo; Flyvbjerg, Bent; van Wee, Bert. *Decision-making on Mega-Projects*. doi: 10.4337/9781848440173.00014. ISBN 9781848440173; D. Kahneman; A. Tversky, (1977). "Intuitive prediction: Biases and corrective procedures". *Decision Research Technical Report PTR-1042-77-6*. In Kahneman, Daniel; Slovic, Paul; Tversky, Amos, eds. (1982). *Judgment Under Uncertainty: Heuristics and Biases*. pp. 414–421.

44 http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histretSP.html ; Federal Reserve database

45 For general information see: <http://www.copenhagenconsensus.com/post-2015-consensus>

46 For example: in a complex world where there is no single isolated causal link, the ROI will benefit as many people as possible. Universal access to contraception (1:120), illicit financial flows (making ownership info public) (1:49); high blood pressure medication (1:47); halving malaria infection (1:36); allowing greater migration (1:45); reduced child malnutrition (1:45); research on increase yields in agriculture (1:34); tripling preschooling in sub-Saharan Africa (1:33); mobile broadband for developing countries (1:17); reducing domestic violence (1:17); phasing out subsidies for fossil fuels (1:15); modern cooking devices for 750 million people (1:15); increased skilled worker migration (1:15); cutting down indoor air pollution through better stoves (1:10); or eliminating open defecation (1:6), see: <http://www.copenhagenconsensus.com/post-2015-consensus/economist>; none of these strategies can be singled out for each individual, but in a world where everything is connected, the community as a whole benefits. The point is: the payment system has to adopt to the commons and not the other way around.

47 S. Preston evaluated the difference between market-based private initiatives and public interventions across countries over several decades with regard to the increase of life expectancy and economic growth. His conclusion is that only 1/4 of the increase in life expectancy is due to general improvement of living standards, whereas 3/4 is due to education, vaccination, antibiotics and vector controls, including hygiene measures. This means that public health and scientific innovations are more important than personal improvements in living standards. See S. Preston, 1975. The changing relation between mortality and level of economic development, *Population studies* 29(2) 231-248; for a similar argument also see: *Lancet* 5 August 1978, 300-301, 'Water with sugar and salt', where the oral rehydration therapy (ORT) is considered the most significant medical progress of the 20th century.

48 Another way to look at this is opportunity costs: the costs of investments and projects that have not been realized—in other words, the loss of a potential gain from other alternatives than the one chosen. The SDGs are such unrealized projects of unmet needs and unmet potential. Therefore the community as a whole does not benefit from the alternative yields available. James M. Buchanan (2008). "Opportunity cost". *The New Palgrave Dictionary of Economics Online* (Second ed.). Retrieved 2010-09-18. For example, the cost of ending poverty is 250 million USD a year. The opportunity costs of unrealized human potential are at least 10-15 times higher.

49 UN, *Global Sustainable Development Report, 2015 edition*

50 Ellen MacArthur Foundation, *Growth Within: A Circular Economy Vision for a Competitive Europe, 2015*

51 UNCTAD, 2014, *Developing countries face 2.5 trillion USD annual investment gap in key sustainable development sectors, UNCTAD report estimates, 24 June 2014*

52 There are different ways to look at the same phenomena: from a pure market perspective there are 1.75 billion people suffering from multidimensional poverty, 3 billion have to cope with less than 2.5 USD for food, shelter and housing per day, 200-250 million are unemployed and 1-2 billion are underemployed. These stark figures reveal huge underserved, unmet potential and needs. Seen from this perspective, the world is vastly deflationary, requiring adequate liquidity to create additional wealth.

53 Agenda 21 cost around 600 billion USD annually worldwide, and the industrialized countries were supposed to contribute 100 billion USD annually, which is equivalent to 0.7% of the GDP of the rich nations at that time. The idea was to extract this amount of money from the "Peace Dividend" of disarmament after the end of the Cold War and redirect it into ecological and social projects. In reality, most of those dividends went into tax reductions within the rich countries. See: United Nations. 1992. Agenda 21, available at: <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>

54 https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html

55 S. McIntosh 2015, *The Redesign of the Global Financial Architecture: The Return of State Authority (Rethinking Globalizations)*. London: Routledge.

56 This so-called 'liquidity trap' describes the phenomena that occur when monetary regulators fail to stimulate or influence price levels with an interest rate at or close to zero; Sumner, Scott. "The other money illusion". *The Money Illusion*. Retrieved 3 June 2011.

57 J. Ryan-Collins, T. Greenham, G. Bernardo, and R. Werner (2013). 'Strategic Quantitative Easing'. Published by the New Economics Foundation (NEF). Available at: <http://www.neweconomics.org/publications/entry/strategic-quantitative-easing>

58 For example, the concept of a Green QE (V. Anderson 2015), People QE (Hines & Murphy 2010) or Helicopter Drops (Bernanke, 1999): Bernanke, B. (1999). 'Japanese Monetary Policy: A Case of Self-Induced Paralysis?', For presentation at the ASSA meetings, Boston MA, January 9, 2000. Available at: http://www.princeton.edu/~pkrugman/bernanke_paralysis.pdf; or: Overt Monetary Financing (OMF), Sovereign Monetary Creation (SMC). As an overview see also www.positivemoney.org: To our knowledge, despite their intellectual scrutiny, none of the proposals offer a dual currency approach of the kind addressed in this text. All the proposals so far remain within a monetary monoculture.

59 Other proposals refer to a roll-over of state bonds to central banks, infinite credits without maturity, credits without interest, or credit lines that modify their conditions and facilities while rolling over from central banks to states and vice versa. (Turner, A. (2015). 'The Case for Monetary Finance – An Essentially Political Issue'. Paper presented at the 16th Jacques Polak Annual Research Conference hosted by the International Monetary Fund Washington, D.C. Available at: <https://www.imf.org/external/np/res/seminars/2015/arc/pdf/adair.pdf>). As convincing as all these arguments are, none of them address the resilience of a dual currency system and therefore stay within the given paradigm.

60 A. Jackson (2013). 'Sovereign Money: Paving the Way to a Sustainable Recovery'. *Positive Money*. Available at: <http://positivemoney.org/wp-content/uploads/2013/11/Sovereign-Money-Final-Web.pdf>

61 For examples, see: www.positivemoney.org

62 Central banks have shifted their traditional mandate towards an active open market monetary policy, buying up corporate and state bonds in order to inject additional liquidity into the market. None of these channels provide a causal link between the amount of liquidity injected and the stability of price level. Most of them remain correlations. This includes OMT (outright monetary transactions), ECT (enlarged credit support), FAP (full allotment policy), LTRO (long-term refinancing operation), SMP (security market policy), STEP (short term European paper) or the well-known ELA (emergency liquidity assistance).

63 As each economic and policy intervention has its end in human labor, we can make the following equation: 52 weeks makes 2080 hours, 12 USD/h (gross salary) equals 24,960 USD annually. Assuming 350 million people are unemployed across the globe, 8.7 billion USD are needed to provide them with jobs. Considering a Keynesian multiplier of two, 4-6 billions are necessary to provide full global employment. This equates to the amount discussed above that is needed to finance the SDGs. The green QE can therefore roughly meet unmet needs, creating purposeful jobs for our common future. The human being is the ultimate resource for wealth, creativity and labor (see J.L. Simon, *The ultimate resource*, Princeton University Press 1983).

64 One of the major concerns is default investment. The balance sheet of a central bank is different to that of a firm, household or state. On the one hand, it can sterilize lost investments causing reduced seigniorage; on the other hand, however, the reduced seigniorage that reduces the state budget has to be compared with reduced costs in the entropic sector (Werner, R., Jackson, A., 2012; H.-W. Sinn, 2016). The main obstacles we would face in implementing a parallel green QE mechanism are the lack of institutional power and pandemic corruption, not

technology, knowledge or scientific evidence or the lack of problem awareness. Concerning corruption, scientific evidence shows that full electronic procurement in the public sector can substantially reduce if not completely avoid political corruption.

65 In the first phase, the QE **-SDG** might have a limited convertibility with the conventional monetary system of, for example, a 10-15% exchange rate. This would encourage clients, companies and states to reinvest in the SDGs or to convert money with a loss. Long term, the QE **-SDG** money would have a higher stability as it would be pegged to real, sustainable long-term investments.

66 P.J. Crutzen 2011: Das Raumschiff Erde hat keinen Notausgang. Berlin: Suhrkamp.

P.J. Crutzen: Paul J. Crutzen, "Geology of Mankind", Nature 415, no. 23, 3 January 2002. Doi: 10.1038/415023a

67 J. Rockström & M. Klum, 2016, Big World Small Planet, wie wir die Zukunft unseres Planeten gestalten, Ullstein.

68 This monetary monopoly is universal in capitalistic, autocratic and Communist societies. The only difference is that in the latter the government owns the banks permanently, whereas in capitalism the government only owns the banks temporarily after a financial crisis or collapse. In order to implement a parallel green QE, the political system in place is irrelevant. It is more about identifying the mechanism in order to steer our society in the right direction.

69 According to our calculation, a Global Sustainability Fund to manage the green QE would require 250 staff (150 lawyers with experts in international trading and payment systems and 100 investment bankers experienced in sustainability and development aid) and it would require less than a year to get started.