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indigo
PRIZE

global perspectives

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EDITORIAL

In an essay last year that outlined a new international order of rapid economic change, Mikhail Fridman coined the term The Indigo Era. He wrote that, "We are entering a disruptive era driven by extraordinary levels of human creativity". But it is also an era he said, based on his observations of recent economic indicators, political and market volatility, and historical patterns, that will generate winners and losers as lagging countries and groups fail to adapt quickly enough.

This conversation has led to many people questioning the value of the ways we currently measure our economy. To focus the debate, The Indigo Prize was launched, an economics competition that challenged entrants to come up with a more accurate way of measuring our economies, that considers creativity, digital skills, and intangible assets. This journal is a compilation of the top entries to that Prize.

Despite indications of returning economic growth it seems many voters – in the UK voted for change – were motivated by broken local economies whose decline was blamed on the pressures of immigration and on the EU. Americans who voted for Trump felt overlooked by the establishment; they felt economically disadvantaged and left behind by the coastal elite.

For many voters, it seems that the prospect of capitalism improving their economic well-being is diminishing. In a survey conducted for this journal in [November] 2017 in the UK, only 18% of people think that capitalism is working well to provide prosperity for everyone. And in the US, as many people see capitalism as a force for bad (38%) as see it as a force for good (38%).

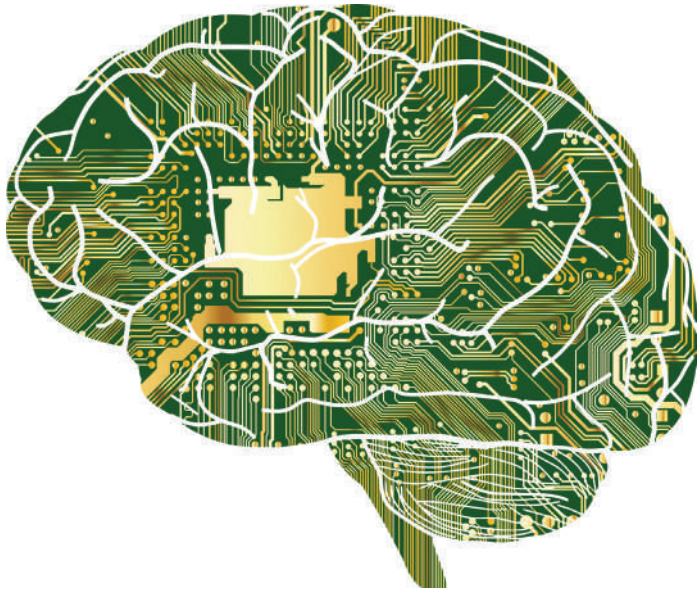
In the US the problem is perceived not to be with wealth creation, but with access to that wealth via opportunity. While 51% of Americans agree that businesses are advantaged by the capitalist system, just 30% believe the working class are. This is fuelling a view of capitalism as a system of winners (businesses) and losers (workers), rather than as a free market of opportunity.

What to do about it?

Clearly, what we can measure matters. If we can quantify something, we can analyse, question, and interrogate it. As a result, we have a tendency to assume that the things that we can measure are important, and those that we cannot measure are not.

The most important and widespread measurement tool for our global economies over the past half a century has been GDP – Gross Domestic Product. Although there is a rough correlation between GDP and quality of life, it is bold to assume that these two things are one and the same.

Since the 1930s GDP has been a barometer of economic growth and proxy for economic well-being. It's



been a political goal for aspiring politicians and a driver of political decisions and policy. As one of the winners of the Indigo Prize has written – even small changes in GDP can decide elections, influence major political decisions and determine whether a country can keep borrowing or be thrown into recession.

While still an important and robust economic indicator – it has become a political badge of honour and measure of success and over time inappropriately taken on importance as a measure of the freedom and human capability created by the market economy. It is a measure of production, a relic of a period dominated by manufacturing, but it provides little insight into the quality and sustainability of economic growth, new 21st century services and intangible goods, and changes in living standards.

The outcome of the Brexit referendum, and the US presidential election, has shown that something strange is happening to world. There is an economic tectonic shift underway, and these plebiscites are laying bare an economic reality. It shows that our perception of economic growth and prosperity, as measured by GDP, is not synonymous with sustained and improved well-being.

In order to invest in economies, by buying and building companies which will become 21st century institutions and create employment and economic prosperity for all, investors need insight into the socio-economic systems and economies in which businesses are based.

In order to stimulate debate about how to fully measure economic activity – and therefore gain better insight into the health and potential of a 21st century economy, The Indigo Prize asked entrants to consider what factors should be taken into consideration in the official economic statistics that measure the health, size and growth of our economies.
Entrants were invited to submit an answer to the following question: *"How would you design a new economic measure for global economies that fully acknowledges not only social and economic factors but the impact of creativity, entrepreneurship and digital skills? How should your new measure be used to improve the way we measure GDP in official statistics?"*.

The competition saw entries from students, professors, engineers, entrepreneurs and leading academics from the UK and around the world, including entries from the UN Development Programme, Harvard University, and a sixth-form sociology teacher.

The first and second prize were awarded in an equal split, with £125,000 shared between teams led by Diane Coyle, Professor of Economics at Manchester University,

and Jonathan Haskel, of the Imperial College Business School.

Diane Coyle's entry was co-written with Benjamin Mitra-Kahn, board member of the Intellectual Property Institute of Australia, and as well as suggesting amendments to GDP, they proposed a radical replacement of GDP with a dashboard measuring six key assets: physical assets, natural capital, human capital, intellectual property, social and institutional capital, and net financial capital. They argue that this 'balance sheet' approach to measuring the economy takes sustainability into account, which GDP does not.

The entry from the team led by Jonathan Haskel proposed running online experiments on people's willingness to pay for free goods, as well as extending GDP to measure economic wellbeing, and including intangible and environmental capital.

The £10,000 third prize for a 'rising star' that showed promise was awarded to Alice Lassman, a 19-year old first year Geography student at Durham University. Alice's entry looked at nations from two perspectives: through its individuals and the activity they generate, and by their standing on the global stage. Alice also argued that indicators of economic development should reflect the nature of development itself.

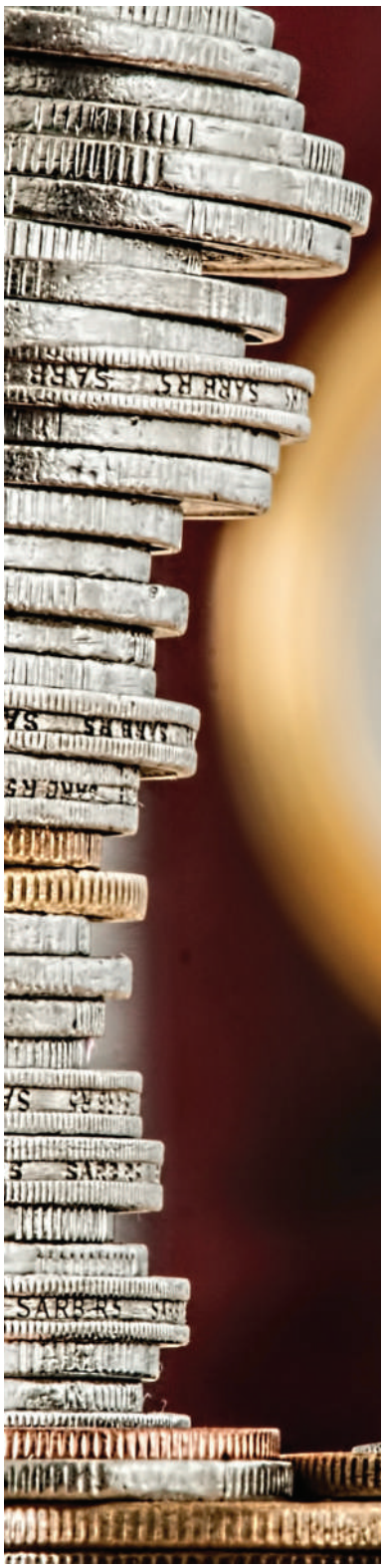
This journal is the second in the Global Perspectives series, with the first issue, The Indigo Era, published in 2016. The Indigo Era journal convened leading thinkers from the worlds of business, academia and technology to consider how creativity, entrepreneurship and digital skills are reshaping our economies. This second issue brings together the top entries to the Indigo Prize.

Many of the entries featured in this journal are concerned with the need to consider economic progress in the context of our impact on the environment. Benedict Gardner's 'Earth Resource Budget' attempts to quantify the value of a healthy, educated, digitally-literate population. His metric is engineered to incentivise green growth and social development. Another entrant, Riccardo Casale, believes that endless pursuit of prosperity has resulted in an economy that's bigger than our planet, and via a City Prosperity Index, we should measure cities to come to terms with individual, civic, and collective energy use.

With many of the largest companies in the world being technology businesses, other entrants focused on the importance of measuring data. A team from Cambridge Econometrics look at how to measure free online services and the value that social media deliver to societies, while a team comprising statisticians from the ONS, the UK's Office for National Statistics, and a machine learning researcher, argue for collecting data on time-use to analyse the online services that population use.

Richard Heys proposes using data collected for the Consumer Prices Index to estimate the impact of price changes for a static basket of goods on the growth of consumer surplus, allowing the impact of free goods to be captured. He points out that the free views of an online newspaper are assumed not to have any value as the consumer didn't pay for them, and proposes including free digital goods in a standard 'basket of goods'.

Robert Phelps compares 'oldGDP' with 'newGDP', which would include free goods, consumer behaviour, and social and environmental conditions.



It is important, he argues, to consider willingness to take opportunities, openness to risk, and other factors that are difficult to measure, such as air quality, countryside conservation, corruption levels, equality and health.

Several entrants pointed out that GDP focuses on the strength of the economy as a whole, rather than the potential of individuals. Claire Devaney's Civic Investment Value index is designed for the innovation economy. It is based on a shift to an investment model, rather than an extractive model of the economy. The Civic Investment Value index incorporates individual assessment of wellbeing and the United Nations' Sustainable Development Goals to evaluate the extent to which people are invested in the places where they live.

Some argued that GDP focuses too narrowly on expenditure and outputs at the expense of wellbeing: Izzy McRae writes that "a focus on wellbeing might well encourage more spending on improving creativity, digital skills and entrepreneurship". Qatar and Monaco may have among the highest GDP in the world, but pale in comparison to the Nordics when it comes to their socio-economic infrastructure.

Indranil Ghosh believes that climate change, inequality and broken balance sheets have wrought havoc in recent decades, and a new set of measures based on prosperity should be adopted.

Many measures of economic performance have simply not kept pace with recent innovation in science, technology and knowledge-based industries. Jacob Assa's Dynamic Measure of Innovation index starts with the understanding that determinants of economic success shift over time. As our societies and economies evolve, so too must our measurement tools. We need to bear in mind that "Performance in the age of technology and innovation involves the pursuit of new creative, technological and knowledge-related advances".

It is becoming increasingly clear, both from the growing debate among academics, pollsters, politicians and statisticians, as well as from the many entries to The Indigo Prize, that GDP as it stands is no longer totally fit for purpose. We need a structural change in the way that we measure progress and success in 21st Century economies. We hope policy advisers and decision makers from around the world will take inspiration from these essays. ●

WHAT IS GDP? WHY DO WE NEED TO RETHINK IT?

Gross domestic product (GDP) is a measure of economic activity that captures the value of goods and services that an economy produces during a given period. GDP can be expressed in nominal or real terms.

Increasing GDP is thought to enhance the welfare of individuals in a society, as economic growth allows average incomes to rise, supporting a higher level of consumption. Decreased GDP is associated with lower incomes, lower consumption and consequently a lower standard of living.

GDP can be estimated using three different methods:

The production estimate is based on the value of output in the economy (such as cars) minus the inputs used up in the production process (such as car tyres and electricity). This information comes from surveying tens of thousands of UK firms.

The expenditure estimate is based on the value of total expenditure on goods and services, excluding intermediate goods and services, produced in the domestic economy during a given period. Whereas the production approach captures the value of production, the expenditure approach reflects the value of spending by businesses, consumers, overseas purchasers and government on goods and services. The primary data for this measure come from expenditure surveys of households and businesses, as well as from data on government expenditure.

The income estimate measures the incomes earned by individuals (such as wages) and corporations (such as profits) directly from the production of outputs (goods and services). The main data for this approach to measuring GDP come from the Quarterly Operating Profits, Average Weekly Earnings and employer surveys, along with administrative data from HM Revenue & Customs.

Using the three different methods avoids sole reliance on one source and allows greater confidence in the overall estimation process. GDP is estimated on a quarterly basis and if perfect data were available, the three approaches would generate equal estimates.

As the data collected and processed by the ONS are based on a variety of statistical surveys and administrative datasets, the three estimates can be different. In order to obtain the best estimate of GDP (the published figure), the estimates from all three approaches are reconciled.

However, there is a growing discussion about whether our current definition of GDP is still an adequate measurement for modern economies.

As far back as 1968 Robert Kennedy said that GDP "does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials".

Does it remain true that increasing GDP necessarily leads to higher standards of living? Many of the things that make a society affluent, successful and innovative are not captured in GDP: leisure time, time spent with children, our consumption of data, education levels, the strength of friendships, the sharing economy, and the level of entrepreneurship.

Moreover, we need to change our approach to measurement as our economies rapidly change: it's important to consider the impact that advances in artificial intelligence, robotics and technology are having, and increasingly will have, on our societies. ●

IMPROVING GDP: DEMOLISHING, REPOINTING OR EXTENDING?

JONATHAN HASKEL, CAROL CORRADO AND TEAM

An international team who have worked in academia, the private sector, at Central Banks and in government on better measurements of GDP, comprising:

Carol Corrado, The Conference Board and Georgetown Center on Business and Public Policy; Kevin Fox, University of New South Wales; Peter Goodridge, Imperial College Business School; Jonathan Haskel, Imperial College Business School, CEPR and IZA; Cecilia Jona-Lasinio, ISTAT and LUISS, Rome

Daniel Sichel, Wellesley College

and Stian Westlake, NESTA

Recent years have seen a proliferation of indices of economic achievement. Unfortunately, none of them satisfy the principles of good measurement, since they tend to double-count, and lack meaningful weights. GDP satisfies these principles. But economies have dramatically changed since the development of GDP: more knowledge production, more digital goods, more things for free. Accordingly, we propose repointing GDP to reflect changes in the economy: to measure intangible and environmental capital, to quality-adjust prices, to run online experiments to value free goods. We then propose extending GDP to measure economic wellbeing, taking account of leisure and measures of security.

We have a plethora of measures of economic and social achievement besides GDP. The Human Development Index adds life expectancy, education and GDP per head. Measures of Australia's Progress includes trust, close relationships and the home; the EU Innovation Scoreboard global connectivity, the Indigo Score political stability and the WIPO Global Innovation Index infrastructure and business sophistication. Perhaps this is as it should be, for isn't the world bristling with activity? Consider an example mini-economy: a fulfilment centre, shown in Figure 1 (the Amazon centre in Dunfermline, Scotland). It has a dizzying assortment of goods.

Figure 1: A mini-economy
Source: Sottish Government

Take this mini-economy and its counterpart in India. How are we to compare economic and social attainment just in these economic microcosms that sell different goods and adopt diverse organisational models? One might sell woolly sweaters, waterproof hiking boots and recipes for haggis; the other, rice cookers and prayer books. One might use software to route workers more quickly, the other might pay higher wages. One might generate energy from solar panels but ship over longer distances causing more pollution. Which is doing better, both for itself and for the world as a whole?

As this example shows, it's difficult to compare even these two relatively similar economic entities. So what is needed to capture the economic achievements in these two mini-economies? What would a "good" index look like?

SOME ECONOMIC MEASURMENT PRINCIPLES

One way to answer this question is by looking at the economy of the entire world. A stylised version is set out below (Table 1).

Sector of economy	Broad description of production activity	Examples		
1	2	3	4	5
Primary	Agriculture, Mining	Wheat	Silicon	Graphite
Secondary	Manufacturing, Construction	Bread	iPad	Pencil
Tertiary	Services (e.g. Transport, Retail, Distribution, Security, Food, Accommodation)	Sandwiches	Computer repair	Restaurants
Quaternary	Knowledge production (e.g. Schooling, R&D, Media Content)	Recipes	Software coding, Blogging	Schooling, Blueprints

Table 1. Economic Activity in the World Economy

Columns 1 and 2 classify all economic activity in the world as in one of four sectors. To the conventional Primary, Secondary and Tertiary sectors shown in column 1, we add the "quaternary" sector describing the knowledge production sector (e.g. education, R&D) (Kenessey 1987). The other columns are examples of activities in the sector.

> We propose not to demolish GDP, but to repoint and to extend it.

Assume we aim to measure the economic activity of the world economy represented in Table 1. A good index must respect two principles:

1) no double counting of production activities (e.g. not counting both wheat and the bread made from the wheat) and

2) a way of weighting different products (e.g. of combining bread, pencils, and iPads) into a coherent measure of activity with weights that can differ as needed across countries and change over time.

SO WHAT'S RIGHT ABOUT GDP?

GDP satisfies these two principles. It avoids double counting, by adding up value-added at each stage of production. And it has a straightforward way of weighting products: by using prices. Prices reflect the balance between what consumers want, what they can afford and what firms can feasibly supply. They are based on information observed in markets that reflect the interactions of millions of people. Because only GDP passes these two tests, we argue that calls to demolish and replace GDP are premature.

SO WHAT'S WRONG WITH GDP?

GDP could be improved in two ways.

— Repointing: improving the way GDP measures production in the modern economy.

— Extending: expanding the scope of measurement beyond production to capture broader measures of welfare.

These improvements must respect the principles of not double-counting and maintaining informative weights.

REPOINTING GDP TO MEASURE PRODUCTION BETTER

We have two broad suggestions for improving how GDP measures production in the modern economy, which we explain in more detail in (C. A. Corrado et al. 2017).

BETTER MEASUREMENT OF INTANGIBLE AND NATURAL CAPITAL

As economies get richer, they become more knowledge-intensive and place a greater value on natural resources. But current methods of calculating GDP to a great extent exclude knowledge and natural capital.

The usual practice, in both national and company accounts, is to treat knowledge-related expenditures as intermediate costs, rather than as investments – even though knowledge goods like R&D, brands and new organisational forms are often long-lived and valuable assets for firms.

As the quaternary sector becomes larger, this error becomes more significant. Corrado, Hulten, and Sichel (2005) and (2009), set out a comprehensive categorisation of intangible expenditures that should be counted as investment (see also Haskel and Westlake 2017).

The same general principle can be used for measuring natural resources, so planting a new forest is an investment in "natural capital", polluting the Great Barrier Reef is destroying it and managing farmland better reduces the costs of using it.

BETTER MEASUREMENT OF PRICES

GDP relies on prices as weights. But in some cases prices have to be adjusted to account for changes in the quality of goods so as to compare like-with-items (for example, because of technological progress), or if valuable products are provided for free (online). Here too there is scope to repoint GDP to ensure its continuing usefulness in a modern economy.

> A monk in a remote Tibetan monastery values quiet, solitude and contemplation. A Wall Street trader in a New York nightclub probably takes a different view.

Statistical agencies use many techniques to capture quality changes, but, while progress has been made, much further work is needed for a wide range of goods, such as high-tech and medical products (Byrne and Corrado 2017; Byrne, Oliner, and Sichel 2017). We recommend (a) close monitoring of the judgements made on what is like-for-like and (b) further work on price adjustment for goods and services where specifications

change rapidly making it particularly hard to compare like with like.

A world of free apps, search engines and Wikipedia makes using prices to weight GDP trickier – but not impossible. One way to make progress is to identify "shadow" prices that capture what consumers would be willing to pay for the free good, or accept for foregoing the free good, and then use these valuations to augment GDP (Diewert and Fox 2017).

Such shadow prices can be ascertained cheaply by online experiments reaching many people. Respondents can be offered the choice to keep a digital good or exchange it for $X (Brynjolfsson, Eggers, and Gannamaneni 2017); researchers can check accuracy by randomly selecting individuals and actually fulfilling their selection.

EXTENDING GDP

FROM PRODUCTION TO WELL-BEING

What if we want to go beyond production to measure well-being? A monk in a remote Tibetan monastery values quiet, solitude and contemplation. A Wall Street trader in a New York nightclub probably takes a different view. To look at well-being, we need to solve two problems: (a) how to find comparable indicators of well-being (b) how to incorporate these elements while respecting the principles of no double-counting and informative weights.

Given the difficulty of measuring and comparing different types of well-being, we advocate three broad indicators of social well-being: consumption, leisure and security. We argue that well-being depends on how much leisure people can take (a good thing) and how much income they can generate from working (a good thing), and the extent to which they experience worry about these things in the future.

At first pass, all this looks a long way from GDP. But Martin Weitzman (Weitzmann 1976) showed that, leaving aside leisure and security, a few adjustments to GDP will indeed measure welfare, by capturing both current and future consumption (i.e., consumption and saving). If we want to go further and incorporate leisure and security, we can look to a recent study by Jones and Klenow (2016), which represents security by measuring mortality and leisure by a relationship between consumption and hours worked. Their measure of well-being is strongly correlated with GDP per capita, with a correlation coefficient of 0.98 across about 100 countries (Figure 2).

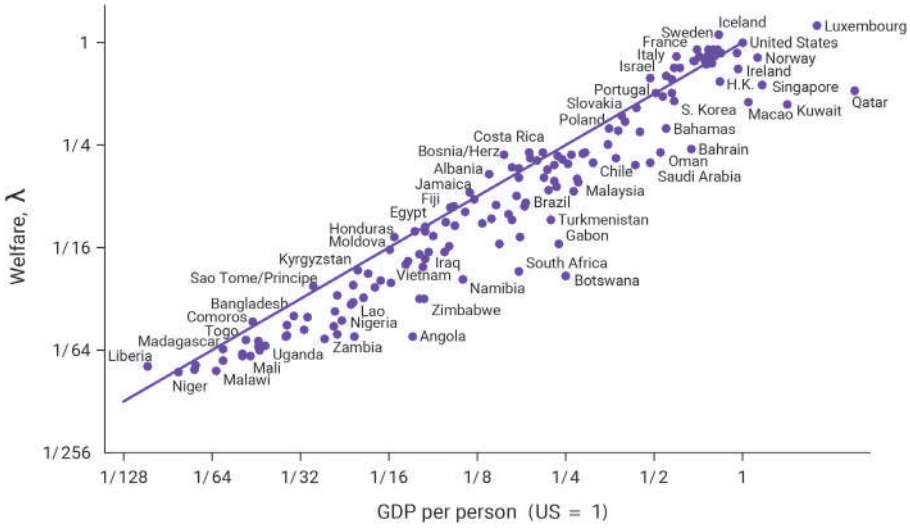


Figure 2: Jones / Klenow welfare measure and GDP per capita
Source: Jones and Klenow (2016)

EXTENDING GDP

We propose following this general approach: combining components of GDP, such as consumption and saving, with other measures of wider societal welfare. One key innovation would be to measure "security" using the same sorts of online experiments we proposed to value free goods above, namely asking consumers how much they would be willing to accept to not have certain forms of insurance for, say, a month.

We advocate repointing GDP by better measurement of intangible and natural capital, by better adjusting for the quality of products, and by using online experiments to assess the value of free goods.

CONCLUSIONS

We propose here not to demolish GDP, but to repoint and to extend it. We value GDP because it avoids double-counting and allows for sensible weights. We advocate repointing GDP by better measurement of intangible and natural capital, by better adjusting for the quality of products, and by using online experiments to assess the value of free goods. We advocate the extension of GDP by constructing a systematic but rigorous measure of well-being that takes into account consumption and saving, leisure and security. ●

MAKING THE FUTURE COUNT

DIANE COYLE AND BENJAMIN MITRA-KAHN

Diane Coyle is Professor of Economics at the University of Manchester, and author of numerous books including GDP: A Brief but Affectionate History and The Economics of Enough: How to Run the Economy as if the Future Matters.

Benjamin Mitra-Kahn is Chief Economist at IP Australia, the Australian Government's intellectual property agency. His doctoral dissertation was a history of economic measurement.

GDP captures only market transactions at the price of exchange, and not environmental externalities, the distribution of wealth or the innovation occurring in the economy. The changes being brought about by digital technology and past unsustainable growth make the case for a new measurement framework more pressing than ever.

We propose a two-stage reform. The first involves three straightforward amendments to GDP: accounting properly for intangibles; removing unproductive financial investment; and adjusting for income distribution.

The second is a more radical switch to a dashboard recording people's access to six key assets: physical assets, natural capital, human capital, intellectual property, social and institutional capital, and net financial capital. This is an ambitious approach but if we had adopted it earlier, there would have been no complacency about economic performance in recent times.

Gross Domestic Product was one of the great innovations of the 20th century. But like many inventions of the past century, from the internal combustion engine to the cathode ray television and the 56.6k modem, it is time to phase it out. GDP was a useful measure of the 20th century economy, but it has struggled to measure what has become an increasingly intangible, digital, unsustainable and unequal economy.

We propose three ways to improve GDP as an interim step to take account of these shortcomings, but even an improved GDP will be inadequate for assessing progress in the 21st century economy. In its place we propose a very different way of conceptualising and measuring the economy – one based on assets: from the physical, natural and financial through the intangible, human and social.

This balance sheet approach to measuring the economy will embed sustainability, which GDP never can because it records only flows of income, output, or expenditure. We are proposing a system of economic measurement that ensures the future gets due weight in present decisions.

The emphasis of our approach is on individuals being able to lead the kind of life they would like, so our approach also monitors people's access to these different kinds of assets. Our system, firmly rooted in economic theory, completely changes our framework for thinking about whether the economy is doing well or badly.

A LONG TERM WELFARE FRAMEWORK

The present national accounts framework conceives of welfare in terms of utility, dependent only on production and consumption in a given time period. This inherently rules out measuring sustainability: for example, past and current generations have damaged biodiversity and air quality more than due consideration of the UK's resource balance sheet would have justified. Thanks to this unmeasured profligacy, future generations will have to pay more for ecosystem services such as pollination and clean air.

Similar problems apply to all economic assets. GDP cannot answer the question about the extent to which current consumption and production leave the nation's assets, from bridges and roads to investments in factories or software, able to sustain future consumption that is at least as high as now.

Nor can GDP answer the question about the extent to which people are able to lead a life that is meaningful

and satisfying to them, including being able to consume goods and services.

We propose an alternative framework based on Amartya Sen's concept of capabilities, or people's opportunities to lead the kind of life they value. Income and consumption are important, but the relevant capability metric is the extent to which people can earn the income they need, and have access to the assets they want.

This implies a profoundly different approach to measuring the economy.

THE SIX ASSETS

We advocate for a high-level dashboard of six assets that underpin the 21st century economy, and behind that, in layers of increasing detail, estimates of their components and of people's access to each type of asset.

These six assets are the basis for our proposal, but, as we note below, no country has adequate data collection for this approach, and that is where the next steps need to be taken:

1. PHYSICAL AND PRODUCED CAPITAL:

No countries have an adequate assessment of the extent and quality of infrastructure and its maintenance, but only partial estimates or maps. In the UK the Victorians and Edwardians built much of the current network infrastructure; we have no idea how much maintenance or new investment has been undertaken since and how much reinvestment to stand still will be needed in the near future. Economists' tools for assessing infrastructure needs are inadequate as they omit the public good characteristics and potentially non-incremental character of much investment in physical infrastructure.

2. NATURAL CAPITAL:

Measurement of natural capital is very incomplete and uses current market values; there are many missing components, no measurement of physical volumes, and the use of market values omits externalities. The available figures are nevertheless not encouraging: natural capital in England & Wales has been in decline over several years. Enhancements would benefit public physical and mental health, and could avert the need for investment in concrete infrastructure for flood defence.

3. NET FINANCIAL ASSETS (INCLUDING CONTINGENT ASSETS):

The government balance sheet does not include the government's contingent liabilities from future promises such as pensions, or public financial liability payments. A National Audit Office report estimated large and rapidly growing contingent liabilities in a limited number of categories; an estimate of 'generational accounts' looking at state pension liabilities estimated these as equivalent to a tax increase of 6-7% of current GDP.

4. HUMAN CAPITAL:

Future income distribution, and social sustainability, depends on human capital. Human Capital measures look at educational qualifications – quite a crude measure of relevant skills and attributes – and use market earnings to value the human capital represented by a given level of qualification, as a starting point for accounting for people's skills, abilities and access to training.

5. INTANGIBLE ASSETS, INTELLECTUAL PROPERTY AND DATA:

There is scant collection of data on data, or on the total value of

intellectual property and intangibles, although companies spend large sums on these investments. The gaps are starting to be filled but research on measuring these and other intangibles is clearly vital, and a theme of both the prize winning Indigo essays in 2017. A pressing policy issue is the distribution of ownership of such assets, the returns they generate, and the power their ownership creates.

6. SOCIAL AND INSTITUTIONAL CAPITAL: Social capital is an abstract concept and there are no systematic attempts to measure it, although surveys ask people how much trust they have in institutions and in other people in general. Some of these surveys make dismaying reading.

> We propose a very different way of conceptualising and measuring the economy – one based on assets: from the physical, natural and financial through the intangible, human and social.

ACCESS

Above all, few of the available statistics are concerned with 'access', or in other words distribution. The measures that exist mainly focus on national aggregates or averages. There is a vacuum in terms of understanding the distribution of national economic wealth.

Yet distribution is everything when thinking about aggregate economic welfare. Economists have always known that the aggregate value depends on distribution, as it is one of the fundamentals of welfare economics, but this has largely been forgotten with the focus on conventional statistics such as GDP. Distributional questions have only recently come to prominence again thanks to the work of a few economists such as Thomas Piketty and Anthony Atkinson.

> We propose an alternative framework based people's opportunities to lead the kind of life they value.

The statistics on distribution offer a dismaying glimpse of the direction of travel for total economic welfare. Several are heading down and the chances are some of the missing elements, such as contingent public financial liabilities, would be deteriorating too. The increases in welfare due to innovation are clearly an exception; they are augmenting economic welfare, and possibly to a large extent – but there is a big question mark about distribution.

If there had been a comprehensive presentation of a systematically-constructed set of estimates of national assets, there can be little doubt that any complacency about how the British economy is benefiting its people would have been swept away years ago.

A CALL TO ACTION

GDP never pretended to be a satisfactory measure of economic welfare. So we should not be surprised that GDP does a bad job of measuring progress. GDP has focused the 20th century economies on maximising the output of goods and services from the current use of resources. The future has zero statistical weight. GDP has ignored individuals, and geography. Many groups in society and places have been invisible in policy debates.

What the state does not see, because of the absence of statistics, is invisible in policy making. Statistically invisible phenomena do not feature in political debate until they become unsustainable.

The radical changes in the structure of the economy and innovation, involving intangible assets, data, and revolutionary changes in production, have been invisible. Policymakers have therefore been caught on the hop by the social consequences. In the short term, we propose amending GDP by adding investment in intangible assets such as data or intellectual property, taking account of income distribution, and deducting unproductive financial activity.

The long-term alternative we propose, underpinned by the range of assets needed to maximise individuals' capabilities to lead the life they would like to lead, would have told a different story about the recent past. It would have painted a picture even more divided than our current one: great improvements, on balance, for people with degrees, and access to new digital services, living in areas well-served by infrastructure; deterioration, on balance, for those who left school with few qualifications, have no access to fast broadband or even fast trains, and live in areas near polluted roads with scant green space.

Re-imagining the economy is not a small task, but it is one we should actively engage in. Because for all the benefits of new technology, current and to come, our current way of measuring the economy, leaves us complacent and blind to the major changes that are taking place – that will have, and has had, serious adverse consequences. This is the time to act. ●

Q&A / INDIGO PRIZE JUDGE

JIM O'NEILL

Lord O'Neill is a British economist who worked for Goldman Sachs for 18 years, spending most of his time there as Chief Economist. He also served as Commercial Secretary to the Treasury, and was a key figure behind the UK's Northern Powerhouse agenda.

WHY IS THIS COMPETITION IMPORTANT?

There is a general view that the data we have isn't necessarily reflective of the data we want, so it's pretty straight forward in a way. I really applaud this effort to reward somebody directly for thinking up new ways of looking at the data.

WHERE DO THE CURRENT MEASURES FALL SHORT IN YOUR OPINION? WHAT ARE THE NEW IDEAS?

In terms of the current measures, new proposals can range from a more "accurate measure" of GDP which is what some people thought this competition was all about, for example, trying to measure things like happiness. In the financial market world, something that is looked at is faster measures of GDP. People in the market always want an edge, something quicker than anyone else. People who don't care about financial markets want something that's valid to their lives, so for a lot of people they think what is GDP anyway; does it make me feel happy? Am I happier, or not? I think we need new data because as technology gets better it allows more people to wonder about whether there are better ways of measuring things, including economic growth.

IN TERMS OF THESE NEW MEASURES, HOW COULD THEY APPROACH MEASURING CREATIVITY IN INNOVATION? WHAT'S BEEN DONE IN THAT SPACE BEFORE?

One of the biggest mysteries of our time is that reported productivity in the UK and around the developed world appears to be very weak. We have all these supposedly wonderful things going on, so how can that be true? Maybe it's because we can't measure Uber and all these fast food delivery systems. All these new technological advances and what they add to our wellbeing in terms of wealth and health – maybe there are better ways of measuring them. That is one of the really good things about having a competition like this, because someone may find a better way. ●

WE NEED NEW DATA BECAUSE AS TECHNOLOGY GETS BETTER IT ALLOWS MORE PEOPLE TO WONDER ABOUT WHETHER THERE ARE BETTER WAYS OF MEASURING THINGS.

GLOBAL INTEGRATION AND INDIVIDUAL POTENTIAL (GIIP) INDEX

ALICE LASSMAN

Alice is a 19-year old Geography student at Durham University – a global idealist, she wants to see a new approach to the key issues of the 21st century: collaborative, pluralistic and citizen-centric. She hopes to take a lead role in global policy after graduating and is researching policy approach alongside her degree.

Indicators of economic development should reflect the nature of development itself: dynamic, evolving, context-specific. The GIIP index is a necessary new function which encapsulates economics at all levels by looking at nations through an individual and global perspective.

Assessing an individual's Perception, Opportunity and Ability exposes a rich and complete representation of their county's potential, as individuals are the sole economic actors that make up producers, consumers and government.

Extrapolating the impact of individual potential creates a clear picture of a state's Global Integration, which, weighted equally to perception, opportunity and ability, influences cultural, economic and social interactions with other countries.

With each country following unique development trajectories of varying time scales, specialisations and rates of social development, finding a comparative measure of economic activity poses an increasing threat of masking true economic potential. Focussing on an individual scale first allows us to gauge an inside perspective, building up a picture of the success and wealth of a nation by piecing together the smallest economic units.

GDP has served its purpose well: not only comprising the total income of a nation, thus its wealth, but the total economic output and expenditure. But using the money charged for individual goods and services to quantify their value is missing the point: money alone cannot encompass the full wealth of the processes and transactions behind an economic exchange. Money cannot represent a creative process, collaboration or social enactor, nor harmful by-products that can move across borders freely, nor impact on local cultures, regional trade relations and international social conventions.

The ease of transferring ideas and technology no longer makes these economic transactions clear-cut: if a Chinese market stall owner is selling a counterfeit Apple iPhone charger on the streets of Beijing, is China's marginal gain in GDP a fair reflection of the input of US innovation and technical skill? When tracing back actions of individuals, we find an interconnected web of impact that sprawls across the globe.

Before exploring the GIIP index as a means for measuring development – social, cultural, economic, political, creative and potential, I first want to highlight the potential dangers of exposing such a measurement on a global platform. GDP has long been used to define international politics by branding industrialised economies as 'developed' and creating a stimulus for the discourse of Western modernity and its promotion through military intervention, trade and aid. Control of intergovernmental organisations, such as the UN, IMF and World Bank is still skewed to favour the largest economies and reduces the influence of many with potential. Potential, which I shall explore first, must therefore be considered within the limitations of these institutions.

However, the GIIP index favours outward-looking potential, including global integration and reputation as one of its four key components.

By promoting cooperation and collaboration that inspires new solutions to global crises, GIIP aims to counteract the competition created when producing an indicator.

PERCEPTION

Perception is a markedly qualitative idea, and the most abstract of the measures within the GIIP index – but the most important and refreshing.

According to Deloitte, uncertain economic outlook is the leading obstacle to growth. Perception not only acts as an indicator of the present state of affairs within a country, but just as equally gives some idea to the shape of their future. Having citizens that are confident in an economy, supported by strong social standing and political stability, results in more expenditure, greater ability and support to take risks and hence creativity.

PERCEPTION HAZARD FILTER

An individual's perception of their country's state is dictated by the political regime: educational and living standards, insecurity and threats from neighbouring states or political militias. It is vital that perception is looked at in context of the national political backdrop, so a perception hazard filter must be used before to ensure accuracy. Positive perceptions of a country may arise through poor education or lack of democratic or media power to understand their environment better, such as North Korean citizens, who will perceive their prospects to be very high. Hence, scores in Education (within Human Capital), Political/ Government and Freedoms – the three factors that determine this skew – will be converted into a percentage out of 10%. Higher scores in these areas will mean less of their perception score is deducted, while low scores could lose up to 10% of their score (1/40th of the overall GIIP score).

OPPORTUNITY

Opportunity is something largely provided for its citizens by their government through equal opportunity laws, investment and infrastructure that attracts businesses and whether their governance is technocratic, and incorporates technical expertise in policy. Social norms also dictate opportunities available, as equal opportunities will not arise simply as a result of a change in law. Cultural and religious standing on marriage and gender take precedence over national law, and countries where FGM, child marriage and disregard for a girl's education are prominent will severely lack opportunities regardless of law.

ABILITY

The ability to execute ideas, by providing the rights networks to and conditions can overcome physical

geography, instead of aiding the course it has chosen for a nation. If a country is able and fulfilled in a number of areas, its vulnerability to/frequency of natural hazards will not be reflected in its ability to bounce back. The ability to dream is inspired by role models, the desire to build oneself up from nothing or bounce back from a bad event, or being inspired by western success are all possible due to economic interconnectedness and technological advancement that proves what success can be.

> Focussing on an individual scale allows us to gauge an inside perspective.

INDIVIDUAL POTENTIAL FACTORS:

SOCIAL: PERCEPTION OF MINORITIES, WOMEN AND WEALTH DISTRIBUTION

— In order for an economy to prosper, all genders, age groups and ethnicities must be equally incorporated into the workforce and given equal opportunities to compete. Thus, jobs will be fulfilled more productively and creatively which leads to an economy adapted to a growth mind-set.

— Economic diversification also arises from an advanced society, as if traditionally gendered jobs are viewed more fluidly than structural unemployment can be avoided. If a man refuses to be a hairdresser on the principle that it is a job for women, despite the ease of training up human capital in these skills, then a local hairdressing salon may go out of business.

ECONOMIC: STATE OF THE ECONOMY

— Diversification of an economy: human potential and capital is restricted if a country is over-reliant on a handful of sectors of highly skilled labour. Providing an education that is varied will create less specialised labour to solve complex modern-day problems.

— Leaders need to navigate their workforce through changes brought about by new technologies – is an economy's infrastructure built to adapt to ideas of AI, mobile supercomputing (fourth industrial revolution) and climate change?

INTERNATIONAL RELATIONS AND THEIR POSITION IN GLOBAL ECONOMY

— In an increasingly interconnected world, maintaining strong relations with other states can be key to a country's economy. A country like Rwanda, which is landlocked, would lack the potential to export tin, tea and coffee without strong relations with the neighbouring Tanzania and Kenya, offering them access to a seaport.

GEOGRAPHICAL: PHYSICAL LIMITATIONS AND WORLD ISSUES

— Physical and human factors have long determined and will continue to fix the state of development within an economy. Dependence on one patriarchal figure within the family increased their vulnerability to shocks like HIV or Malaria, increasing the chance of falling into the poverty trap. Having economic centres nearby provides the opportunities, capital and expertise to grow an economy. A domino effect might ensue if economies in close proximity pass on prosperity.

HUMAN CAPITAL

— Investment in human capital is a key aspect of providing opportunity and creates a more diverse and

> The GIIP index favours outward-looking potential.

sustainable workforce, yet only 62% of global talent is being fully utilised, Human Capital no longer is limited to skills and education training, but the mental and physical health of individuals can cause presenteeism an increasing barrier to economic productivity.

— Human capital improves the prospects of individuals, companies and societies and is a key factor for growth, development and competitiveness. For individuals it can provide an income, prosperity and transferable skills, companies and society will benefit from improved health, education and skills training by strengthening the call for democracy and human rights. Collaborating our skills, beliefs and knowledge is the best way to provide innovative solutions, cross-fertilisation of ideas and layers of different perspective.

HEALTH

— High living standards and enjoying good health ensures prosperity and higher productivity. Prosperity and health also reflects positively on election of government (provided there are free and fair elections), as populist appeal arises as a result of disparity, globalisation or discontent, spurred by economic downturns or deindustrialisation.

POLITICAL/GOVERNMENT

—A government's ease to create policy impacts the redistribution of wealth, infrastructure and investment in key sectors needs to be paired with business networks to allow sharing and knowledge creation.

The ability for individuals and businesses to tap into up-to-date, uncensored technology act as tools for progressing towards innovation.

FREEDOMS

— Freedoms in recreation, such as access to a wide spectrum of critical and historical arts, drink and drugs, public spaces and freedom of assembly inspire creativity as individuals can express their feelings or beliefs through outlets as they choose. The ability to feel secure economically, politically and socially provides the only environment for investment, prosperity and creativity. ●

> Money alone cannot encompass the full wealth of the process and transactions behind an economic exchange.

THE EARTH RESOURCE BUDGET

BENEDICT GARDNER

Benedict Gardner is a Geography undergraduate at the University of Oxford. He entered the Indigo Prize out of concern for the policy direction GDP has encouraged for the last century. He has attempted to create the Earth Resource Budget as a compass point for 21st century growth.

The Earth Resource Budget is based on two key ideas: human development should be quantified just as economic development is; and all forms of development operate within the bounds of the living planet. The ERB attempts to quantify the value of a healthy, educated, digitally-literate population to make sure that economic growth is focussed on human growth, not just for its own sake. The metric is engineered to incentivise green growth and social development in the frame of dollar values, something current Index-based measures fail to do. This will help politicians and the public alike to engage in the metric.

HOW IT WORKS

The Earth Resource Budget has two key parts – Gross Domestic Value (GDV) and Resource Outflows. GDV contains all the value humans put into society, both economic and social.

All of these inflows are set against just one outflow – that of Environmental Resource Use. By putting all of human effort and ingenuity against our own resource use, the ERB attempts to create a metric around which sustainability movements can rally and measure success.

GDP
+
DOMESTIC CAPITAL
+
HUMAN CAPITAL
+
IDEAS CAPITAL
+
ENVIRONMENTAL CAPITAL USE

EARTH RESOURCE BUDGET (ERB)

INVESTING IN THE ECONOMY – DOMESTIC CAPITAL

VALUING GROSS DOMESTIC PRODUCT

GDP gives us a valuable insight into the production capabilities of a nation, which indicates how well it is using resources efficiently and employing Human Capital. It also has the advantage of being a uniquely quantifiable measure, and so serves as an essential basis for many of the calculations below. GDP PPP has been used for all calculations in this report, as this allows the chance to compare country development over time.

VALUING THE DOMESTIC CAPITAL

Currently, no widely used metrics consider 'domestic' work, such as cooking, cleaning, childcare, and elderly care in measuring value of human work. It is vital that if we are to truly consider Human Capital as part of economic measurement, that we include the work of the 'Domestic' economy as equally important as GDP in terms of measurement. To work out the value of the Domestic economy, a similar metric to Human Capital will be used.

NATIONAL GDP * (100 - EMPLOYED + UNEMPLOYED RATE) = DOMESTIC CAPITAL

The values in the tables show the figures for Gross Domestic Value, before consideration is made for Ideas and Human Capital. This will be referred to as Base Gross Domestic Value. Four example countries are on the right in Table 1.

Country	GDP ($bn)	Domestic	Base GDV
UK	2905	758	3663
Denmark	284	74	358
Ethiopia	194	43	237
China	23194	7422	30616

HUMAN CAPITAL – INVESTING IN PEOPLE

Measuring Human Capital will incentivise policy-makers to focus on deployment of human skills and value. The use of Base GDV will mean that the Human Capital of those employed in the Domestic Economy will still be valued equally. Unemployed Human Capital will not be included, thus providing governments an incentive to work towards full employment, or better recognise the extent of their Domestic Economy. Human Capital will be calculated using the following formula.

BASE GDV * (HUMAN CAPITAL SCORE) % = HUMAN CAPITAL VALUE

Human Capital Score	80+	70+	60+	50+	40+
Multiplier	2x	1.5x	1x	0.5x	0.25x

Country	Human Capital Score	Human Capital ($bn)
UK	0.8004	7358
Denmark	0.8247	712
Ethiopia	0.5302	102
China	0.6781	29371

For countries that invest heavily in Human Capital deployment (education, health and gender parity being three key areas) the potential budget gains are considerable.

IDEAS CAPITAL – INVESTING IN IDEAS

Valuing ideas is vital to tackling 21st century issues like climate change and poverty. Therefore, we should attempt to quantify the value of these traits in the ERB.

ENTREPRENEURSHIP CAPITAL

This report defines entrepreneurship, a term that has always eluded a solid definition, as 'the ability to maximise income (at all scales) with a limited resource base'. Therefore, the new figure for entrepreneurship will be based on a country's domestic consumption against their GDP.

GDP PPP / DOMESTIC MATERIAL CONSUMPTION PER CAPITA
=
ENTREPRENEURSHIP CAPITAL ($/ METRIC TON)

INNOVATION CAPITAL

Innovation is at the core of any economic development, and in an increasingly crowded and competitive global market, innovation needs to measured more than ever. Research and Development (R&D) funding as a percentage of GDP will be used to measure Innovation Capital.

GDP * R&D % OF GDP = INNOVATION CAPITAL

CREATIVITY CAPITAL

Creativity is perhaps the hardest form of Capital to assign a dollar value. Every human being has creative capital that we exercise in our daily lives, which should be government supported. Therefore, Creativity Capital will use Public Arts Funding and Press Freedom as the base of Creativity Value within an economy.

GDP PPP PER CAPITA * PUBLIC ARTS SPENDING* (100-WORLD PRESS FREEDOM INDEX)%
=
CREATIVITY CAPITAL PER CAPITA

DIGITAL SKILLS CAPITAL

Digital Value is not created like normal GDP. Much value is free and open-source, therefore not considered in traditional GDP. Therefore, a 'time replacement saving' is the best way to consider the value of Digital Skills to an economy. The ability to send an email versus a written letter, along with other savings in a basket of savings much like the UK CPI Basket and assigned a dollar value assuming 1 monthly use.

TIME SAVING * 12 * PENETRATION %
= TIME SAVED PER CAPITA

> The Earth Resource Budget is a way to rethink development in terms of the limits of the planet, and put a real quantifiable value on Human and Ideas Capital.

Service	Skill Required	Time Saving	Penetration	Time Saved per Capita
Email	Internet Use	24 hours	87%	251 hours
Text	Phone Use	24 hours	94%	271 hours
Online Banking	Internet Use	2 hours	63%	15 hours
Telecommuting	Internet Use	2 hours	12.8%	5 hours
			Total	542 hours

IDEAS CAPITAL INFLOW TOTAL

The final dollar values (in $bn) can be found below:

Country	Innovation Capital	Creativity Capital	Entrepreneurship Capital	Digital Capital
UK	49	19	420	227
Denmark	9	4	17	22
Ethiopia	1	0	110	0
China	394	1	2355	727

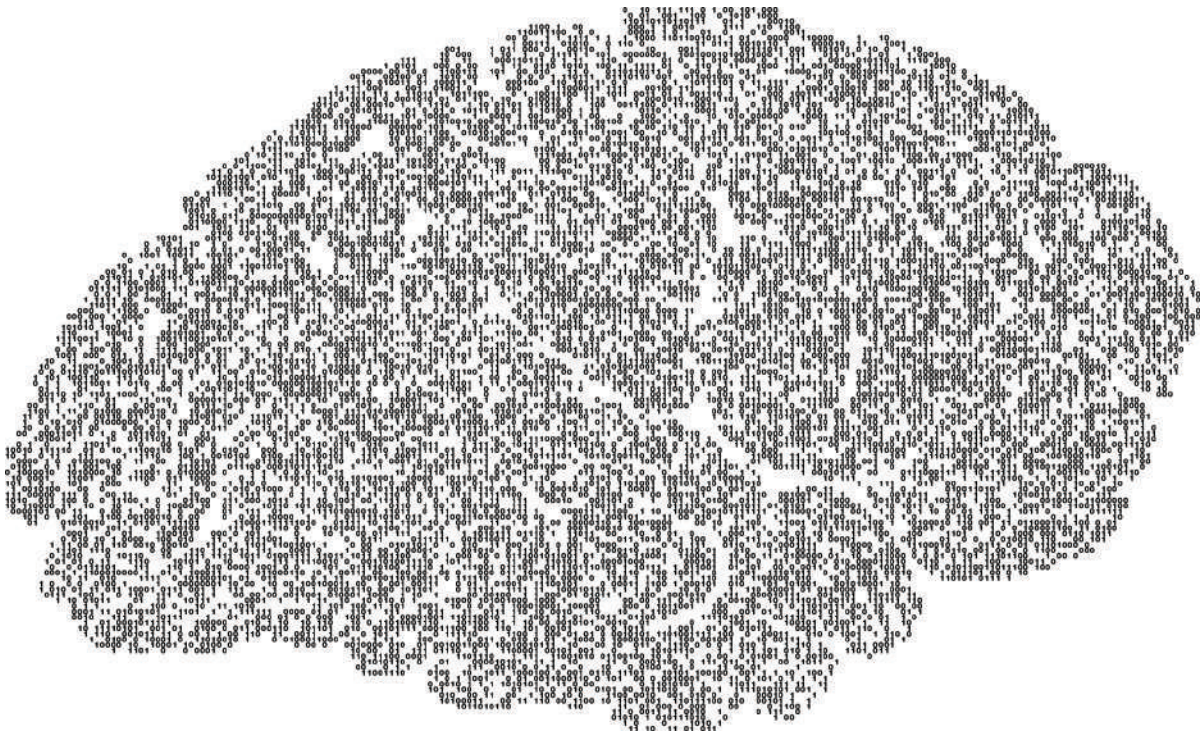
ACCOUNTING FOR USE – ENVIRONMENTAL CAPITAL

It has been well established that the Earth currently uses more Environmental Capital than is replenished on an annual basis. The Footprint Network estimates that 1.6 Earths are used per year to meet our needs. Therefore, the ERB reflects this overshoot in consumption, multiplying GDP by Earth Use. From a policy perspective, this will encourage policymakers to consider whether a resource-intensive project or industry is worth investment, as it could damage ERB at a greater rate than it contributes.

Country	Earth Use	Final Capital Out ($bn)
UK	2.96	8599
Denmark	3.58	1017
Ethiopia	0.59	114
China	2.11	48939

NATIONAL GDP *
(EARTH USE PER YEAR)
=
ENVIRONMENTAL CAPITAL

Currently low-consumption countries like Ethiopia see Capital Output lower than GDP (leading to a higher ERB). If they can retain growth while not increasing Earth Use (i.e. decouple growth), this reduction will continue. Any nation, developed or developing, that can decouple growth from resource use will see a larger Earth Resource Budget.



CALCULATING EARTH RESOURCE BUDGET

The final quantified results can be seen below. Four example countries – the UK, China, Ethiopia and Denmark have been chosen to represent a mix of incomes, population sizes and levels of development. All values are in $bn. Full values can be found here: http://bit.ly/2zosehR

> The Earth Resource Budget could be used to see humans live within the means of the biosphere and to full human potential for the first time in history.

BASE GDV

Country	GDP	Domestic	GDV (before ideas)
UK	2905	758	3663
Denmark	284	74	358
Ethiopia	194	43	237
China	23194	7422	30616

IDEAS AND HUMAN CAPITAL

Country	Innovation Capital	Creativity Capital	Entrepreneurship Capital	Digital Capital	Human Capital	Ideas Adjusted GDV
UK	49	19	422	228	7358	13596
Denmark	9	40	17	22	712	1534
Ethiopia	1	0	94	0	102	403
China	394	1	2259	697	29371	62158

RESOURCES OUT

Country	Earth Use	Final Capital Out
UK	2.96	8599
Denmark	3.58	1017
Ethiopia	0.59	114
China	2.11	48939

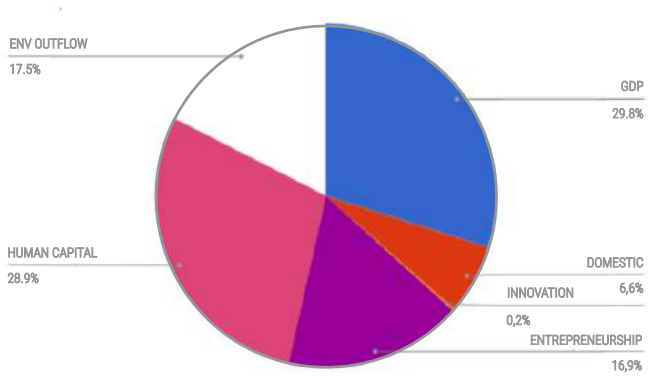
EARTH RESOURCE BUDGET

Country	Capital In	Capital Out	National Resource Budget	Net ERB per capita
UK	2.96	8599	3105	$47,193.36
Denmark	3.58	1017	109	$19,105.86
Ethiopia	0.59	114	351	$3,445.80
China	2.11	48939	15770	$11,240.09

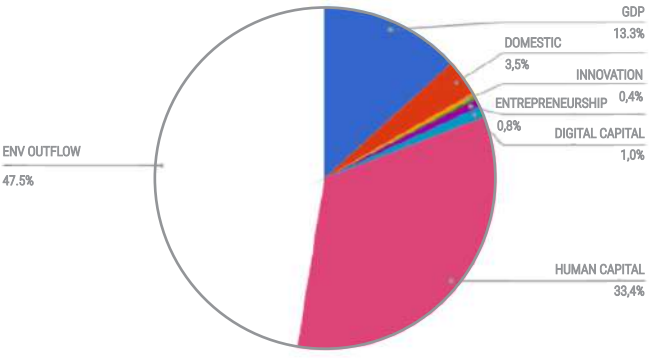
THE DEVELOPMENT PIZZA – CONCEPTUALISING NATIONAL DOMESTIC VALUE

The Earth Resource Budget can be visualised as a pizza. The different slices represent the different forms of capital as part of GDV. The area of the pizza that's missing is the Environmental Outflow. By making it a circle shape, the pizza allows two key aspects of comparison between countries, exploring how big the economy is (by the size of the Pizza's area) and the amount the country is losing out on due to excess Environmental Outflow. The examples on the right are not size-adjusted.

ETHIOPIA NET DOMESTIC VALUE - $351BN



DENMARK NET DOMESTIC VALUE - $109BN



CONCEPTUALISING NATIONAL DOMESTIC VALUE

The Earth Resource Budget can be visualised as a pizza. The different slices represent the different forms of capital as part of GDV. The area of the pizza that's missing is the Environmental Outflow. By making it a circle shape, the pizza allows two key aspects of comparison between countries, exploring how big the economy is (by the size of the Pizza's area) and the amount the country is losing out on due to excess Environmental Outflow. The examples above are not size-adjusted. ●

Q&A / INDIGO PRIZE JUDGE

GUS O'DONNELL

Lord O'Donnell is Chairman of Frontier Economics. He was formerly Cabinet Secretary and Head of the Civil Service, serving under three successive Prime Ministers from 2005 to 2011. He also serves as Chair of the Public Interest Board at PWC, and President of the Council at the Institute for Fiscal Studies.

WHY DO WE NEED NEW WAYS TO MEASURE MODERN ECONOMIES?

There are two things. One is, are we measuring the activity that's going on in the economy? A lot of the activity that's in economies is not measured in a traditional way, for example the internet, emails and all of that work does not feature in standard GDP definitions. Secondly, we are starting to ask bigger questions, it's not just about the economy, it's 'How satisfied are we with our lives', 'Are we succeeding as a society'? All those much bigger questions that go beyond our economy which bring in areas like social capital and look at distribution – which GDP is very poor at – and which basically pick up whether we think our lives are good lives, whether we are enjoying ourselves, for example. If we have longer holidays then GDP goes down, when actually, longer holidays are great!

WHAT KIND OF CONVERSATION DO YOU THINK THE INDIGO PRIZE HAS STARTED UP?

I hope that the Indigo prize will start up a conversation about what it is that makes a society successful. What is it that makes my life successful? What do I really care about? Is it just how much money I earn, or is my life actually fulfilling? Am I doing things which I think are worthwhile? Is society going in the right direction? Is it sustainable? Are we using up our planet's resources too fast? All those sort of bigger questions, how do we pick them up in the way we measure society? We certainly don't pick them up in a single measure like GDP.

WHAT SORT OF IDEAS OR THEMES OR TOPICS REALLY CAUGHT YOUR EYE FROM THE ENTRANTS?

A lot of the entrants focused on the gig economy, and the fact that we now spend a lot of time looking at screens. There are a lot of things that are provided free to us but in return we are giving back our data for free. That is a very different kind of world. The measures that we started up that we still use were fine when we were basically dominated by a society producing manufactured goods and agriculture goods, but they don't work in a world of services. So how do we value financial services? How do we value health? And that sort of thing matters a lot to people.

WHERE DOES THE INDIGO PRIZE GO NEXT YEAR? WHAT SHOULD WE BE ASKING?

I hope that the Indigo prize will move on to start to get to grips with the big philosophical question about 'What is success for an individual, for a company and for society, and how should we measure that?'. GDP is an interesting activity measure that tells you about the taxable measure of an economy, and it's not that good at that. It's more a question of what matters for people and what makes a successful society, and do we really think that because America has the largest GDP, it's the most successful society in the world? Actually when you look at a lot of the Scandanavian societies it turns out that there people are much more content and feel that their lives are much more fulfilling that those on average in America. ●

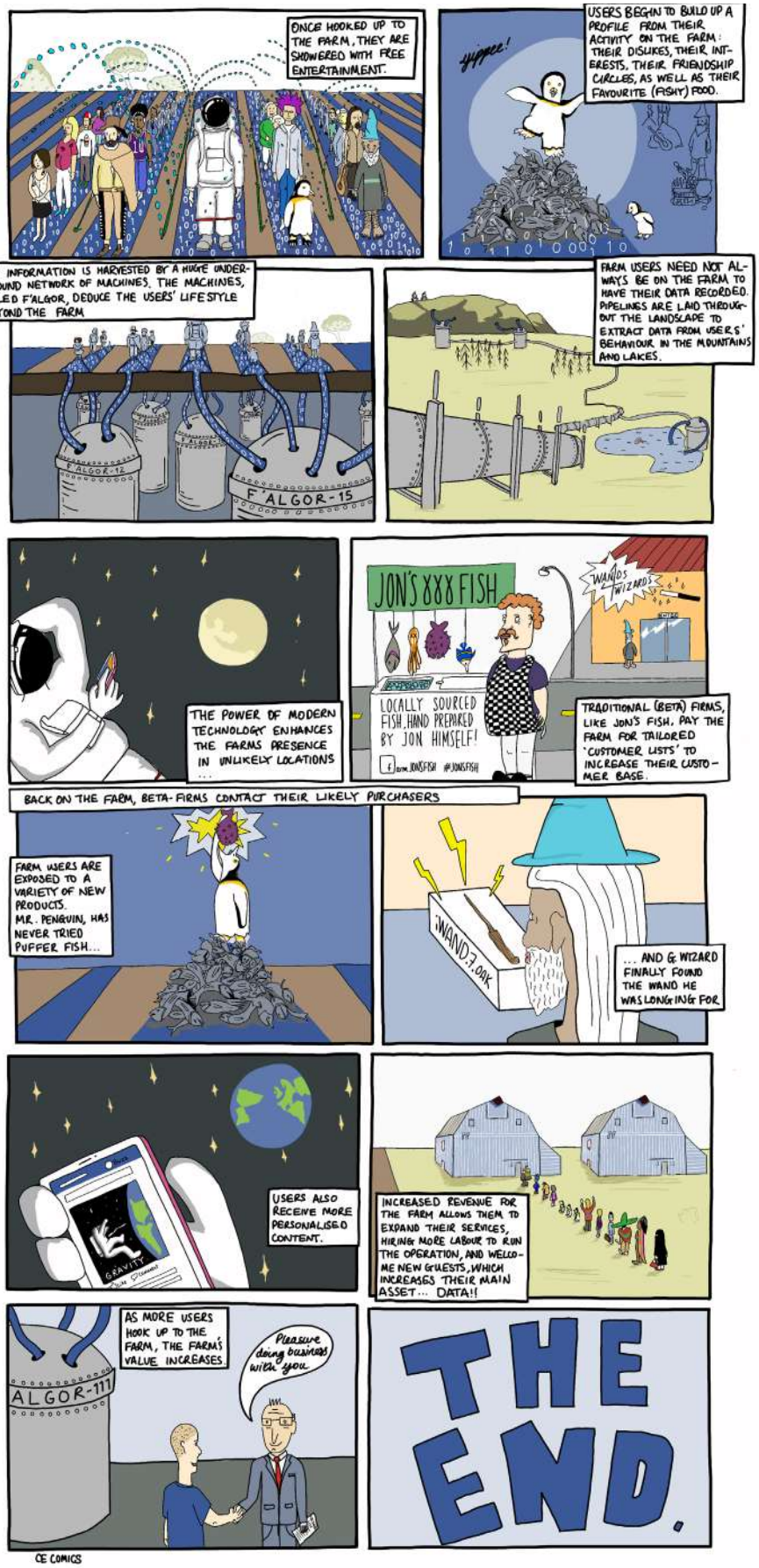
WE ARE STARTING TO
ASK BIGGER QUESTIONS.
IT'S NOT JUST ABOUT
THE ECONOMY,
IT'S 'HOW SATISFIED
ARE WE WITH OUR LIVES?',
AND 'ARE WE
SUCCEEDING AS
A SOCIETY?'

VIRTUALLY IGNORED: HOW WE'RE FAILING TO MEASURE THE 21ST CENTURY ECONOMY

CAMBRIDGE ECONOMETRICS TEAM

Sachin A. Babbar, Michael Lee, Richard Lewney and Jack Spencer are applied economists who work for Cambridge Econometrics. Their work involves applying economic theory and quantitative methods to economic, energy-environment and labour market policy issues.

Free online services provide enjoyment to large segments of the population, delivering a wide variety of services: wide-reaching connectivity with friends, access to a plethora of music and much more. The use and development of these services will become more integral to our lives, as start-ups and established digital multinational companies explore and exploit the potential of new technology. At present, measures such as GDP fail to reflect the scale and importance of these free services.


ONCE HOOKED UP TO THE FARM, THEY ARE SHOWERED WITH FREE ENTERTAINMENT.
yippee!
USERS BEGIN TO BUILD UP A PROFILE FROM THEIR ACTIVITY ON THE FARM: THEIR DISLIKES, THEIR INTERESTS, THEIR FRIENDSHIP CIRCLES, AS WELL AS THEIR FAVOURITE (FISHY) FOOD.
THE INFORMATION IS HARVESTED BY A HUGE UNDERGROUND NETWORK OF MACHINES. THE MACHINES, CALLED F'ALGOR, DEDUCE THE USERS' LIFESTYLE BEYOND THE FARM
F'ALGOR-12
F'ALGOR-15
FARM USERS NEED NOT ALWAYS BE ON THE FARM TO HAVE THEIR DATA RECORDED. PIPELINES ARE LAID THROUGHOUT THE LANDSCAPE TO EXTRACT DATA FROM USERS' BEHAVIOUR IN THE MOUNTAINS AND LAKES.
THE POWER OF MODERN TECHNOLOGY ENHANCES THE FARMS PRESENCE IN UNLIKELY LOCATIONS ...
JON'S XXX FISH
WANDS 'N WIZARDS
LOCALLY SOURCED FISH, HAND PREPARED BY JON HIMSELF!
TRADITIONAL (BETA) FIRMS, LIKE JON'S FISH, PAY THE FARM FOR TAILORED 'CUSTOMER LISTS' TO INCREASE THEIR CUSTOMER BASE.
BACK ON THE FARM, BETA-FIRMS CONTACT THEIR LIKELY PURCHASERS
FARM USERS ARE EXPOSED TO A VARIETY OF NEW PRODUCTS. MR. PENGUIN, HAS NEVER TRIED PUFFER FISH...
'WAND.7.OBJ
... AND G WIZARD FINALLY FOUND THE WAND HE WAS LONGING FOR
GRAVITY
USERS ALSO RECEIVE MORE PERSONALISED CONTENT.
INCREASED REVENUE FOR THE FARM ALLOWS THEM TO EXPAND THEIR SERVICES, HIRING MORE LABOUR TO RUN THE OPERATION, AND WELCOME NEW GUESTS, WHICH INCREASES THEIR MAIN ASSET... DATA!!
ALGOR-111
AS MORE USERS HOOK UP TO THE FARM, THE FARM'S VALUE INCREASES.
Pleasure doing business with you.
THE END.
CE COMICS

THE MAIN REPORT

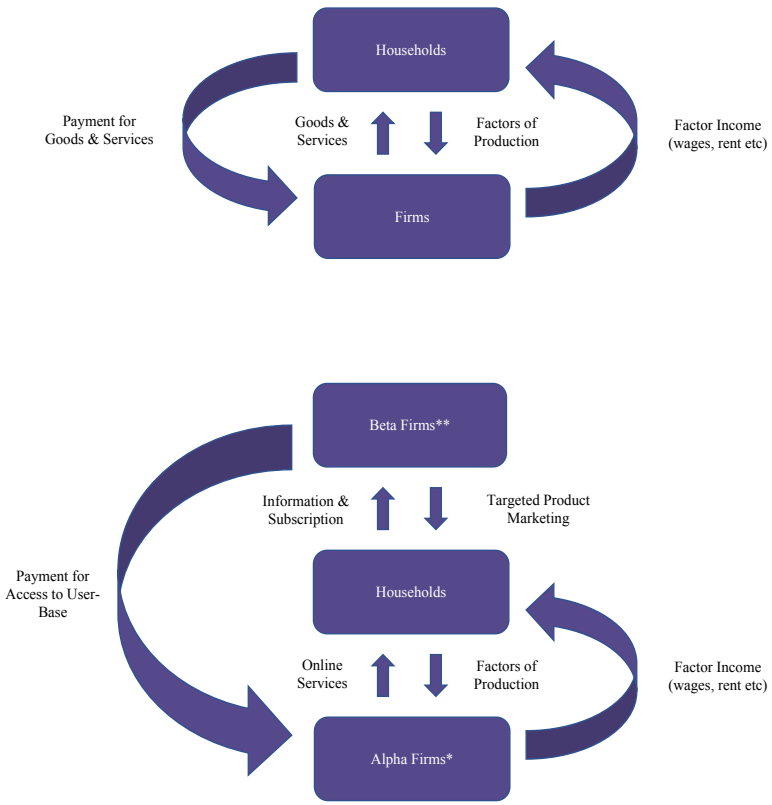
Over a third of the world uses social media. The pervasiveness of free online services brings enjoyment to the individual, and enables tech companies to thrive. However, conventional measures of the national economy fail to capture this value. Traditional methods of measuring value rely on expenditure: if something is free, it doesn't get counted. Exchanging data – from consumers to businesses, may be one way of reconciling these discrepancies. Framing the data gathered by these tech companies to monitor consumer preferences and behaviours as an asset can improve representation of its value in national accounting.

The starting point of these transactions is that users agree to become an audience for advertising, in return for the benefits. This includes the web-service itself (sharing photos, enabling instantaneous and wide-reaching connectivity, for example). It encompasses the value of 'better targeted advertising' (for those users who regard this as a benefit) and facilitates 'ease of transaction' (matching producers and consumers). More fundamentally, these online services provide enjoyment and value to the consumer.

The other side is businesses. Social media websites generate no money directly from households, who are their main users. After the web-service providers have processed the data, they can enhance the user experience by creating personalised content. They can also leverage this information to earn revenue from third parties, notably from targeted advertising.

One example is Uber, the company linking drivers with individuals needing a ride. It made a loss of $2.8bn in 2016, which suggests that its backers regard this as a period of investment, much like the development phase of a new pharmaceutical therapy, but the national accounts don't attribute much value to the IP asset they're investing in.

Crucially, unlike other free services, such as household services or charitable activities, this is big business. By market capitalisation, in mid-2017, Apple Inc. ranked highest in the world, followed by Alphabet Inc, and then Microsoft.

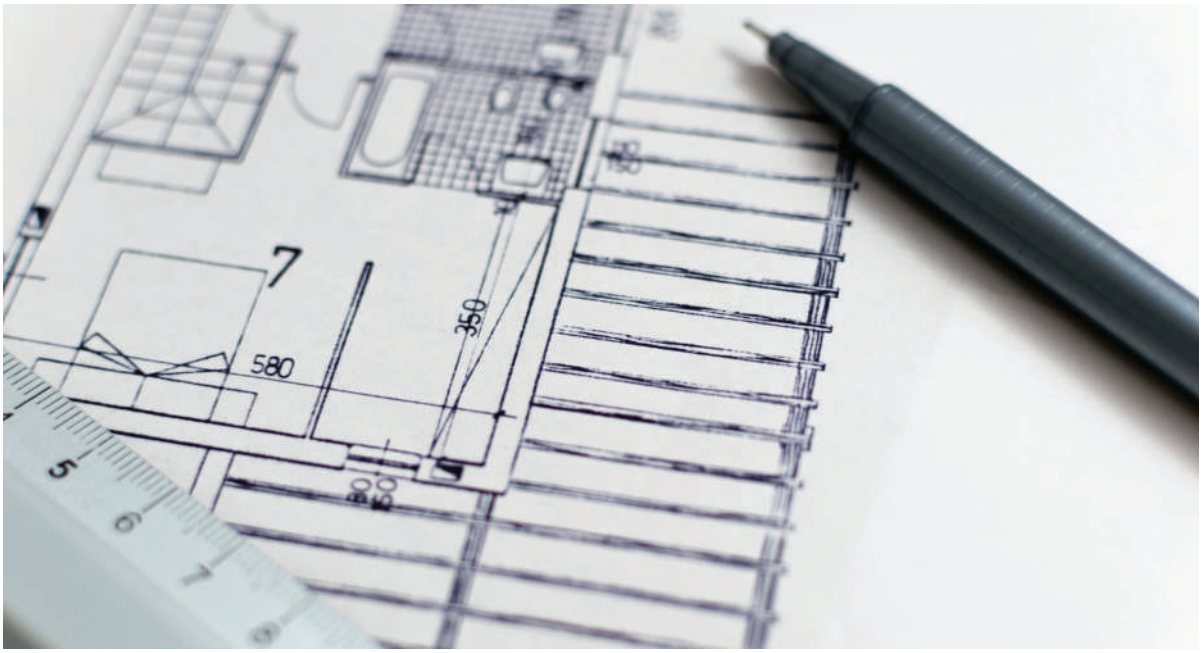


Notes:

* Alpha firms provide online services for free. They receive no direct remuneration for the service they provide. Successful alpha firms amass a large user-base which they "redeem" for revenue at a later date.

** Beta firms pay the online providers for access to their user-base (e.g. in the form of targeted advertising (Facebook) or of higher search priority (Google search engine)). It is also possible for a firm to play the role of alpha and beta when establishing market presence. Apple provide iTunes for free to any user, but have used the presence of this service to market their own products.

Source: Cambridge Econometrics.



Existing measures in the national accounts of the free services treat the cost of production as an intermediate cost to the free service provider. The revenue received from those who place ads on the platform are income to the web-service provider and an intermediate cost to the advertiser. Insofar as it is recognised at all, the value of consumer's data is treated as a 'database' asset, valued only at its cost of production, not the prospective income that it can earn.

In addition, while there is no return for the firm at the point of sale, there is still income received from the venture. This income does not reflect the value to the consumer of the product. Rather, it reflects the value of access to the user-base to the third-parties (see charts on facing page).

The approach that we recommend works within the national accounts framework to adapt the existing measure of GDP. It has similarities to the national accounts' existing treatment of imputed services of owner-occupied dwellings and of financial intermediation services indirectly measured (FISIM):

— Place a value to the web-service provider of the 'service' that households are providing, namely the provision of personal information

— Households are treated as purchasing the web-service at that value, which is in turn treated as service income to the web-service provider

— The total income of the web-service provider is now the sum of the actual advertising revenues earned from the use of the data and the imputed web-service revenues

— The total costs of the web-service provider are now the sum of the actual costs of maintaining the web-service and an imputed cost for purchase of data from a new class within group 63.9, 'Other information service activities', representing the activity of supplying own personal information

— Households receive as imputed income the revenues of this new class (covering the activity of supplying of own personal information)

> The pervasiveness of free online services brings enjoyment to the individual. However, conventional measures of the national economy fail to capture this value.

Household consumption, GDP and Gross Value Added would be higher by the imputed value of the personal data supplied by households, and labour productivity statistics are no longer distorted by the timing of investment in, versus exploitation of, an asset whose value is not properly recognised.

The critical question becomes what value should be placed on the service that households provide to the web-service provider. Soloveichik (2015) implemented an idea along similar lines for the US for 'advertising–supported entertainment', both 'traditional' (print and broadcast media) and online. She defines the imputed value of such entertainment as equal to the advertising revenues, just as FISIM is valued on the basis of the revenues earned by banks from the interest-rate spread on loans and deposits. Her estimates are therefore far less than those of other authors she cites for the utility to consumers of leisure time spent online, but this is consistent with the treatment of all consumption products in the national accounts (which measure, for example, what people spend on food, not the utility they get from eating it). In this sense, the approach would measure the "raw value" of household's provision of information rather than the enjoyment of online services.

> Data and information are integral to the modern-day economy. Being able to measure, assess, and value the contribution of this data are of critical importance.

Can we imagine that the information about and the opportunity to influence behaviour could become more valuable than the advertising opportunity? What if an electricity utility offered to supply grid electricity for free in return for smart access to a household's non-critical appliances and storage solutions?

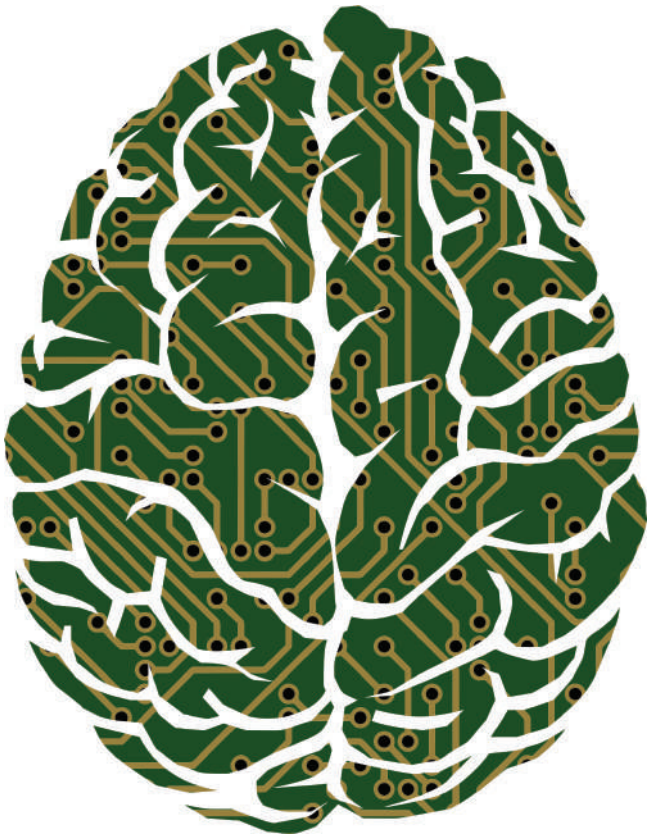
Soloveichik's approach focuses on the delivery of 'advertising viewership' and so the role of the media company is simply to engage the attention of the audience, preferably targeting particular demographic groups.

But this attempt to squeeze online services into an old economy box misses what is innovative about online services. They don't just target demographic groups effectively: they gather information about the real-time behaviour of users and generate new knowledge and products based on that information. Consequently, the value of households' engagement is more than the revenues currently earned by pitching advertisements to them.

To start to capture all this, Soloveichik's approach needs to be extended in three ways:

— Add the revenues from web-service companies' sales of information about consumers to the value of households' supply (counted as the advertising revenues earnt) in return for free online services, boosting the estimate of household consumption.

— Produce price estimates for the value to consumers of online services that reflect the (sometimes dramatic) improvements in quality they represent, boosting household consumption when measured in real terms.



— Treat the data that web-service providers harvest and process as an intellectual property asset, valued not merely on the basis of the cost of developing and maintaining it, but at the much higher value given by the prospective revenue streams to be earned by exploiting it, boosting the value of gross fixed capital formation.

Valuing the data (the intellectual property asset) is also of critical importance to this approach. It is necessary to derive the value of the asset by relating it to the income stream that is subsequently earned from exploiting the asset (data). We expect the additional value of the intellectual property asset to be lower than the value generated from the income stream earned from using the asset, given value added in the downstream activities to put meaning on the data. It is also important to view the value of the asset from the perspective of the businesses, rather than the individual consumer, as an individuals' data asset in isolation is of limited value to the business.

Data and information, then, are integral to the modern-day economy. By extension, being able to measure, assess, and value the contribution of this data are of critical importance. ●

MEASURING THE MODERN ECONOMY

DARREN MORGAN, DEPUTY DIRECTOR, NATIONAL ACCOUNTS COORDINATION, OFFICE FOR NATIONAL STATISTICS

Measuring the modern economy is complex and challenging and it is unrealistic for any single piece of data to tell a full story about the economy or society of a country. GDP is an important piece of that jigsaw and other ONS statistics are good at capturing the flows of money around our economy. However, there is an understandable and growing desire among many people to move beyond these traditional measures to try and capture other changes in our society, such as people's life satisfaction and general well-being.

It is for this reason that the ONS has taken an active interest in the Indigo Prize and the ideas presented were fascinating. The entries were diverse, thought-provoking, and covered the full spectrum of how to measure a modern economy.

These helpful ideas will feed into the work that the ONS has been conducting to develop wider measures of the economy that go beyond GDP. This is becoming increasingly important as we meet the challenges of measuring an ever changing, diverse and digital society where there are so many different ways that we live our lives and do business.

We are already bringing new insight to areas such as economic well-being, the value of unpaid work and intellectual property. All this will help us understand the modern economy better and the impact that growth has on people and the environment.

We are keen, though, to further develop in these and other areas and indeed have plans to do so. Meeting these challenges can only be bolstered with initiatives such as the Indigo Prize; working in partnership with other thinkers in this space will help us provide better statistics that lead to better decisions. ●

CIVIC INVESTMENT VALUE 4.0

A NEW MEASURE TO SUPPORT GLOBAL SUSTAINABILITY AND PLACE-DRIVEN INNOVATION ECONOMIES

CLARE DEVANEY

Clare Devaney is founding Director of Citizen-i Ltd, a platform for citizen-led research and innovation, based in Manchester, UK. She is co-founder of Impact Hub Manchester, an innovation lab, incubator and collaborative workspace for Greater Manchester's social impact community, and co-founder of M4, a civic innovation platform which works with people as innovators in driving 'whole-self' growth and social change.

Clare's recent research work has included leading the Royal Society of Arts' (RSA) 'Citizens and Inclusive Growth' project (2017), and its 2014-17 'Heritage, Identity and Place' programme, in partnership with HLF. She is a Research Associate of the MAPS-LED International Research Partnership (University of Salford) and a Senior Research Fellow of the Agirre Centre for Social and Political Studies (University of Basque Country/Columbia University, New York).

The Civic Investment Value index (CIV4.0) is designed for 4.0, the age of the innovation economy. It is based on a critical shift to an investment rather than extractive economic model, in which places no longer compete in the accumulation of wealth, but work collectively toward shared human and global sustainability goals. CIV4.0 is place-driven, and incorporates individual assessment of wellbeing, experiential indicators of place (cultural, spatial and social) and sustainable development goals to create a multi-faceted measurement system which can evaluate the extent to which people invest in place and place invests in people, comparative performance and collective progress.

4.0: THE AGE OF THE INNOVATION ECONOMY

We are at the dawn of a new age: 4.0.

In economic terms, 4.0 is a post-growth world, characterised not only by a sharply-focussed awareness of the global economy as a networked, reciprocal ecosystem but, in the face of the increasingly apparent limitations of 'trickle-down', stark crises of poverty, addiction and homelessness, and the devastating environmental effects of unconstrained development on a planet of finite resources, by a critical re-framing of what 'growth' means and how it is manifest. 'Economy 4.0' is the next level in the sequential evolution of dominant economic schools of thought which has previously travelled through state-centric (1.0), free market (2.0) and latterly socio-economics (3.0). At the same time, as Professor Otto Scharmer notes, we can consider the associated journey of 'ego' through each of the dominant economic frameworks (Scharmer, 2017) and find in 4.0 a particular understanding of the role of the individual as contributor to that global ecosystem, with effects good or bad.

As we navigate our way into the 4.0 age, there is a palpable and increasingly obvious tension with the current paradigm, infrastructure, and tools, designed in support of the 'old economics'. Increasingly, and against this pressing imperative, we are exploring more open, collaborative approaches to the narrative of 'competitiveness' which has marked our recent past. Work by Professor Mariana Mazzucato (2017) is bringing forward the idea of 'mission-

oriented' economies and strategies, moving away from 'competitiveness', siloed sectors and working in isolation, and advocating instead for collaborative action in tackling social challenges and working toward shared economic goals. This 'mission-oriented' framework can be applied to economic ecosystems at any level; including cities, city-regions, nations and globally, and as such can also demonstrate how those ecosystems might inter-relate in the 4.0 age.

There is also a frustration caused by the limitations of current tools to measure and evaluate economic success. Broadly speaking, this tension is underpinned by a binary school of thought which separates the 'economic' and the 'social', and which tends to define 'economic' in purely fiscal terms. In this polarised understanding, the understood economic 'mission' is wealth generation, and the measure of success is accumulation of wealth. This is the paradigm of capital, of GDP, of an understanding of human endeavour purely as 'productivity'; people as generators of product in a labour market. It is the paradigm of economics 2.0, the limitations of which were felt in 3.0, resulting in the introduction of GVA as an alternative measure, but which are even more acute on our move to 4.0. There is an increasingly apparent need for a new measurement system to support a critical shift from a principally extractive economy to an investment economy; one in which the shared 'mission' is not accumulation of wealth, but which instead focusses our collective capacity on our most pressing shared challenge: the sustainability of the planet.

In 4.0, investment and 'value' requires expression and measurement not in monetary terms, but in levels of individual and collective contribution. Here, value is measured as the extent to which an individual contributes their creativity, entrepreneurship and human skills to the collective goal, rather than the amount of 'productivity' the system can extract from the individual.

Adoption of the new 4.0 paradigm brings with it far-reaching implications across policy and practice in areas such as skills and education. Despite our understanding of the 'fourth industrial revolution' as the coming of a technological age, the top three skills required by tech businesses in 2020 will be complex problem solving, critical thinking and creativity. All three are innately human skills. Our current education and skills system, driven by a 'working mentality' going back to the second industrial revolution of the 1870s, remains focussed on conformity, compliance and the development of skills principally for the labour market. The dynamics of the 4.0 world requires critical skills and independent minds. It is not all about coding.

There is an increasingly apparent need for a new measurement system to support a critical shift from a principally extractive economy to an investment economy; one in which the shared 'mission' is not accumulation of wealth, but which instead focusses our collective capacity on our most pressing shared challenge: the sustainability of the planet.

Instead, there is an opportunity to respond to the zeitgeist of 'innovation' as the dominant characteristic of 4.0, embracing both technological and human aspects in an understanding of innovation as not simply a fixed, tangible product, a 'thing' which exists in labs and universities and which can be developed, commercialised and sold (and which pitches universities, cities and countries against each other in a 'competitive' innovation race), but as a dynamic and networked process, embracing people as innovators, and bringing people, cities and nations together in collaborative innovation 'missions', designed to make collective progress and address shared challenges.

2. FROM 'PLACE-BASED' TO 'PLACE-DRIVEN'

The need for an alternative to the competitive narrative of globalisation has been widely acknowledged, and has contributed to the rapid rise of the notion of 'place' in policy and practice, alongside renewed calls for localism, and (to some extent) the ongoing devolution agenda in the UK.

Often, and perhaps due to the speed of its ascent and related conceptual incompleteness, 'place' has been primarily interpreted either in spatial terms, as a fixed geographic territory, or as a self-contained socio-economic system. This static understanding of 'place-based' approaches, alongside the calls for localism and devolution has meant a retreat in some instances to insularity and parochialism, and at times finds a claimed alternative being, in fact, the same limited 'old economics' model, simply played out at a local scale.

'Place-based' approaches tend to seek or prove 'embeddedness' in a place. Place-based innovation tends to focus on the acknowledged strengths of a place, which are often so called because they have a basis in a place's heritage (such as Greater Manchester's smart specialism in advanced manufacturing). Instead of evidencing an historical significance to a place, grounding, anchoring – and in many cases tethering – that innovation to the confines of history, there is an opportunity with 4.0 to liberate 'place' through the prioritisation of culture and its past, current and future dynamics. Incorporation of a cultural facet which includes the full spectrum of a place's strengths and needs - and, critically, embraces people as key drivers of that culture, in effect unlocks 'civic' innovation. This is a distinctly 'place-driven' paradigm, the fourth tier in the spatiotemporal understanding of place, and representative of how new innovation economies are manifest within 4.0 thinking (as presented in Table 1).

> We propose an alternative framework based on people's opportunities to lead the kind of life they value.

Place	Driver	Concept	Construct	Innovation Space
Place-blind	Private	Spatial	Where	Science Parks
Place-based	Public / Academic	Economic	What	Anchor Hubs
Place-grounded	Social / 3rd	Cultural	Who	Regenerated Urban Areas
Place-driven	Civic	Civic	How	Citizen Led

Table 1: The emerging place/innovation hierarchy

3. THE 'INNOVATION ECONOMY WHEEL'

Drawing on this context, "The Innovation Economy Wheel" (Figure 1) has been developed (Devaney, 2017) as a prototype tool for the measurement of an evaluation of innovation economies.

In the model, each axis represents a critical quality in successful innovation economies. The first axis – the where – represents spatial factors, the second axis – the who – represents social factors, and the third axis, completing the spokes in the wheel, represents cultural factors – the what – those aspects of place such as heritage, identity and culture which make a place distinctive and its innovation specialisms unique. The fourth aspect, the catalyst to make the wheel spin, is the how (the CIV4.0 score, as described in Section 4).

The dynamic nature of the wheel allows for and predicts an innovation economy which not only responds to, but feeds off, all aspects of a place, and the entire spectrum of place-related indicators; a 'place-driven' innovation economy (see Figure 2)

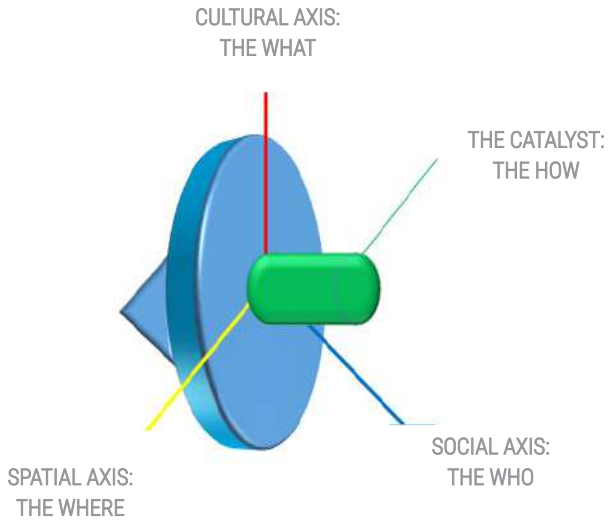


Figure 1: The Sustainable Innovation Wheel

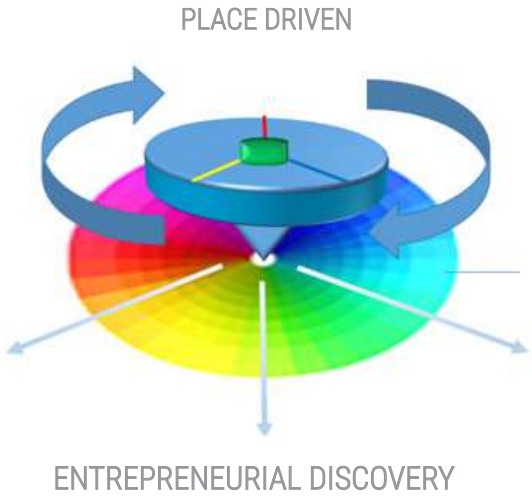


Figure 2: A 'place-driven' innovation economy

4. CIVIC INVESTMENT VALUE

Using the Innovation Economy Wheel as a foundational framework, the Civic Investment Value (CIV4.0) index takes the United Nation's 17 Sustainable Development Goals (SDGs) and the New Economics Foundation's 2008 'Five Ways to Wellbeing' as the key tenets in a performance measurement index designed to evaluate reciprocal investment (people investing in place, and places investing in people) and focussed on a shared 'place-driven' mission of sustainability.

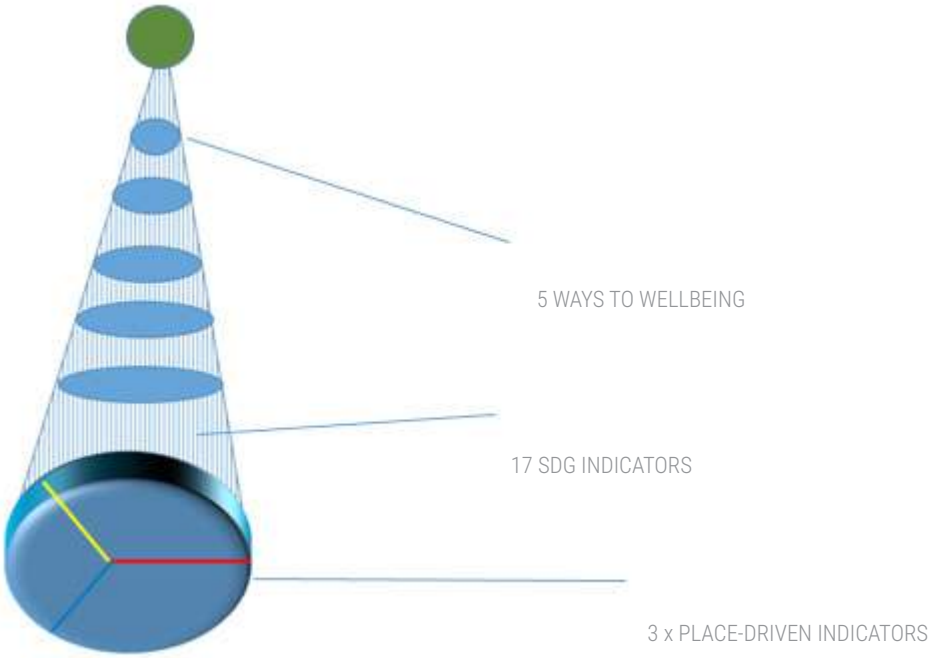


Figure 3: The CIV4.0 Value Index cone

As shown in Figure 3, the goal of sustainability sits at the top of the cone, with a place's progress towards the SDG's indicated by the extent to which the cone is vertically filled, and the five 'Ways to Wellbeing' indicators incorporated as radials.

Scores are awarded in decimal performance measures (using the 169 quantitative targets which sit underneath the 17 SDG goals) against a whole score of 1 for each SDG, alongside whole scores of 1 for culture, space and society (awarded by the people of the place and generated through citizen survey), and whole scores of 1 against the five 'Ways to Wellbeing' measurements.

A multiplier of 4.0 is then applied to the total score for 25, to create an overall score out of 100. The index can be adapted to economies of any scale, demonstrating both comparative performance and collective progress toward 4.0's global sustainability goals. ●

THE MONIAC MACHINE

MONETARY NATIONAL INCOME ANALOGUE COMPUTER

The Monetary National Income Analogue Computer (MONIAC) machine was created in 1949 by New Zealand economist Bill Philips to model the interrelated national economic processes in the United Kingdom. The MONIAC was one of the first macroeconomic 'computers'. It was able to demonstrate the interrelationships between certain economic variables such as taxes and consumption.

The MONIAC used coloured water to mimic the flow of money using various tanks that represent different aspects of the economy such as income, taxes, consumption and domestic spending. The actual flow of the water was automatically controlled through a series of floats, counterweights, electrodes and cords. When the level of water reached a certain level in a tank, pumps and drains would be activated.

Economic parameters that affect the flow of money to these sectors could be entered to carry out experiments in fiscal and monetary policy. The MONIAC pioneered the field of economic forecasting by facilitating complex macroeconomic calculations that were unable to be carried out by other computers at that time.

WHAT THE DIFFERENT TANKS DO:

(1) TREASURY

At the bottom of the MONIAC is a large tank representing the treasury. Water flowed from the treasury to the other tanks to show how a country could spend its money. To simulate increased spending on healthcare, a tap can be opened to drain water from the treasury to the health tank.

(2) INCOME

The water for the 'income tank' is pumped to the top of the machine from the National Income tank at the end of the model, where it begins its journey around the circular flow of the economy. The water from the 'income tank' flows into 'taxes' that provide the government with all of its revenue and 'Disposable Income'.

(3) DISPOSABLE INCOME

This tank represents the income that all of the consumers in the economy receive after the government has taxed their total income. Consumers can choose to either save this money within their bank (Savings and Investment) or they can spend it on goods and services (Consumption).

(4) CONSUMPTION

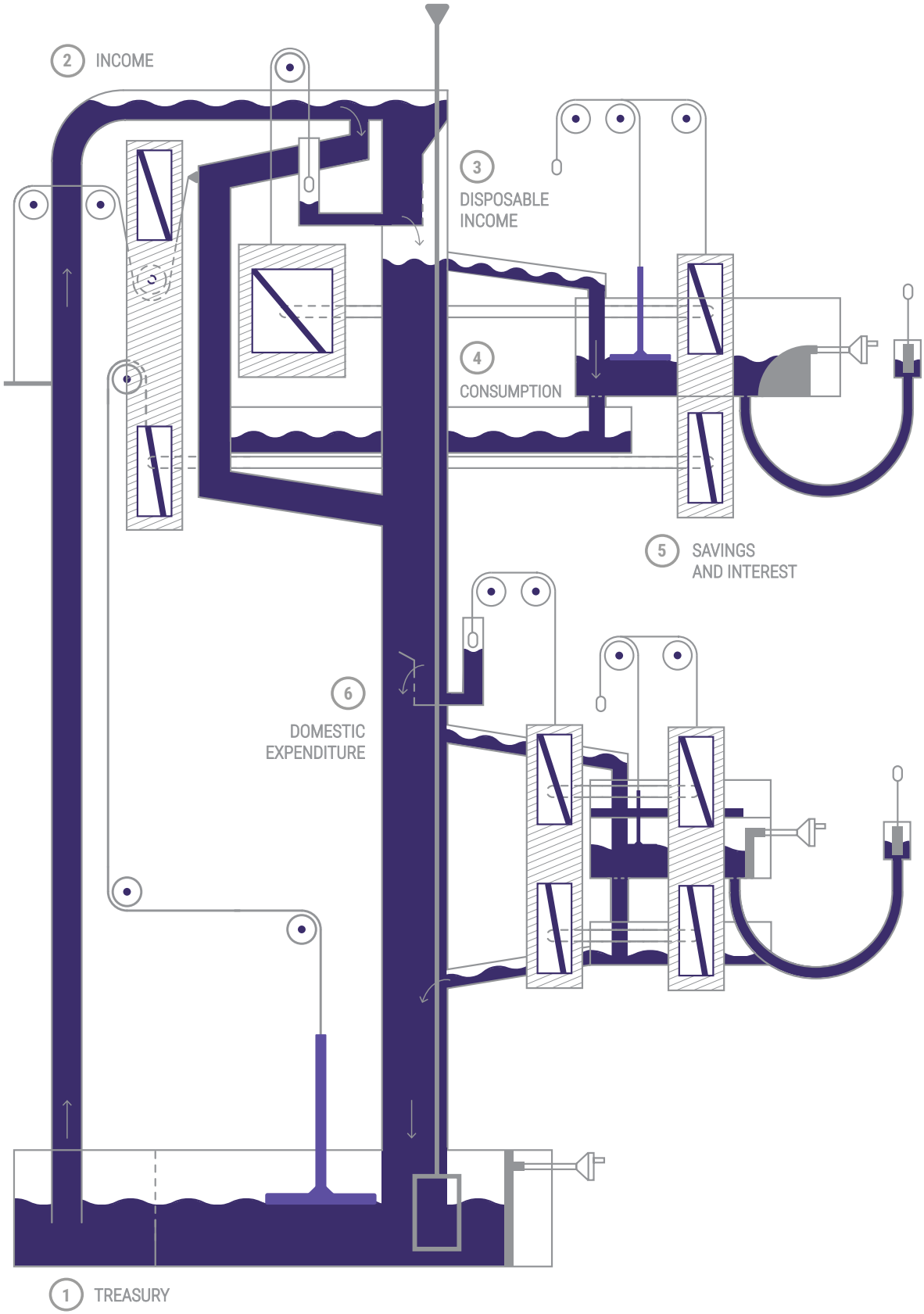
The level of consumption is determined by two factors. High interest rates encourage you to save money, additionally, low interest rates encourage you to spend money. The higher your income, the more you are likely to spend money.

(5) SAVINGS AND INTEREST

If consumers choose to save their money then this contributes to an 'Investment Fund' which is the total amount of money in banks and financial systems that is available to loan out. When there is a large amount of money in this Investment Fund then interest rates are low; when there is a low amount of money then interest rates are high. When the savings flow exceeds the investment flow, the level of water in the savings and investment tank (the surplus-balances tank) would rise to reflect the accumulated balance

(6) DOMESTIC EXPENDITURE

This tank measures the total spending within the domestic economy. There are three main sources of this spending: consumers buying goods and services, government expenditure with money from taxes on projects such as health care, roads and education, and business expenditure from the purchase of buildings, factories and machines. If the expenditure from any of these sources is used to buy things made domestically then it flows into either 'foreign economies' including imports and exports, or 'national income' which corresponds to the expenditure measure of GDP and leads on to 'income' to restart the system. ●


2 INCOME
3 DISPOSABLE INCOME
4 CONSUMPTION
5 SAVINGS AND INTEREST
6 DOMESTIC EXPENDITURE
1 TREASURY

QUESTIONING THE QUESTION

SHOULD CREATIVITY, ENTREPRENEURSHIP AND DIGITAL SKILLS BE GIVEN PRECEDENCE OVER OTHER FACTORS IN MEASURING ECONOMIC PROGRESS?

IZZY MCRAE

Izzy McRae was a diplomat and economist for 13 years for the FCO, serving in Washington DC, Islamabad, Rome and Dublin. She left in 2015 to work for Action for Happiness, a charity set up by economist Professor Lord Richard Layard to create a happier and more caring society. She has since set up Applied Happiness, a consultancy focused on helping people increase their happiness and wellbeing. She created the Gratitude Garden app, which helps people cultivate gratitude and now has had over 40,000 downloads.

Implicit in the question posed by the Indigo Era is an assumption that creativity, entrepreneurship and digital skills are under-acknowledged and should be measured in a way that better recognises their impact on our standard of living. This essay challenges this assumption, arguing that it seeks a technical solution to a subjective question. Though GDP struggles to keep up with the technological changes brought about by these skills, there are many other important things that are also undervalued, such as natural resources, kindness, and security. A better approach would be to look at the effect these factors have on wellbeing, and ensure policy responses take this into account.

4.0: THE AGE OF THE INNOVATION ECONOMY

Implicit in the question posed by the Indigo Era is an assumption that creativity, entrepreneurship and digital skills are under-acknowledged and should be measured in a way that better recognises their impact on our standard of living.

> The ultimate purpose of economics, of course, is to understand and promote the enhancement of wellbeing. (Ben Bernanke 2012)

This essay challenges this assumption, and argues for a technical solution to a subjective question. It argues that, though GDP struggles to keep up with the technological changes brought about by these skills, there are many other important things that are also undervalued, such as natural resources, kindness, and security. Both the value and the limitation of GDP is that it aims to be an impartial judge, counting all economic activity equally, without judgment. Politicians have long recognised how limiting this is – see Kennedy's famous comment:

"Our gross national product…counts air pollution and cigarette advertising and ambulances to clear our highways of carnage. It counts special locks for our doors and the jails for the people who break them. It counts the destruction of

the redwood and the loss of our natural wonder in chaotic sprawl.... Yet the gross national product does not allow for the health of our children, the quality of their education, or the joy of their play."
– Robert F. Kennedy on the presidential campaign trail in 1968

HOW GOOD IS GDP AT MEASURING OUTPUT?

GDP sums together the output of all the different parts of the economy (agriculture, construction, government, manufacturing etc.). All the component parts of the output process are measured for the value added they produce, which is paid as income to either labour or capital. As a result, GDP can also be calculated through summing the income that is paid out to different groups in the economy.

This incredibly informative way of looking at the economy is why Paul Samuelson gave GDP the following plaudit:

Without measures of economic aggregates like GDP, policymakers would be adrift in a sea of unorganized data. The GDP and related data are like beacons that help policymakers steer the economy toward the key economic objectives.

– Paul Samuelson and William Nordhaus (1995)

Because of this, GDP figures have become the indicator of economic progress in most Western economies. Along with the unemployment rate and inflation, they make up the basis for macroeconomic policy.

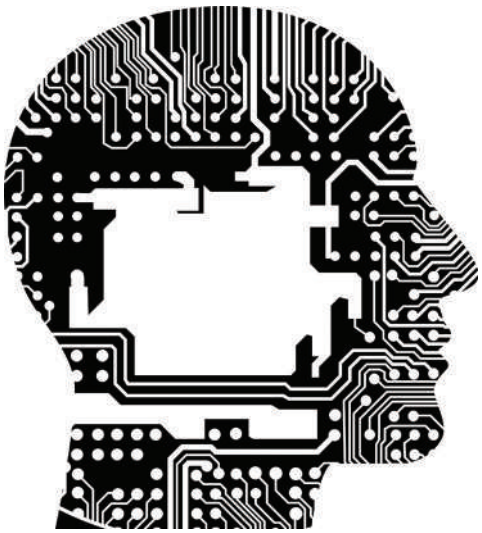
But even purely measuring economic progress, there are straightforward measurement problems. This is particularly true in the new technologies that have been brought about by a combination of creativity, entrepreneurship and digital technology. For example, when the price of a good changes, does that reflect a change in quality of the good, a change in demand for the good or a change in productivity to produce the good? How should the cheaper cost of taking Ubers versus black cabs be counted? Are they of a lower quality? Or has there been a productivity increase due to Google Maps so taxi drivers no longer need to spend three years learning all the streets off by heart?

Other technological advantages are completely missed by GDP. How can you price the huge increase in welfare from being able to leave your house just in time for the bus, because you were able to track it on an app?

So the impact of creativity, entrepreneurship and digital skills as demonstrated through the availability and ease of use of new technologies is tricky to measure. Many of these new technologies are free to the user, so the improvement in welfare appears to cost nothing. This highlights an old problem with GDP – that it does not get to the heart of the human experience, be it through not having to wait for a bus, or taking advantage of Google Maps so you don't get lost.

HOW AND WHERE SHOULD CREATIVITY, ENTREPRENEURSHIP AND DIGITAL SKILLS BE INCLUDED?

Given the fact GDP does not make a moral judgment about the value of different types of economic activity, it makes more sense to go back to the impact of these skills on the fundamental quality that GDP is aiming to measure – wellbeing. If you want to understand how much of a contribution creativity, entrepreneurship and digital skills are making, why not focus on what people say about how happy they are, or how satisfied they feel with their lives? Why use GDP (even augmented to give these things a fuller weighting) instead of just asking people?



If these factors were given special weighting in GDP, it might well lead to increased efforts to promote creativity, entrepreneurship and digital skills. But should there be an effort to increase spending on these things over and above other options that might increase wellbeing by more?

My personal opinion (as a creative digital entrepreneur!) is that the key to good data is to remove subjectivity as far as possible. If there is evidence that creativity, digital skills and entrepreneurship increase wellbeing by more than other skills, a separate study should be made to demonstrate this, perhaps looking at cross-country correlations. However, the most important policy goal is that these skills contribute to the economy in a way that improves people's lives. That is not always the case. PornHub, cyber bullying, and manipulation of voting by foreign powers are a few issues that have been thrown up by new technologies. They demonstrate the pitfalls of attaching a moral judgment to what should be included in GDP. A better approach is to see how these skills feed into a general sense of wellbeing that can be measured.

CAN WELLBEING DATA BE TAKEN SERIOUSLY?

Many economists are cautious about using data from surveys about peoples' emotional states, because they are subjective. However, although wellbeing data is subjective, studies demonstrate that they can be measured in a reliable way. Social, medical and political sciences have been using data from studies of happiness or life satisfaction for years. There are also correlations between reported happiness and blood pressure, and among emotions, relative reward, and the brain.

The World Happiness Report 2012 makes three main points:

1. Once people's basic needs have been fulfilled, they care much more about the status that wealth brings rather than the actual amount.

2. There are much stronger correlations between happiness and factors such as personal relationships, health, and sense of purpose than income.

3. People seem to care much more about losing wealth than gaining it. Various studies seem to imply that people care roughly twice as much about losing $1 than gaining $1.

WHAT ARE THE IMPLICATIONS OF THIS FOR HOW WE TREAT CREATIVITY, ENTREPRENEURSHIP AND DIGITAL SKILLS?

Taking these findings in turn, the first – that past a certain point people care more about relative wealth than absolute wealth – is an argument in favour of redistribution to ensure wealth in society remains relatively equally distributed. New technology companies have often undercut traditional models of employment, (e.g. Deliveroo, Uber, Taskrabbit) providing roles that mean people count as being self-employed. This provides freedom and flexibility, but also means that workers take on many of the risks of working, losing the social provisions that a full-time contract would offer them.

> Why not focus on what people say about how happy they are, or how satisfied they feel with their lives?

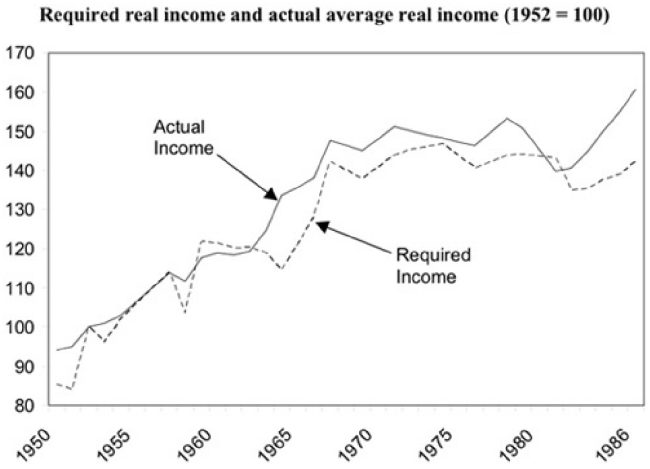
In addition, the ease of accessing foreign labour through labour-sharing platforms provides a downwards pressure on wages in the UK. I used Ukranian programmers and designers to build my app, paying a much lower rate than I would have had to for comparable London-based labour.

Policy makers could intervene to reduce this negative externality to legislate for more social provisions from gig-economy companies. The recent increase in the minimum-wage has also provided a higher floor to protect the least well off.

The second finding, that there are much stronger correlations between happiness and factors like purpose and relationships than income, leads to the importance that technological and education policy ensure digital skills and entrepreneurship are developed and used in a way that benefits society. It creates an incentive to measure the positive impact of social enterprises and to find ways of rewarding success and encouraging them to grow.

In addition, this focus on purpose would help to avoid a "one-size-fits-all" approach to encouraging entrepreneurship, creativity and digital skills. These are qualities that some people develop very easily, though by no means all. They may have been traditionally undervalued by the education system, however the key to providing a useful education is to encourage the development of strengths and skills that can be used to increase wellbeing.

The final finding, that people care much more about losing wealth than gaining it is important when it comes to the way new technologies have created a less-stable working environment. If people care so much



Source: Layard 2011.

A focus on wellbeing might well encourage more spending on improving creativity, digital skills and entrepreneurship.

more about losing money than gaining it, precautions should be taken to protect those that are likely to lose out, and help them transition in a way that maintains their wellbeing. This may include equipping them with creative, entrepreneurial and digital skills.

CONCLUSION

In conclusion, this essay question seeks a technical solution to a subjective question. The implication of the subjective question is that there is innate value in creativity, digital skills and entrepreneurship. This essay has argued that the fundamental aim of GDP is to measure wellbeing, and creativity, digital skills and entrepreneurship are only of value insofar as they promote wellbeing.

In many cases, recent technological and social change brought about by these three factors has undermined wellbeing. For example, there have been increasing concerns that social media is having a detrimental effect on children's mental health. Focusing on these three issues and ways to give them "fuller acknowledgement" could risk skewing the data in ways that would undermine the fundamental impartiality of GDP.

Focusing on wellbeing data instead (judging it alongside GDP rather than trying to include it in the measure) would be a better approach to ensure policy targets are lined up with social value in this area.

A focus on wellbeing might well encourage more spending on improving creativity, digital skills and entrepreneurship, as these all can have a pronounced positive social impact. Creativity in particular is highly related to wellbeing.

But this would not be the major new focus of public spending. Instead it would lead to some glaringly obvious conclusions, such as the need to increase spending on mental health. Mental illness is the single biggest factor in explaining the variation of life-satisfaction in the population. It would also increase the importance of stability over growth. People care much more about losing income than gaining it. This might encourage a more cautious approach in embracing new technologies, where there are often losers.

Both GDP and wellbeing data are flawed. But they both give policy-makers a deeper understanding of the effect of the economy on welfare, and they should enable more informed policy making as a result.

The OECD and ONS already measure wellbeing, but the data is rarely quoted in the media or by politicians. Just as it took 20 years between the development and adoption of national income accounts, it will take some time before wellbeing measures are widely accepted. For now, this is the measure through which policy should be judged, including in regard to creativity, digital skills and entrepreneurship. ●

TIME-USE IN THE DIGITAL ECONOMY

A NEW ECONOMIC MEASURE ACCOUNTING FOR GLOBAL CREATIVITY, ENTREPRENEURSHIP AND DIGITAL SKILLS

MIKE HOLMES, SAMI HAMROUSH, STUART NEWMAN, YANITSA PETKOVA

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Views expressed are those of the authors and not their respective institutions and all work on this competition entry was completed in the authors' own time, in line with the Civil Service Code.

Recent criticisms of GDP have highlighted the metric's inadequacy in measuring welfare and possible mismeasurement of the economic benefits of technological advances. In this paper, a novel approach is proposed for measuring consumption of digital services. The solution involves the collection of time-use data and automated learning approaches. We propose valuation methods and link this data to an internationally recognised classification system that can be used to compile GDP statistics. The approach has both social and economic consequences through providing better estimates of welfare gains from digital services and enhancing estimates of cross-border consumption of digital services.

INTRODUCTION

This report presents a novel approach for measuring the value of non-monetary activity in the digital economy. We start from the basis that people's activities provide key information, so monitoring these activities would improve our understanding of how people interact and transact online. The report details how the collection of rich, time-use data of online activities within a sample of the population would allow for creativity, digital skills and entrepreneurship to be measured quantitatively. We then suggest how activity can be classified and valued to improve the measurement of Gross Domestic Product (GDP).

GDP MEASUREMENT

GDP focuses on measuring economic transactions such as the consumption of final goods and services, and various payments, including wages, taxes and subsidies. While these traditional economic transactions are important for capturing economic activity, other activities that create value or involve unorthodox transactions are more challenging to measure and may be missed by established data collection practices.

CHALLENGE

Criticisms of GDP in academic literature tend to focus on different areas, including the inability to track changes in wellbeing (Stiglitz et al., 2012; Fleurbaey and Blanchet, 2013), the failure to capture growth from technological progress (Mokyr,

2014; Byrne et al., 2015), or a failure to deflate adequately to track quality and price changes (Glaeser, 2014). Yet all three are increasingly important as global websites such as Wikipedia or Skyscanner replace traditional providers of their respective services; presumably by increasing consumer welfare. GDP can only capture these changes if the services are captured using existing data collection methods and if they are adequately deflated to account for falling marginal costs. As Mokyr (2014) notes, "[GDP] measures were designed for a steel-and-wheat economy, not one in which information and data are the most dynamic sector... Dealing with altogether new goods and services was not what these numbers were designed for." Ahmad et al. (2017) found that measurement errors are likely small, but notes that all studies are backward looking, so the mismeasurement issues are likely to grow if unaddressed.

IMPROVEMENTS TO CONSUMPTION MEASURES

If a new measurement focused on the digital economy is to improve how we measure GDP, it needs to use consistent concepts so that it could be incorporated into the measure.

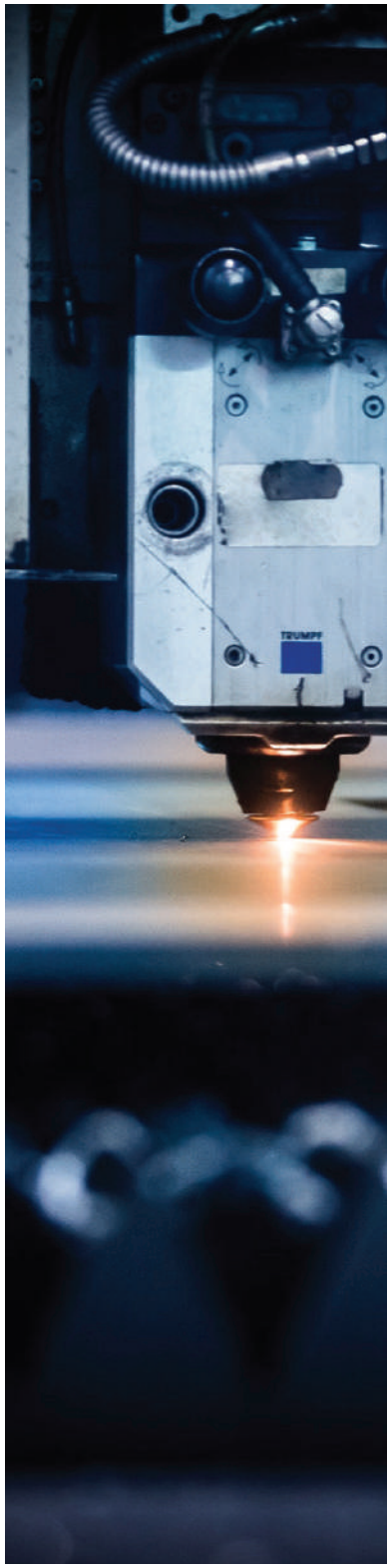
When considering which measure best addresses these challenges, it is important to note that online services often incur considerable upfront costs and marginal costs that tend to fall dramatically (for example, setting up a new social network is expensive, but extending its access to additional users is negligible). While free online services costs are ultimately reflected in household consumption through advertising costs (Ahmad et al. 2017), there are two key challenges. First, expenditure on advertised goods may not reflect welfare yielded by consumers from free online services. Second, even if advertising expenditure does reflect welfare gains, current GDP concepts do not provide a granular enough perspective to analyse these welfare gains.

> This report suggests using time-use data to analyse what online services a sample of the population are using via a downloadable browser plugin.

Since this paper is concerned with the measurement of the welfare from online activity, the focus is on the expenditure measurement of GDP. Household Final Consumption Expenditure (HHFCE) is a major component of GDP for all advanced economies, and accounts for approximately 60% of the UK economy (ONS, 2017). While HHFCE statistics provide a rich source of information on household spending, these statistics only focus on market transactions. Adapting HHFCE statistics to reflect the consumption of free services would allow for analysis of the welfare implications of emerging technologies. Furthermore, tracking the country of origin and consumption of online services could provide more information on cross-border trade of digital services.

THE ECONOMIC VALUE OF TIME-USE WITHIN THE DIGITAL ECONOMY

To measure numerous transactions and consumption behaviours, we propose a time-use approach to measure how people use their time online, the services they consume, and the interactions they have.



POPULATION-SCALE AUTOMATED TIME-USE DATA COLLECTION

A browser plugin is an application that is installed into a web browser and can be distributed online. Upon registration, demographic information would be collected, including age, gender, ethnicity, education and income level, but no further personal information. All subsequent data is collected against the demographic profile of the participant, thus allowing for rich datasets while protecting privacy. When active, the browser plugin records information about webpages visited, creating a log of the domain, timestamp, and webpage meta-description. To turn webpage data into time-use data, two problems must be addressed:

— Browsing activity must be grouped and split into contextualised segments
— Segments must be labelled with meaningful activity classes

SEGMENTING BROWSING HISTORY BY USAGE CONTEXT AND CLASSIFYING ACTIVITY

Browsing history can be segmented by grouping webpages into content topics (Abdallah et al., 2016; Ustinovskiy et al., 2013). Commercial services, such as Alchemy API (IBM, 2017) provide content categorisation that is based on a taxonomy of web content.

We recommend the use of Classification of Individual Consumption according to Purpose (COICOP) to classify the content categories recorded. COICOP provides 14 categories of consumption, which can be further divided into 58 sub-categories (United Nations, 2017).

The use of COICOP provides a framework for classifying a range of activities and is fully consistent with HHFCE and GDP.

This method of classification is akin to document classification techniques (Sebastiani, 2002). The solution requires initial research to evaluate appropriate data and classification maps. However, machine learning approaches, including Bayesian models, artificial neural networks, support vector machines and nearest neighbour algorithms, have all demonstrated capability in document classification tasks (Khan et al., 2010).

Due to the complexity of the learning task, it is too naïve to assume that a single round of supervised learning would provide sufficiently robust classification. The scale and variability of the data to be classified means there are orders of magnitude more unlabelled cases than there could be manually labelled cases to learn from. Due to relatively limited labelled data and the changing nature of the data, it is necessary for the classifier to update regularly without supervision.

> Time and activity segment meta-description keywords could yield rich insights into creative activities, digital skills and entrepreneurship.

Semi-supervised online learning has been used to accommodate similar web-scale document classification problems (Blum and Mitchell, 1998; Chapelle et al., 2002). Initial training of partially labelled data will teach the classifier features for each COICOP category. When an activity segment does not fit a known COICOP category, the user would be prompted to provide feedback on their current activity. The classifier is then updated

online with the newly labelled features. Over time, semi-supervised learning updates will allow the classifier to learn novel behaviours.

VALUATION

The Green Book (HMT, 2011) recommends valuing non-market impacts with revealed preference techniques: willingness to pay or willingness to accept surveys. These techniques seem relevant because the services in question have falling costs and increasing consumer welfare, so the utility consumers receive from the services will be missed by traditional GDP data collection methods. However, over time, consumers may decrease the value they place on these services as their costs decrease. This would have to be accounted for when using these techniques.

Another option is to use the value of people's time spent consuming these services. It is now common for people to book various parts of their holidays online rather than using

travel agents. Thus, we can measure the time people spend when booking holidays and multiply it by an average salary. There are alternative sources of time-value information. For example, the Department for Transport has commissioned studies on this topic (Batley et al., 2010; Wardman et al., 2013). They could provide a proxy for valuations of time, yet they are limited in that their focus is on transportation.

MINING TIME-USE DATA

This solution would provide a rich source of information about activities in the digital economy. Time and activity segment meta-description keywords could yield rich insights into creative activities, digital skills and entrepreneurship. Assuming different countries adopted similar approaches, there would be greater clarity on where services are consumed and, if information on online service providers' residence was available, also where services are sourced from. This would be valuable information for trade in services. In addition to feeding into an improved dataset for GDP, the data would allow academics and policymakers to study trends in the digital economy, the population, and specific demographic subgroups.

CONCLUSION

This report provides a technical solution to measuring creativity, entrepreneurship, and digital skills. It suggests using time-use data to analyse what online services a sample of the population are using via a downloadable browser plugin. The plugin logs websites visited, including time spent. Lastly, these logs are categorised and mapped to a COICOP classification for consistency with national accounting concepts. The collected data can then be valued and used to improve the measurement and granularity of GDP. It can also be used to enhance trade in services data and information on cross-border consumption of digital services. While we have suggested valuation methods, we acknowledge that more detailed studies are required. ●

FROM PRODUCTION TO PROSPERITY

INDRANIL GHOSH

Indranil Ghosh is CEO of the London-based advisory firm Tiger Hill Capital and former Head of Strategy at Mubadala. Dr Ghosh works with governments, investors, corporates and innovative start-ups on corporate/investment strategy as well as catalytic projects to advance socio-economic development and the adoption of positive-impact technologies and businesses.

For most of human history, we have strived to produce the basic necessities of life. More production, as measured by GDP, has equated to more prosperity. Since the 1970s, however, the equivalency between production and prosperity has broken down as negative externalities such as climate change, inequality, and broken balance sheets have wrought havoc globally. GDP no longer illuminates our global wellbeing. A more contemporary method to measure and manage prosperity is needed. This essay proposes a compact set of measures, organised around several principles of prosperity, for steering a national or regional socio-economy.

It began, anthropologists tell us, with the pig. From the beginning of human history, humans hunted meat and gathered grains, berries and the other staples of their survival, vulnerable to the whims of predators and the environment. However, about 13,000 years ago in Mesopotamia, hunters began capturing rather than killing wild boar. In time, the smaller and more docile among these creatures proved easier to manage in captivity, and evolved into the domesticated pig. Domestication of cattle would follow, about 2,000 years later, along with the first cultivation of grains, fruits and vegetables. The first building block of civilization was thus laid, and along with it, the primacy of economic production.

For most of the intervening years, whether the commodity in question was Sumerian pork bellies, East Indian spices, Dutch tulips, Virginia tobacco, or rare earths from China, expanding production has been equated in the human consciousness with increasing prosperity. Arguably, the equivalence makes sense as long as increasing production continues to alleviate the scourge of hunger and poverty and provides the average person with basic provisions. Since production has not reached a level to satisfy the basic material needs of society – except very recently in the richest countries – it is not surprising that humanity has been obsessed with increasing production as its primary means to achieve prosperity.

The Great Depression demanded a new rigor in economic statistics, and in 1934, the economist Simon Kuznets devised Gross National Product (GNP) as a way to measure the speed of US economic growth, and as the basis of a National accounting method. Its initial success in the 1930s led to the use of GNP as a foundation for US production planning during World War II. Although Kuznets himself warned that "the welfare of a nation can scarcely be inferred from a measure of national income", GNP (revised in the 1970s to GDP – Gross Domestic Product), was adopted as the national, and eventually the global, standard for measuring production. As with any standard, once ingrained into our ways of working as a simple, actionable and widely understood construct, GDP became the primary yard-stick by which nations not only measured, but also steered, their economies. It also became the accepted proxy for prosperity.

For me, the answer must lie somewhere in-between. A small set of primary measures that are not merely invisible components of a sprawling mega-index, but rather form a dashboard of the most fundamental, root drivers of prosperity. When these 'primary measures' look strong, other benefits tend to follow. For example, more inclusive democracies tend to have higher voter participation, pursue stronger antitrust actions, and wage less war. Therefore, 'the percentage of voters required by a ruler to gain power' would be a 'primary measure' of an inclusive democracy, while higher voter participation and greater equality would be correlated outcomes that contribute to prosperity.

For many decades, particularly from the perspective of the US, Western Europe and the other industrializing powers that dominated the post-war global economy, GDP and its per capita offspring told a happy story. The long-term trend line for the US economy since 1943, when war production pushed it toward full employment, has been aggressively positive. The same was true for other industrialising countries. By the end of the 1970s, however, the rosy picture of a seemingly perpetual growth of production (and prosperity), painted by long-term GDP figures began to ring hollow. Statistical lag time, academic dogma, plus a deep reluctance to admit to fundamental problems of capitalism in the ideologically charged environment of the Cold War, meant that broad acceptance that something had changed was slow in materialising. Indeed, not until 2009, when the US-mortgage market's meltdown destroyed years of wealth from American households, did the true story hit home. Income growth for most American households, and indeed most households in the economies of the OECD, had been stagnating since the early 1980s, obscured by massive government borrowing and a private sector credit bubble that substituted consumption for gains in wealth. And increasingly, production growth came at the expense of a grave toll on the environment and the fabric of society.

> A small set of primary measures form a dashboard of the most fundamental, root drivers of prosperity.

By 1980, equating "the welfare of a nation ... with growth in national income," as Kuznets put it, was not only flawed but unsustainable. A modern and cross-disciplinary approach to measure prosperity was required. Based on my decades of work for corporates, governments, and many forms of investors, I have witnessed successful, far-sighted strategies to develop prosperous economies. Whether it is Abu Dhabi, Singapore, the Boston-Cambridge metro, or Greater Manchester, I have found that the stars at generating prosperity embrace several principles for generating prosperity, and score high on the associated metrics:

INCLUSIVE DEMOCRACY

Not all democracies are equally measured by the percentage of the electorate required to gain power. In Nordic countries, the figure is typically about 40%; that compares with only 25% in the UK. Greater equality correlates directly with this metric because when a government has to gain the support of a larger proportion of the electorate, it must enact policy to benefit all segments of society (e.g. progressive taxation, stronger anti-trust laws and their enforcement, inclusive labour laws, avoidance of opportunistic conflicts). It also becomes more difficult to pander to the whims of special interests.

INCLUSIVE WORK ENVIRONMENT

An Inclusive work environment is a critical driver of social stability and economic mobility. 'Primary measures' are a high employment rate; good jobs that attract equal levels of participation from all segments of the workforce, viewed by age, gender, race, and region; and equal pay for equal work. Differences in income between the top and bottom of the pyramid will

be tolerated – within reason – as long as those at the bottom have access to the resources and opportunities, which when combined with hard work, will catapult them to the top. In most countries, workforce participation by women, ethnic minorities, the aging, and those living in provincial areas is much lower than their younger, male, urban, and local counterparts. Unlocking this human potential would undoubtedly generate significant prosperity.

UNIVERSAL BASIC PROVISION

Regions that provide a high-quality basket of basic services at a competitive per capita cost, reap a very high return. Education, health, childcare, affordable housing, and low-cost clean energy enables workforce participation by a broader segment of society, which, in turn, drives a virtuous circle of economic mobility, lower costs from the negative impact of crime, and a broader tax base to further improve services.

ROBUST BALANCE SHEET

Star nations nurture public assets, while keeping public and private debt under control, and thereby preventing asset bubbles. Public assets such as land, real estate, infrastructure, and state-owned companies often present excellent opportunities for value creation through professionalised asset management or privatisation. Sustained investment and commercial operation of these assets is rewarded with higher revenues streams which governments can re-invest to generate further prosperity.

INNOVATION, CONNECTIVITY, ENTREPRENEURSHIP (ICE)

The ICE triumvirate is the cornerstone of productivity growth. Innovation, measured by the growth in well-paid jobs in innovation sectors that enhance prosperity, such as digital technology or clean energy, is the only true defense against the threat to jobs from automation or lower-cost workforces. Crucibles of innovation are fueled by access to global flows of goods, services, talent capital, and knowledge as measured by the McKinsey Connectedness Index. And a supportive environment for entrepreneurship, as measured by the Global Entrepreneurship Development Index (GEDI), is essential for generating the new businesses as well as attracting large corporates that cannot afford to be left behind.

ENVIRONMENT AND SUSTAINABILITY

This measure focuses on the reduction of waste and the displacement of carbon dioxide emissions, through the implementation of emerging clean technologies and new business models. Without concerted global

action in this area within the next few decades, global climate change is poised to wreak unimaginable damage to our collective prosperity. As such, it is the area that demands the most urgent collective attention.

STABILITY AND SECURITY

Without sustained stability and security, most initiatives to advance prosperity will not have time or conditions to reach fruition. Macroeconomic and financial sector stability; low risk of social and political upheaval; and strong security and emergency readiness make for safe havens that attract long-termism from top talent, investors and corporates alike.

To be sure, aspects of these views exist in the annual reports of the IMF and World Bank, as well as some of the world's leading investment banks, economic advisory firms, think tanks, and academic institutions. But none has created a compact set of metrics, validated by diligent back-testing that reliably measures prosperity growth and provides a framework for prioritising policy actions. This approach – or one modeled upon it – is certainly within reach.

> It is time for GDP to be retired, and for a modern model for measuring prosperity to take the stage.

The lifetime achievement award to be presented to Dr. Kuznets at the next Nobel ceremony, a fitting complement to his Nobel Economics honors in 1971, is a greatly deserved accolade for the founder of GDP – a seminal, necessary metric that helped pull the world from the chaos of the mid-20th Century. However, it is time for GDP to be retired, and for a modern model for measuring prosperity to take the stage. ●

CITY PROSPERITY INDEX (CPI)

HOW SHOULD WE MEASURE ECONOMIC ACTIVITY IN A 21ST CENTURY GLOBAL ECONOMY?

RICCARDO CASALE

Riccardo Casale believes the global economic model must be transformed. As a strategist, storyteller and entrepreneur, he has a bias for action and brings a different approach to applied economics. He has a Masters in Engineering and an MBA with a career spanning LEK Consulting, The Coca-Cola Company and technology start-ups.

The endless pursuit of prosperity through growth has resulted in an economy that is bigger than its host, our planet. Put simply this means we must transform our economy if we wish to prosper. We measure what we value: sustainability is at the core of the new measure and energy flow is the driver of change. The framework is based on energy as the fundamental resource of the new economy and quantifies its flow in terms of people's contributions and energy resources consumed. Paradoxically measuring smaller entities (cities not states) is expected to amplify the magnitude and speed of transformation.

A NEW NARRATIVE

The predominant economic model globally is premised on 'prosperity through growth'. The hegemony of economic growth leads to the narrow view of prosperity as success through the endless pursuit of financial wealth and material accumulation. The scale of this endeavour has resulted in an economy that is bigger than its host, our planet. Put simply this means that our economy is unsustainable. At risk of depletion are the basic fundamentals: food and water, soil and climate.

The new narrative is based on the alternative proposition of 'prosperity through place' where 'public affluence' is the goal of an alternative route to a rich living standard. Prosperity is defined more broadly in social as well as economic terms and is created from individuals' contribution to civic as well as commercial life. Place is more inclusive than social hierarchy in fostering our sense of belonging and connectedness. Public affluence is realised in the wealth of public assets within society (such as public parks and museums); in the quality of its shared natural resources (clean air and water quality); and in the collective purpose of living in a better present (with clean economic growth and less wasted energy).

The flow of energy through a place is at the core of wellbeing and the consumption of energy from natural resources is an indication of its sustainability. This energy flow occurs in three domains: individual, civic and collective.

DESIGN PRINCIPLES

We need a new way to measure the drivers and progress of a sustainability revolution. The economic transformation is a moving target so the design principles must be relevant today and also to the destination:

1. ENERGY FLOW

Energy is a more fundamental resource than money in driving the economy. The focus is on energy that moves through places: both figuratively in terms of people's actions and contributions, and literally in terms of energy resources consumed by burning fossil fuels and capturing renewable energy.

2. CIVIC POWER

There is an important dynamic in the economy alongside commercial markets and state governance that is overlooked and underestimated: civic power. It is an essential conduit of energy from individuals into the community. Empowered local residents create a greater sense of belonging to a place and of connectedness between individuals, and channel their efforts at a more human scale than at state or global levels.

3. CITY CENTRIC

The unit of analysis is the city and not the state. Cities are lead indicators for their respective states as well as potentially more agile change agents. Ultimately the appropriate scale is the community, both urban and rural. Communities are the intellectual and creative hubs and are the places that most define us collectively. Cities are chosen as the starting point as they can amplify change through their high density and economic diversity.

4. SUSTAINABLE

A community could thrive economically while using energy resources unsustainably and disregarding negative externalities. The challenge of every forward-thinking economy is not simply to become more sustainable but to accelerate the seismic shift in addressing its environmental impact. A new measure of economic performance cannot be decoupled from the environment that is fundamental to future prosperity.

5. NON-PARTISAN

The outlook is not biased towards any political or interest group. 'Prosperity through place' is a narrative based on private and public energies and on combined individual and collective enterprise. It tells us not to replace state governance or market forces but instead to augment them with civic power and work towards a common goal of public affluence.

METHODOLOGY

The transition to a global economy built for the long-term prosperity of humanity will redirect a massive amount of energy. At the same time, its implementation is intensely place-based. This leads us to a focus on measuring the energy throughput in specific places. The flow of energy in a city is measured across three domains: individual, civic and collective.

– Individual Energy – derived from residents in the metro area;

– Civic Energy – generated by municipal organisations and private sector enterprises;

– Collective Energy – directed towards common resources used by many individuals.

A localised prosperity indicator must be streamlined or else it will not be implemented or propagated.

The reductive nature of a short list, in an attempt to simplify what is inherently complex, inevitably has the potential to misrepresent real world efforts and effects. Nonetheless the 18 metrics selected correlate with a wider range of metrics and focusing on the performance of a few may still drive the desired change. Sources include GDP data customised by metro area; locally established Air Quality Indices; and the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories.

Each metric is converted into an index with a normalised range and overall score of 100 equal to the average of all participating cities. Indices within each domain are averaged and the city score averages its three domains. The metro population and growth rate are included (but not indexed) for the purpose of separate scaling calculations, e.g. per capita indices may be declining but absolute values rising depending on metro population growth rate.

Example:

City A	Pop. Size (milion)	Growth (%)	CPI	Individual Energy	Civic Energy	Collective Energy
Baseline	3.4	2.5	110	93	107	130

DOMAIN: INDIVIDUAL ENERGY

Individual energy builds social capital – the bonds and bridges between people with a shared sense of place and identity – through individuals' interactions with one another and the contributions they make to society. These links enable people to trust each other and work together, providing the foundation for co-operation, exchange and innovation. Individual energy is inferred by measuring the participation in the workforce and in unpaid work, by the intensity of social connectivity and level of community engagement. Its potential is judged on the basis of gender and ethnic diversity.

> The hegemony of economic growth leads to the narrow view of prosperity as success through the endless pursuit of financial wealth and material accumulation.

Domain	Measure	Metric (indexed)
Individual energy	Work force	Workforce participation rate
	Unpaid work	Dependent population
	Social connectivity	Mobile-broadband subscribers
	Community voice	Participation in local elections
	Gender diversity	Woman in full-time education
	Ethnic diversity	Ethnicity in full-time education

DOMAIN: CIVIC ENERGY

Civic energy channels a renewed sense of common purpose, by shifting the perspective from striving against each other to overcome individual problems to striving together to overcome shared problems. Some of the pressing challenges we face are too big for individuals, yet cannot be solved by the state or market forces alone. The solution is to restore systems that are not so big that they cannot respond to us but not so small that they cannot tackle the scale of the changes. Powered by civic energy, these systems are built around the places where people live and anchored in local communities and parts of the economy. Civic energy goes into shaping civic spending and growing the (sustainable, shared and/or knowledge-driven) 'New Economy' and into efforts to conserve more natural resources and use more renewables.

Domain	Measure	Metric (indexed)
Civic Energy	Work productivity	Gross Metro product (GMP) per person
	"New Economy" growth	"New Economy" jobs created
	Participatory budgeting	Metro PB budget
	Energy efficient	Energy consumed per person
	Renewables	Low-carbon energy used
	Water smart	Water consumption per person

DOMAIN: COLLECTIVE ENERGY

Building on the foundation of individual and civic energy, collective energy is used to increase public affluence that is the goal of long-term prosperity anchored in the places where people live. Collective energy builds communal ethos and a more sustainable urbanism, and leads to more effective stewardship of thriving commons.

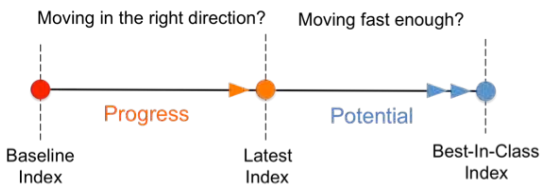
It is measured by the wealth of assets created within and for the community, such as open parks and access to public libraries. It is inferred from the quality of the shared natural resources that belong to and benefit the whole community, such as clean air and water. It is powered by the collective purpose of living in a better present (clean economic growth with less wasted energy).

Domain	Measure	Metric (indexed)
Collective Energy	Public assets	Spaces and places
	Local water quality	Share of waste water treated
	Local air quality	Airborne particulates
	Climate protection	City GHG emissions
	Climate economy	Solid waste recycling rate
	Clean growth	Emissons Intensity Ratio

CREATING A MULTIPLIER EFFECT

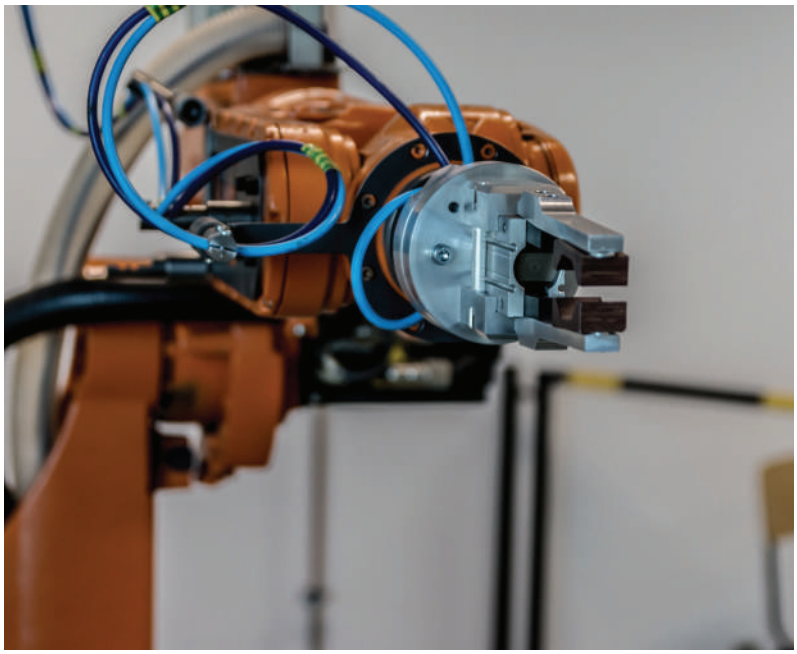
In asking ourselves 'how' we should measure our economy we are not simply asking 'what' but also in what way the act of measuring will spread the desired change more rapidly. Involving communities in local measurements creates ownership and disseminating their success stories spurs action. We start by measuring 100 cities across the world and expect a multiplier effect from their collective energy and ambition.

To encourage a race to the top, a city's progress is also measured by tracking its latest indices against the best-in-class indices from all other cities to see if it is moving fast enough. Best-in-class indices will change continuously so the comparison of current performance is against a moving target of increasing potential. ●



CITY PROSPERITY INDEX : PROGRESS AND POTENTIAL

Energy is a more fundamental resource than money in driving the economy. The focus is on energy that moves through places: both figuratively in terms of people's actions and contributions, and literally in terms of energy resources consumed by burning fossil fuels and capturing renewable energy.



Q&A / INDIGO PRIZE JUDGES

MERVYN DAVIES AND LYNDA GRATTON

Lord Davies of Abersoch is Non-Executive Chairman of LetterOne, the international investment business. He was previously Minister for Trade, Investment, Small Business and Infrastructure, and Chairman and CEO of Standard Chartered, serving on the Board for over 12 years.

Lynda Gratton is Professor of Management Practice at the London Business School. She is the author of several books, including 'The Shift', about the impact of technology and other changes in business, and most recently, together with distinguished economist Andrew Scott, 'The 100-Year Life: Living and Working in an Age of Longevity'.

WHY DO WE NEED NEW WAYS TO MEASURE MODERN ECONOMIES?

Lynda: Modern economies only have so much value within them and so little of that is picked up by GDP and that's why this award is so incredibly important because we look at not just that, but also innovation and social capital.

Mervyn: I think that the pace of change in the world is so speedy. There are such extraordinary changes going on that whatever measures we use need to change and adapt and this is a good way of looking at one of the measures, which is GDP.

WHAT WERE YOU LOOKING FOR IN THE ENTRANTS AND HOW DID YOU COME TO YOUR DECISION ?

Lynda: I'm not an economist, I'm a psychologist, so it was very easy for me to ignore any of the economic rigour and just say 'Is it innovative and is it exciting, will it make a difference to the narrative and the story that we tell about countries?'

Mervyn: I was looking for creative thinking and new ways of looking at GDP, and I think that we found that.

WHERE DOES THE INDIGO PRIZE GO FROM HERE? WHAT'S NEXT?

Mervyn: I think that when Mikhail Fridman and LetterOne got into the discussion about the shape of

economies and countries and how you measure things, we have to accept that the pace of change is extraordinary, with 3D manufacturing, robotics, AI, they're having profound changes on society. There's huge inequality and huge issues that politicians and businesses are facing, and we have to find ways of addressing them.

Lynda: When you think about how countries and politicians and young people talk about the future and what they value, GDP is part of that whole process. It's an incredibly important conversation, and from my perspective a very important prize. ●

THE PACE OF CHANGE IS EXTRAORDINARY, WITH 3D MANUFACTURING, ROBOTICS, AI... THEY'RE HAVING PROFOUND CHANGES ON SOCIETY.

BEYOND THE BASKET

RICHARD HEYS

Richard Heys is Deputy Chief Economist at the UK Office for National Statistics, responsible for economic statistics research, productivity statistics and deflator development. He holds a Masters in Economics from University College London and an honours degree in Philosophy, Politics and Economics from Balliol College, University of Oxford.

This paper proposes using data collected for the Consumer Prices Index to estimate the impact of price changes for a static basket of goods on the growth of consumer surplus, allowing the impact of free goods to be captured. This is augmented by capturing the value of future consumption through the value of capital stocks and life expectancy to deliver the overall impact of economic activity on welfare. Many countries could retrospectively create this series.

This index demonstrates, even under strongly positive assumptions around consumer surplus, the post 2008 recovery, in welfare terms, was slower than implied by the headline GDP index.

INTRODUCTION

GDP is the sum of the costs of production and producer surplus. It is not a measure of welfare; that is the sum of these plus consumer surplus. In a period when the quantity of goods and services consumed were the key factors driving changes in living standards, the assumption that it behaved in growth terms sufficiently closely to welfare to be used as a proxy was valid, but is this still the case?

—Measurement of GDP still poses challenges.

— Does GDP represent the innovative (digital) margin in the economy?

— In increasingly complex economies, is focussing on just one flow helpful?

Where stocks of natural resources were once effectively infinite, with zero marginal cost, abstracting away from their existence was acceptable. Today, with increasingly scarce natural resources and climbing marginal values, this no longer holds.

CAPTURING THE MODERN ECONOMY

Deflation converts cash into real volumes, stripping out quality change, but goods change all the time: Mars Bars become smaller, BMWs gain in-built GPS, mobile telephones become more powerful. To say nothing of services: How does one measure the quality of economists?

Driving quality change is new goods. These are taken up by consumers as they deliver greater value than the products they replace, but is it fair to assume that a new good with a lower price, (e.g. free digital apps), is inferior to the incumbent?

Take a newspaper which creates a free on-line version, and cuts its paper price in half. In period 1 it sells 1,000 copies for £1 and in period 2 sells 500 copies for 50p, with 5,000 free online views.

> The free views of a newspaper are assumed to not have any value, because a consumer was not willing to pay for them whilst they had a price.

Current measures place period 1 volume at 1,000 and period 2 at 250. Currently the *additional* free views (the 4,500 digital downloads not included in the table) are assumed to not have any value, *because a consumer was not willing to pay for them whilst they had a price*.

	Price	Quantity	Volume	Average Price	
Period 1	1	1,000	1,000	1	
				Including Digital	Excluding Digital
Period 2 Paper	0.5	500	250	0.25	0.5
Period 2 Digital	0	500	0		-

Table 1: Newspaper Free Good Example

The values measured depend on the treatment of digital 'sales': if the digital newspaper is considered the same product, its price would be included when calculating the price movement. If it was considered a new product, it would not be included, resulting in newspaper inflation being twice as large. Volume is also under-estimated: the newspaper has gone from 1,000 to 5,500 consumers, but volume falls by three quarters.

The obvious solution is to apply shadow prices, particularly market prices, such as the 50p paper version price: applied to 5,000 free downloads this adds £2,500 to volumes. However, we would also need to add equivalent values to GDP(Expenditure) and GDP(Income) to balance the three measures. The addition of £2,500 of shadow income and expenditure would call into question the consistency of measurement of inflation, real wages, and volumes, and the very concept of productive activity. We would also struggle to create a back-series and apply these adjustments retrospectively.

PROPOSAL

This paper suggests the following criteria for any proposal:

— Affordable delivery, on the same timetable as GDP

— Consistency with other measures.

— Delivery of a historical time-series to inform policy-making today.

I reject a new survey of individuals to estimate consumer surplus because of the expense, the impact of new collection burdens on existing surveys, and the problem that a new survey routinely takes a number of years to bed down and become effective.

I propose using existing data to measure consumption-based welfare in the following model:

BREAKING THIS INTO COMPONENTS:
To estimate:

— If Consumer Surplus is a function of GDP, then we can simplify so:

CONSUMPTION

=

α (GDP PER HEAD)

Changes in α will be driven by changes in the ratio between consumer surplus and GDP per head.

AS GDP PER HEAD

=

Y/p AND Y

=

Af(K,L)

Then we can approximate:

ΔGDP PER HEAD

≈

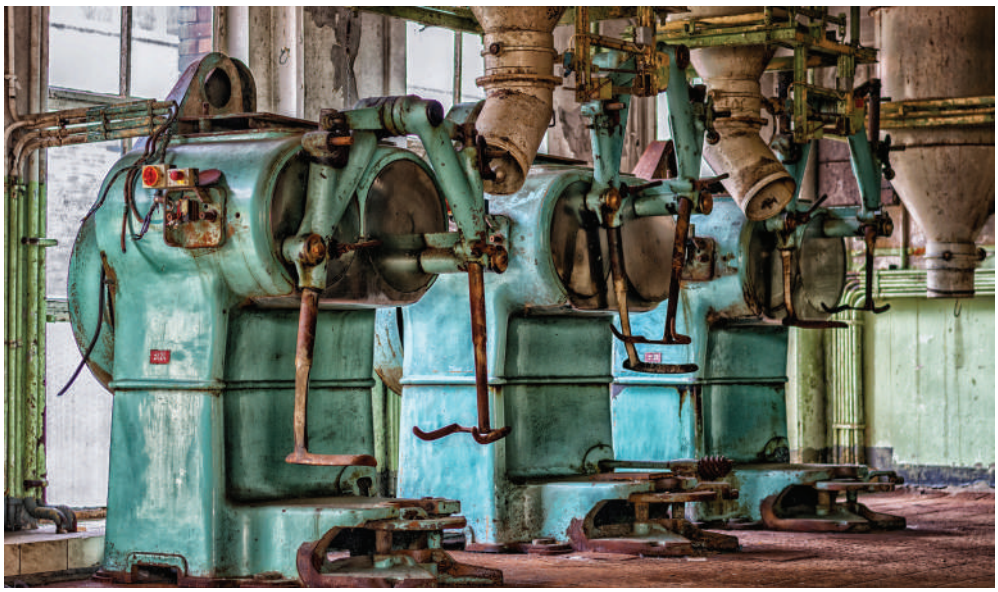
f(ΔK, ΔL) /Δp

If we include human capital in K, and as in period t we cannot foresee labour input in period t+1, we can represent future consumption as a function of the quantity of capital and population (p) growth. The model therefore becomes:

$$Welfare\ Gain_t =$$

$$Welfare\ Gain_t = \alpha_t(GDP\ per\ head_t) + \frac{(1 + \Delta Life\ Expectancy).\Delta(Capital\ Stock)}{Population}$$

Again, we normalise welfare gain 0= 1.



ESTIMATING α

If one consumes a basket of goods at different times, it should deliver the same consumer surplus. However, as the price of these goods fluctuates, over time we should expect to see a fall in the price of this 'base-basket', as better quality products appear and force producers to mark-down products to retain sales. This process should allow consumers to purchase a greater number of the same basket of goods with the same expenditure.

What we are interested in is the changing price of maintaining a constant level of consumer surplus, rather than the changing price of changing spending patterns. The argument is effectively akin to comparing Marshallian and Hicksian measures of demand – Marshallian demand functions measure the utility which can be gained from a given set of prices and income, whereas Hicksian measures of demand calculate the prices and incomes required to deliver a pre-determined level of utility. If we assume the consumer surplus delivered from a constant basket of goods is constant through time, then as incomes and prices change we should be able to compute the percentage change in the consumer surplus received in terms of the number of 'base-baskets' which can be afforded by the average consumer. However, this model cannot measure the level of α, only the growth-rate of α.

To identify the basket of goods consumed by the average household in a base year, I propose using data from the CPI basket of goods. However, I do not propose to use existing measures of inflation. We do not want to observe the price of the basket of goods consumers purchase, revised on an annual basis to reflect new spending patterns, but rather a measure of the cost of purchasing the same basket of goods through time, whilst addressing two facets of the digital economy:

— Discontinuation of products in the base-basket. Because CPI baskets overlap every January, (Gooding 2017) we can chain-link similar products, identifying the difference in prices and stripping this out from future changes. Scanner data, providing both sales price and volumes, will be invaluable in creating such an index, including populating a historic series.

— Free digital goods would make the base-basket cheaper and therefore increase welfare. I propose a '30% rule' to decide when a product has become 'functionally free': that is when more than 30% of consumer's interactions with a product are via free means, then we assume that an informed consumer could become part of this significant minority and access the good for free.

In the absence of the necessary microdata, Table 2 assumes competition and free goods allow consumer surplus (α) to grow at 1%p.a. over the period from 2008:

	2008.	2009.	2010.	2011.	2012.	2013.	2014.	2015.	2016.
GDP per head Index (CVM)	1.00	0.95	0.96	0.97	0.97	0.99	1.01	1.02	1.03
Consumer Surplus Index	1.00.	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08
Welfare Index	1.00	0.96	0.98	1.00	1.01	1.03	1.07	1.09	1.12

Table 2: Estimating a measure of the total value of welfare from consumption

LIFE EXPECTANCY

Because we are focussing on an index, rather than a level of welfare, I focus on the change in the discounted value of the additional average number of quality adjusted life years as a fraction of the original average number of disability free life years.

$$\left(\sum_{1}^{41}\frac{\Delta DFLE}{1+\partial^{n}}\right)/\left(\sum_{1}^{40}\frac{\Delta DFLE}{1+\partial^{n}}\right)=1.011$$

Again this factor would be included multiplicatively into the welfare index, with changes measured relative to the base year:

I propose a '30% rule' to decide when a product has become 'functionally free': when more than 30% of consumer's interactions with a product are via free means, then we assume that an informed consumer could become part of this significant minority and access the good for free.

English Disability free life expectancy (three year periods to year…)	2008	2009	2010	2011
Male	63.3	63.5	63.6	63.9
Female	64.5	64.8	64.8	64.4
Overall	63.9	64.8	64.8	64.4
Median age	39.1	39.3	39.5	39.6
Resultant average further years of disabiliy free life	24.8	25.5	25.3	24.8
Change from base-year	0.0	0.7	0.5	0.0
Discounted change	0.0	0.3	0.2	0.0
DFLE Index	100.0	100.3	100.2	100.0
DFLE Index (re-based to 1)	1.000	1.003	1.002	1.000
Assumed male population share	*49.20%*			

Sources:
https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/datasets/disabilityfreelifeexpectancydfleandlifeexpectancyleatbirthbyregionengland
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/overviewoftheukpopulation/february2016 (Figure 3)

Table 3: Estimating the DFLE Index

CAPITAL

With increasingly scarce resources, and increasingly fast capital depreciation our main measure needs to take account of capital depreciation, and include all capitals in a net stock of assets (NSA) Index. This faces empirical challenges: not all components exist, requiring a wholesale increase in the resources to produce these on a quarterly timetable.

I normalise the NSA Index to 1 in the base year, and then measure changes in percentage terms from this base year to feed into the welfare index.

Value of capitals
2015 prices

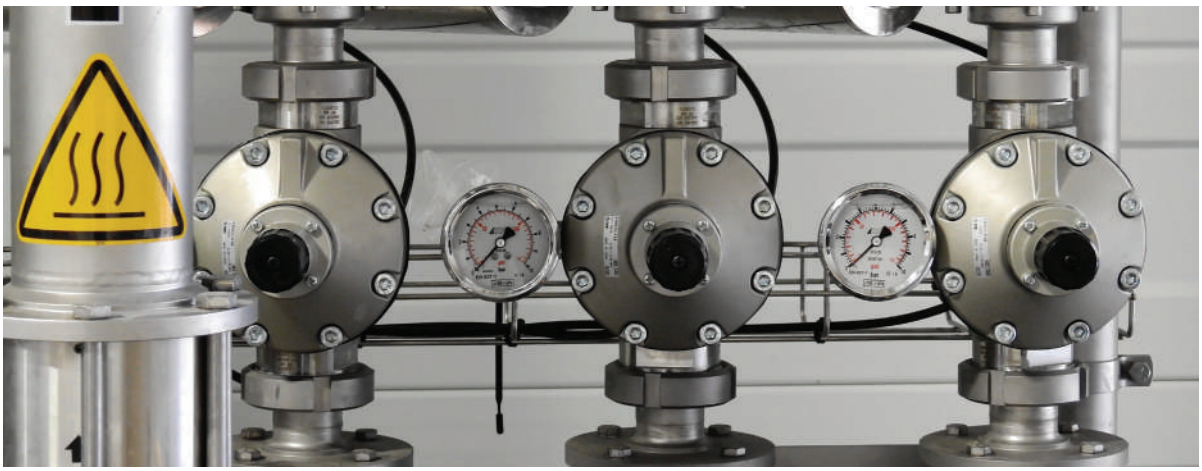
£m	2008	2009	2010	2011	2012	2013	2015
Tangible + intangible capital stock[1]	3,900.00	4,000.00	4,000.00	4,000.00	4,100.00	4,100.00	4,200
Human Capital[2]	19,753.86	19,723.38	19,435.91	19,020.69	18,848.74	18,816.36	19,904.25
Mineral Reserves[3]	2.21	2.74	2.53	2.88	3.66	3.89	*3.76*
Oil and Gas Reserves[3]	238.28	216.47	205.33	202.34	149.35	92.02	*22.78*
Wind[3]	13.71	15.64	15.14	25.87	33.24	40.40	*45.57*
Hydropower[3]	10.93	10.86	10.92	11.52	10.49	9.89	*9.22*
Carbon sequestration[3]	52.76	54.12	55.52	56.87	58.25	59.68	*61.15*
Pollution Removal[3]	*124.91*	*122.43*	*119.96*	*117.49*	*115.01*	*112.54*	*112.54*
Recreation[3]	*212.67*	214.96	261.94	227.49	225.26	178.88	*167.46*
Stock of Assets	24,309.33	24,360.60	24,107.25	23,665.15	23,544.00	23,413.67	24,526.74
UK resident population mid-year estimates (persons) (EBAQ)	61,824,000	62,260,000	62,759,000	63,285,000	63,705,000	64,106,000	65,110,000
Stock of assets per head (£)	393.20	391.27	384.12	373.95	369.58	365.23	376.70
NSA Index	1.000	0.995	0.977	0.951	0.940	0.929	0.958

All data is sourced from ONS website, except figures in italics, which are author's linear imputations

1: https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/bulletins/capitalstocksconsumptionoffixedcapital/2016

2: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/datasets/humancapitalstatistics (Table 1)

Table 4: The Value of Capitals



	2008	2009	2010	2011
(GDP per head index (CVM)[1]	1.000	0.950	0.961	0.967
x				
Consumer Surplus Index (α))	1.000	1.010	1.020	1.030
+				
(DFLE Index)	1.000	1.003	1.002	1.000
x				
NSA per head Index)	1.000	0.995	0.977	0.951
Welfare Index	2.000	1.958	1.959	1.947
Welfare Index normalised to one in 2008	1.000	0.979	0.980	0.974
GDP Index (CVM)[2]	1.000	0.957	0.975	0.990

1: Source CDID: IHXW

2: Source CDID: ABMI

Table 5: Composition and comparison of the Welfare Index

The Welfare Index gives a different picture to headline GDP. Whereas GDP fell sharply and then recovered to parity with 2008, the Welfare Index's initial drop is not as steep but recovery did not happen, even with an assumption that consumer surplus grew at 1% p.a. Whilst detailed microdata work is required, the impact of life expectancy and the stock of capitals is clear. ●

A FRAMEWORK FOR A NEW GDP

ROBERT PHELPS

Robert Phelps is Head of Research for Nova, a credit rating agency in China. He holds a PhD in Economics and has a varied background including universities, management consulting and finance. His working interests are in metrics, analytics, A.I. and simplicity of communication.

We consider GDP as a guide to policy, both economic and political. By examining two family businesses, we can identify the key elements that GDP needs to include. Crucially we distinguish the output of an economy (both monetary and social/environmental) from its driving engine – infrastructure and behaviour.

We then examine and revise this model the light of what is (and what is not) measurable, giving examples of how each element can be measured. We come up with new approaches to measure concepts such as free goods, innovation and creativity, treating them as elements of the engine rather than as outputs.

A TALE OF TWO HOUSEHOLDS

A) The Spenders inherited a large house in the country and a small furniture retail business. Mr Spender isn't a particularly energetic businessman. He hasn't invested in expanding the business and it is under threat from online stores. Their total net income is the profit from the business which they take out, currently £250k. They spend it each year. They don't invest.

In many ways this family seems a good model for current GDP estimation: its wealth is fairly captured in income/spend measures (there is for example no unpaid work involved), and their quality of life corresponds with the high GDP level. But this high figure doesn't provide a good basis for policy: their assets are declining in real terms and they are living off the past. The Spenders are relying on inherited wealth and 'selling off the family silver'. It's a prescription for long term GDP decline.

B) The Saveurs both had poor parents and inherited nothing. They started their own business on the internet. This year their business profit was £50k. They spend very little on themselves and plough much of the profit into developing their brand. Luckily high speed broadband and webserver services can be bought cheaply. Mrs Saveur spends her time developing its software. She is not a director or employee and works unpaid.

The family GDP is low: 50K. But again, this picture of low GDP does not provide a policy prescription. While the current output from the business is low, the Saveurs are actively investing to create assets (brand, software) that will grow the business. They are focussed less on the visible GDP tip and more on the underlying engine that will drive future earnings.

This sort of economy shows the pitfalls of present GDP as a basis for policy. Mrs Saveurs' important contribution to the business is not counted, because her services are not bought and sold in a market. Their skills in business development and software are increasing, but do not count in GDP. The improvements in quality they have made to the customer experience are not counted since they do not charge extra for them. They have taken a big risk and have been innovative in creating a new business, and have put a lot of energy into making it successful. They have been supported by an economy where many things are either free or available at low cost: their business relies on the internet, which is worth far more to them than the low price they pay. All these elements are ignored in present GDP calculations.

THE GDP ICEBERG

To guide economic policy, we want to know not just how much an economy produces in marketed goods but also how much is produced that isn't marketed, whether the engine that spits out GDP – the economy's assets – is

being maintained and developed for the future, and what behaviours are driving the economy.

To guide political policy, we want to know how spending power is distributed (each according to his needs, or a slave society) and how GDP growth impacts the social and environmental aspects of life.

Several key areas need to be included in newGDP:

— the 'engine' driving GDP output (assets)

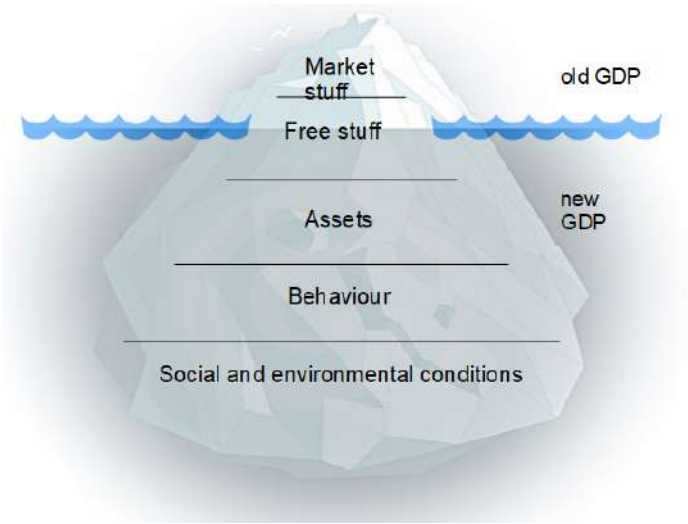
— free stuff

— behaviour

— and social and environmental effects

oldGDP is like the tip of an iceberg – what you need to see is the bulk of the economy hidden under that GDP tip.

We add components around oldGDP that together give a better picture of an economy.



A) ASSETS

To understand an economy we need to distinguish its output from its underlying engine. Economic activity is greatly helped by having the right things in place to create or grow a business.

Firstly, it is distributed by physical infrastructure. Then organisational infrastructure – the business networks and systems that have grown up such as supply chains, clusters, markets, banking systems. Third, social infrastructure – intangible things such as skills, legal systems, education systems, government. As well as relying on these assets, current economic output either drains them or builds up new assets.

B) FREE STUFF

Stuff that could be provided through the market but instead is done outside either with no paid cost, for example house cleaning, or with a paid cost, for example government provided healthcare. We will call this 'forgotten price stuff'.

Stuff that has little impact on GDP but a large impact on the economy because it is provided free or for a price far lower than its value, for example online information and cheap generic drugs. We call this 'zero price stuff'.

Free stuff includes innovation such as new technologies that reach the market at close to zero cost and quality improvements which are not reflected in price. Free stuff is difficult to measure but becoming increasingly important. So whereas in the past it could be ignored, in post-industrial societies it will form an increasingly large part of GDP.

C) BEHAVIOUR

Being hardworking or entrepreneurial is an important driver of economic growth. Keynes famously identified 'animal spirits', a level of confidence and willingness to take opportunities (entrepreneurship).

Most growth in economies occurs where new technologies are developed and introduced (railways, computers, communications), or where new ways of doing business are discovered (joint stock companies, online retail) so innovation – coming up with new ideas and deploying them – is also a key driver of economic growth.

Both animal spirits and innovation involve a willingness to take risks, but risk needs to be managed.

Risk behaviour needs to be included in newGDP to have a balanced view of an economy's prospects.

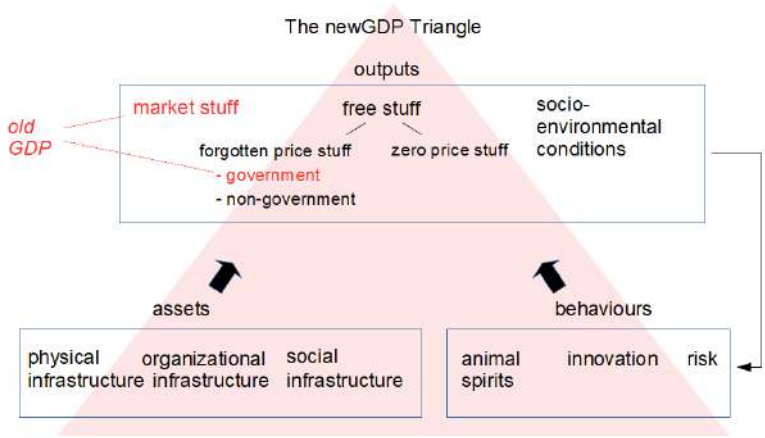
D) SOCIAL AND ENVIRONMENTAL CONDITIONS

Social and environmental effects are things that are not part of economic production but which are affected by the way the economy works – living

conditions, air quality, wildlife, countryside, corruption, equality and health are all affected by how things are done in the economy and needs to be included in newGDP.

Putting these components together leads us to our first attempt at a model of newGDP: the newGDP triangle.

We now need to refine this model to ensure we are dealing with measurable concepts.



NEWGDP AND ITS MEASUREMENT

A) FREE STUFF

Non-government forgotten price stuff, for example housework, may be available on the market, to give market prices; if not it can be valued at its cost of provision.

'Zero price stuff' has no market price and low cost of provision. Measuring value for zero price stuff, including improvements in quality and new technologies, is a difficult problem.

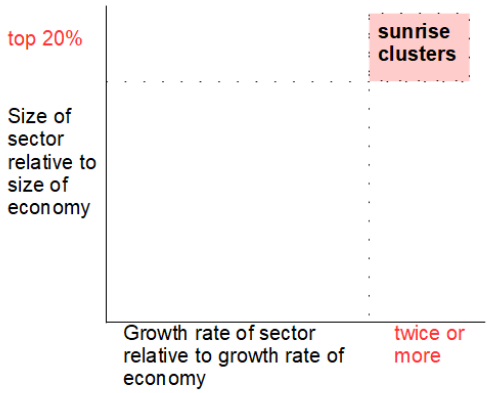
But zero price stuff is given to the world, not contained within one economy. Quality improvements and technologies are rapidly copied and dispersed, so they are not advantages to one country.

What we need to measure is not the current value of zero price stuff, but the ability of the engine of the economy to drive innovation and quality. That is, we need to think of the ability to produce zero price stuff as part of organizational infrastructure. To measure this ability, we can measure R&D spend; another way is to measure the parts of the economy most likely to come up with innovations and improvements. These advances usually come from organisational clusters – groups of interacting organizations which have a level of excellence. The internet as a new technology did not affect the economy by itself, but through being taken up for various uses by the 'Silicon Valley' cluster of firms.

So, the quality and innovation capability of an economy is indicated by the size and number of these clusters particularly in fast growing sectors which we will call 'sunrise clusters'.

> To guide political policy, we want to know how spending power is distributed

The engines of innovation and quality



OTHER COMPONENTS OF NEWGDP ARE MORE STRAIGHTFORWARD TO MEASURE

B) ASSETS

Physical Organisational and Social infrastructure items can be measured by tailored metrics such as replacement cost and effectiveness. For example, markets provide clear price and quality information so that a particular item will find a particular price, so markets can be measured by the variation of prices for similar stuff, and education can be measured by international pupil attainment comparisons.

C) BEHAVIOUR

Animal spirits can be measured subjectively by confidence (using a business confidence index), and objectively by metrics such as consumer spending and the number of new businesses set up. Risk of an economy can be measured by the sovereign risk ratings that are produced by companies such as Moody's and S&P.

D) SOCIAL/ENVIRONMENTAL CONDITIONS

Social/environmental conditions cover a wide range of outcomes resulting from how an economy is run and how its benefits are used in a society. For example, the OECD in its 'How's Life' project produces the measures shown over the page.

> The quality and innovation capability of an economy is indicated by the number and sizes of clusters like Silicon Valley in fast growing sectors which I call 'sunrise clusters'.

Table 1.1 . An overview of headline well-being indicators in OECD countries

"Circles" denotes OECD countries in the top two deciles, "diamonds" those in the bottom two deciles, "triangles" those in the six intermdiate decilese

	Material Living Conditions							*Quality of Life*																
	Income and Wealth		Jobs and Earnings			Housing		Health Status		Work and Life			Education and Skills		Social Connections	Civic Engagement and Governance		Environmental Quality	Personal Security		Subjective Well-being	
	IW I	IW II	JE I	JE II	JE III	HG I	HG II	HS I	HS II	WL I	WL II	WL III	ES I	ES II	SC I	CG I	CG II	EQ I	PS I	PS II	SW I	SW II
	Household net adjusted disposable income per person	Household financial net wealth per person	Employment rate	Long-term unemployment rate	Average annual earnings per employee	Numer of rooms per person	Dwelling without basic facilities	Life-expectancy at birth	Self-reported health status	Employees working very long hours	Time devoted to leisure and personal care	Employment rate of women with children of compulsory school age	Educational attainment	Students' cognitive skills	Social network support	Voter turn-out	Consultation on rule-making	Air quality	Intentional homicides	Self-reported victimisation	Life-satisfaction	Affect balance
	2009	2009	2010	2010	2009	2009	2009	2009	2009	2009	2000	2008	2009	2009	2010	2007	2008	2008	2008	2010	2010	2010
Australia	●	▲	▲	●	●	●	..	●	●	◆	▲	▲	▲	●	●	●	●	▲	▲	▲	●	▲
Austria	●	▲	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	◆	▲	▲	▲	▲	●	▲	▲	▲
Belgium	▲	●	▲	▲	▲	●	▲	▲	▲	▲	●	▲	▲	▲	▲	●	◆	▲	▲	◆	▲	▲
Canada	●	▲	▲	●	▲	●	..	▲	●	▲	◆	●	●	●	●	◆	●	▲	▲	●	●	▲
Chile	◆	..	▲	..	..	▲	◆	▲	◆	▲	..	..	▲	◆	◆	●	◆	◆	◆	◆	◆	▲
Czech Republic	▲	▲	▲	▲	◆	▲	▲	◆	▲	▲	..	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲
Denmark	▲	▲	●	▲	▲	●	●	▲	▲	●	●	●	▲	▲	●	●	▲	▲	▲	▲	●	●
Estonia	◆	◆	▲	◆	..	▲	◆	◆	◆	●	◆	▲	●	▲	◆	◆	◆	●	◆	◆	◆	◆
Finland	▲	▲	▲	▲	▲	●	▲	▲	▲	▲	▲	●	▲	●	▲	▲	▲	▲	◆	▲	▲	▲
France	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	▲	▲	▲	▲	▲	◆	●	▲	▲	▲	▲
Germany	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	◆	▲	●	▲	▲	▲
Greece	▲	▲	▲	◆	▲	▲	▲	▲	▲	▲	..	◆	◆	▲	◆	▲	▲	◆	▲	▲	◆	◆
Hungary	◆	◆	◆	◆	◆	◆	◆	◆	◆	●	..	▲	▲	▲	▲	▲	▲	▲	▲	▲	◆	◆
Iceland	..	..	●	▲	..	▲	▲	●	●	..	..	●	◆	▲	●	▲	▲	▲	●	▲	▲	●
Ireland	▲	▲	▲	◆	●	●	▲	▲	●	▲	..	◆	▲	▲	●	▲	▲	●	▲	▲	▲	▲
Israel	..	●	◆	▲	..	◆	..	●	▲	◆	..	..	▲	◆	▲	▲	◆	▲	◆	●	◆	◆
Italy	▲	▲	◆	▲	▲	▲	▲	●	▲	▲	▲	◆	◆	▲	◆	▲	◆	▲	▲	▲	▲	◆
Japan	▲	▲	▲	▲	▲	▲	▲	●	◆	..	◆	▲	▲	●	▲	▲	▲	▲	●	●	▲	●
Korea	▲	▲	▲	●	▲	▲	◆	▲	◆	..	▲	..	..	●	◆	▲	●	◆	▲	▲	▲	▲
Luxembourg	●	●	▲	▲	●	●	▲	▲	▲	▲	..	◆	▲	◆	▲	●	▲	●	▲	▲	▲	▲
Mexico	◆	◆	▲	●	..	..	◆	◆	..	◆	..	..	◆	◆	▲	◆	▲	◆	◆	◆	▲	▲
Netherlands	▲	▲	●	▲	●	●	●	▲	▲	●	..	▲	▲	●	▲	▲	▲	◆	▲	▲	●	●
New Zealand	▲	..	●	●	..	●	..	▲	●	◆	..	▲	▲	●	●	▲	●	●	▲	▲	▲	▲
Norway	●	◆	●	●	▲	●	▲	▲	▲	●	●	..	▲	▲	▲	▲	▲	▲	●	▲	●	●
Poland	◆	◆	◆	▲	◆	◆	▲	◆	▲	▲	◆	▲	●	▲	▲	◆	●	◆	▲	●	◆	▲
Portugal	▲	▲	▲	◆	◆	▲	▲	▲	◆	▲	▲	▲	◆	▲	◆	▲	▲	▲	▲	◆	◆	◆
Slovak Republic	◆	◆	◆	◆	◆	▲	▲	◆	◆	▲	..	▲	●	◆	▲	◆	▲	▲	▲	▲	▲	▲
Slovenia	▲	▲	▲	▲	..	◆	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	▲	●	▲	▲	▲
Spain	▲	▲	◆	◆	▲	●	●	●	▲	▲	▲	◆	◆	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▲	▲	●	▲	▲	▲	●	▲	▲	●	▲	●	▲	▲	●	▲	●	●	▲	◆	●	●
Switzerland	▲	●	●	▲	●	▲	▲	●	●	▲	..	●	●	▲	▲	◆	▲	▲	●	▲	●	▲
Turkey	..	..	◆	▲	..	▲	◆	◆	▲	◆	..	◆	◆	◆	◆	●	▲	◆	◆	◆	◆	◆
United Kingdom	▲	●	▲	▲	▲	▲	▲	▲	▲	◆	▲	▲	▲	▲	▲	◆	●	●	▲	●	▲	●
United States	●	●	▲	▲	●	..	●	▲	●	◆	▲	▲	●	▲	▲	●	▲	▲	◆	●	▲	▲

Note: In this table the indicator "Dwelling with basic facilities" considers only data referring to dwellings without indoor flushing toilet.

Source: OECD's calculations based on the indicators shown in this publication.

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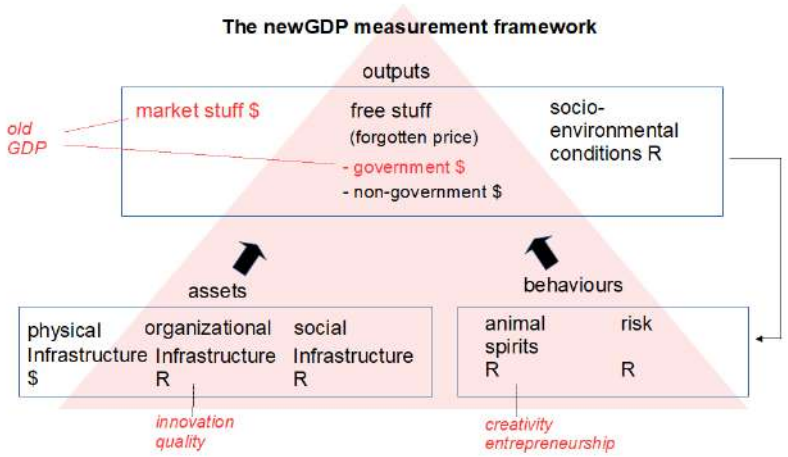
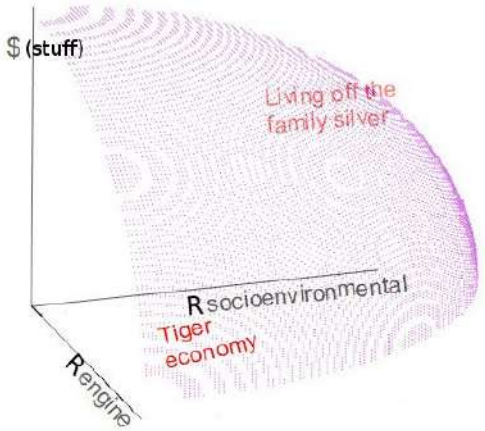
This leads to a revised model for newGDP, whose components are measurable either in money terms ($) or as indices (R) .



The output of the economy is measured by three $ output together with socioenvironmental conditions as a rating R(socio). The economy's engine is measured by assets and behaviours to give a rating R(engine).

These three newGDP measures provide a rounded view of economic performance. ●



THE SUCCESS OF NATIONS

TOWARDS A DYNAMIC MEASURE OF INNOVATION FOR THE 21ST CENTURY

JACOB ASSA

Jacob Assa holds a Ph.D. in economics (2015) from the New School for Social Research. He is currently a Policy Specialist with the U.N. Development Programme, where he contributes to the Human Development Report. Previously he worked as economic affairs officer and statistician for the U.N.

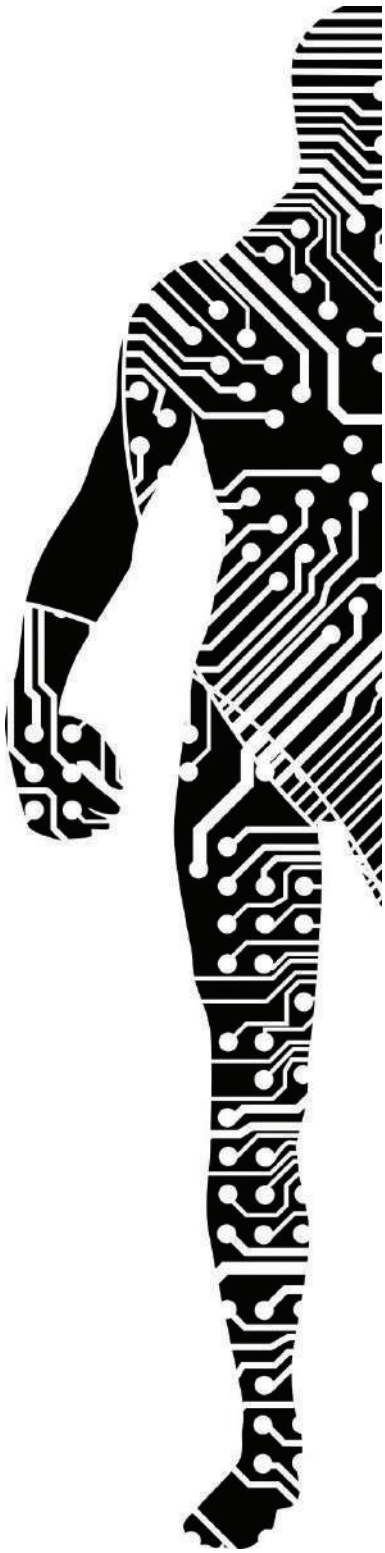
Measures of economic performance such as Gross Domestic Product (GDP) have not kept pace with recent innovations in science, technology and knowledge-related industries. This essay applies principal component analysis to data from the Global Innovation Index (GII) and constructs a Dynamic Measure of Innovation (DMI), deriving weights from the variation in the data itself. The resulting scores and rankings for 127 countries are compared to those in the GII, the Indigo Score and income per capita, with a view to understanding what drives the results in each case. Implications for policy as well as official statistics are discussed in the conclusion.

Over the course of nearly three centuries, measurements of national economic performance have tracked various sources of income as economic activity evolved from agricultural production to manufacturing and then heavy industry. Overall, the changing structure and content of the estimates reflected many innovations and economic transformations resulting from the first and second industrial revolutions (occurring in the late 18th century and early 20th century, respectively).

By the mid-20th century, the construct of Gross Domestic Product (GDP), a key aggregate of national accounting, had taken centre place as a measure of economic activity. However, even judged narrowly as indicators of economic performance, official statistics in general and GDP in particular have not caught up with the latest cutting-edge developments, including those of the third industrial revolution. Areas of high-technology and productivity such as nanotechnology, 3D printing, and robotics – to name just a few – are still not fully reflected in GDP at this time.

Beyond the realm of national accounting, several composite indices have been recently compiled which focus on innovation and the necessary conditions for its development – a key factor for success in the 21st century. The Indigo Score (IS) looks at a broad range of socio-economic infrastructure with a view to assessing countries' competitiveness and growth potential in the new economy. The Global Innovation Index (GII) likewise includes measures of innovation inputs and outputs.

Both the IS and the GII constitute a step forward in the right direction, in that they include important new elements of modern innovative economies. Both go beyond GDP in covering legal and political institutions, infrastructure and technology, and innovation and creativity. However, unlike the national accounting framework from which GDP is derived, neither the IS nor the GII has a clear theoretical structure or conceptual method for determining the relative importance of their components. In GDP, the income and product accounts are arranged largely around the Keynesian components of aggregate demand, and each component is weighted by the appropriate price index (e.g. expenditures on housing services are weighted by an index of housing prices in deriving real GDP).



By contrast, many composite indices such as the GII and IS use equal weights, on the assumption that these are neutral and thus avoid giving à priori special preference to one component over the other. This is also the case with the Human Development Index (HDI) of the United Nations Development Programme (UNDP) – comprising only four indicators – as well as the Sustainable Development Index recently published by the Bertelsmann Foundation and the Sustainable Development Solutions Network – summarizing 99 of the 232 official SDG indicators for which data are available (Sachs et. al. 2017).

THE TYRANNY OF EQUAL WEIGHTS

The idea of neutrality implicit in the use of equal weights to construct composite indices is widespread, as the compilers of such measures consider it an act of humility to recuse themselves from having to evaluate the relative importance of sub-component indicators. While this approach may have virtue in principle, it is both wrong and misleading.

There are several problems with using equal weights to construct a composite indicator. First and foremost, while some may believe they are making no assumptions regarding the importance of the underlying indicators, they are in fact implicitly assuming that all are equally important, often without empirical research to examine whether this is true or not. Second, in the case of indices summarising many indicators, the use of equal weights results in an index comprising many equally unimportant components. The SDG index, for example, gives each of its 99 constituent indicators a weight of merely 1.01% of the total score. Thus, a change in any of these underlying indicators, even a doubling of an indicator score – in itself a significant rate of progress (or decline) for that indicator – would have a total effect of merely a 1% change in the overall index score. In technical terms, the marginal effect of component indicators when using equal weights in a large dataset is negligible.

Third, and most importantly for the purposes of measuring innovation, the use of equal weights results in a static measure, assessing the phenomena under analysis identically every year, as if the world remains the same forever. This may be a useful approximation in the case of the HDI, since human development looks at the long-term evolution of variables such as life expectancy and mean years of education, and these phenomena do not change very quickly. To apply the same logic to the fast-changing realms of innovation, technology and creativity is akin to making a movie by pasting together several still images in a row.

LETTING THE DATA SPEAK FOR THEMSELVES

The Trade and Development Index (TDI) of the United Nations Conference on Trade and Development (UNCTAD 2005 and 2007) is a good model to follow in this case. It applied the statistical method of principal component analysis (PCA), resulting in a reduction in the dimensions of the data from 29 indicators to 11 independent components, each weighted by the proportion of overall variance between countries it explains. The dynamic nature of this methodology lies in the fact that in each period, different weights would arise out of the data, ex post, rather than determined ex ante based on the presumed theoretical or political importance of different dimensions. This is a particularly valuable property for an index of

innovation and creativity, given that these phenomena are ever-changing, with technology and science progressing faster than ever before.

> Performance in the age of technology and innovation involves the pursuit of new creative, technological and knowledge-related advances.

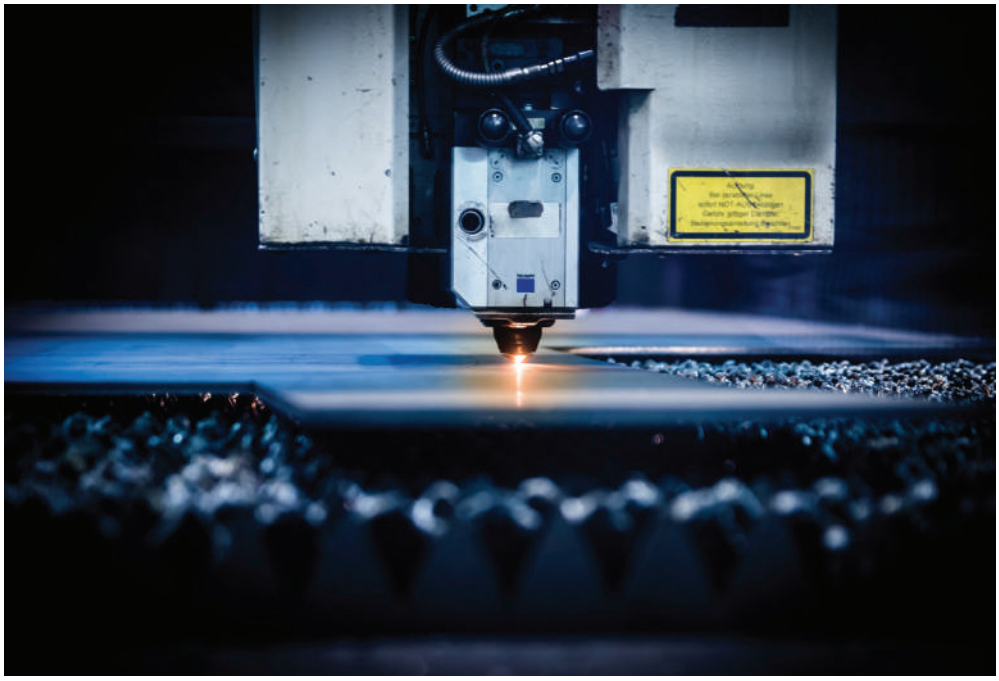
Applying PCA to the 44 indicators in the GII which have data for at least 90% of countries resulted in 10 components which cumulatively explain 80% of the variance. Their weighted sum is a composite index which can be referred to as a Dynamic Measure of Innovation or DMI. It is dynamic precisely because the relative importance of the components and sub-components comes from the data, and could be different every year, reflecting the ever-evolving nature of innovation, creativity and technology.

RANKINGS AND SOURCES OF SUCCESS

At the very top, five countries have higher rankings in DMI than in GII – the Netherlands, Singapore, the U.K., Germany and Japan. By contrast, Switzerland, Sweden and the U.S. are ranked somewhat lower under DMI. What explains this relative change of position?

Whereas the GII gives equal weights to indicators such as logistics and patent applications, the DMI has a weight of 4.2% for the former 3.3% for the latter. As Switzerland ranks higher than the Netherlands in patents but lower in logistics scores, the change in relative weights caused them to switch places (first and third ranks, respectively). A more dramatic example is the increased weight of the ease with which insolvencies can be resolved. In DMI it is 4.1% of the total, where in GII it was merely one of 81 equally less important indicators (a weight of around 1.2%). Switzerland's relatively low score in this area has also contributed to its descent from first to third rank overall.

The United States ranked fourth on the GII but only seventh on the DMI. Traditional areas of US strength such as FDI outflows have a weight of only 0.8% in DMI, while areas the U.S. ranks lower than other countries in the top 10 include the now higher-weighted government effectiveness (4.7%), ICT use (4.6%) and logistics performance (4.2%).



CONCLUSION – INNOVATION IN THE CONTEXT OF OFFICIAL STATISTICS

The analysis above has argued that the determinants of economic success have shifted over time, and showed that performance in the age of technology and innovation involves the pursuit of new creative, technological and knowledge-related advances. The DMI constitutes a new measure of success for the 21st century, accounting for this dynamic cross-fertilization of domains, as well as their changing importance in a constantly-evolving economy and society.

How does the DMI fit within the universe of official statistics? First, most of the indicators used to construct the DMI come from official sources (either national or international), with the result that the index combines a standardised, internationally comparable dataset with an innovative method for measuring progress. Second, as these underlying indicators already exist and are regularly produced by national and international statistical systems, no additional reporting burden is created in constructing the DMI.

> The Dynamic Measure of Innovation Index constitutes a new measure of success for the 21st century.

Third, and most importantly, the juxtaposition shown above of traditional measures such as GNI per capita and more innovative indices such as the DMI is an example of how the latter can be utilized within the context of official statistics. Rather than supplanting GDP or GNI,

the DMI and other such measures could use these official aggregates as benchmarks against which to judge innovation and technical progress.

Recent years have seen the rise of not only new technologies and innovations but also of Big Data, often gathered in unprecedented quantitates from often unfamiliar sources. Beyond proposing a new possible indicator of the success of nations, this essay has put forward a path for striking a balance between the quality and standardisation of official statistics and the innovative needs of the future. ●

THINK BEYOND GDP TO MEASURE THE TRUE SUCCESS OF AN ECONOMY

GUS O'DONNELL
AND BRENT HOBERMAN

With turmoil at home and battles in Brussels ahead, it can be hard to feel positive about Britain's economic future. But we have one of the most creative, innovative and diverse economies on the planet. With solid policy decisions Britain can face the headwinds of globalisation and embrace the opportunities of our modern world. But getting policy decisions right rests on something crucial that Britain is getting badly wrong: measurement.

Our world-class universities, strong rule of law, and digital infrastructure let new businesses thrive. Our culture, arts and open spaces boost the wellbeing of our workforces and attract talent from overseas. But the conventional way in which we measure our economy — gross domestic product — fails to tell the full story about the new economic reality.

Leading thinkers such as Google's chief economist Hal Varian complain that GDP is a haphazard way of gauging the pulse of a nation. In the UK, for example, we measure the £4.8 billion worth of sales of our publishing industry but ignore the transfer of tens of thousands of times more information, which is shared for free, at the touch of a button.

Likewise, the impact of the gig economy, such as Uber's cars, Airbnb's hotels and the entertainment provided by Facebook and YouTube, are undervalued.

Given that we have so much information about our economic, social and creative lives, why do we allow such a blunt statistic to guide economic policy?

In our world of big data, we can, and should, do better. So as we prepare for a future outside Europe, it is time to ask what our success or failure as a country will be based on. To what extent should we measure success not by the amount of activity in our economy but by the improvements in the quality of our lives that it provides?

We can hold ourselves to a better standard.

The Indigo Prize attempted to find a better means with which to measure the potential of our modern, tech-enabled, creative, innovative economies.

The UK can lead the world by measuring what matters. Perhaps it's time to count the things that truly reflect Britain's standing. ●

SYMBOLISM OF INDIGO

Rarely occurring in nature, its symbolism is shrouded in intrigue. The status of indigo as one of the colours of the rainbow is a point of contention: many argue that it does not belong on the spectrum at all, instead falling under the categories of one of its neighbours, blue or violet. The visual difficulty in differentiating its hue in the rainbow spectrum adds to its ambiguity, and supports the concept that it represents a mixing, meshing, and merging of two related, but different, ideas.

Traded since the fifteenth century and used to dye cloth, indigo has a rich history as a valuable commodity. It was imported in trade routes across continents via the Silk Road from India and traded for centuries, epitomising its role as a uniting force: in this case, that of East and West. Today, developments in dying technology mean that it can be produced artificially, making it ubiquitous in denim jeans. The tension between artificiality and authenticity, the manufactured form and the natural state, reinforces and reflects the new economic era into which we are entering, in the move away from the value of natural resources to that of innovation and creativity, driven by technology and man-made resources.

The colour indigo has also held a significant place in religious contexts. Christian art often depicts the Virgin Mary as clothed in a shade of blue. The colour indigo has been suggested as similar to the unidentified colour of techelet, the colour of the fringed robes worn by Ancient Israel's high priests in the Second Temple in Jerusalem. Intense debate surrounds what exactly the biblical text meant by this colour; many attest that it is similar to indigo, and the search for its alleged natural source, the chilazon snail, continues, adding to indigo's elusiveness.

Indigo as a personality trait is related to spiritual thought. People with indigo personalities are characterised as insightful, creative, resistant of authority and structure, and fiercely iconoclastic. This embodies a breaking of the norm, something that is highly reflective of the new era that we are entering into, one that lacks convention and is driven by innovation. ●

FROM THE INDIGO ERA TO THE INDIGO PRIZE

MIKHAIL FRIDMAN

Mikhail Fridman is an international businessman and entrepreneur. He is Co-Founder of LetterOne, a global investment business focused on the telecoms, technology, energy, health and retail sectors.

The Indigo Prize originates from an article I wrote last year titled 'The Indigo Era'. The main topic of the article focused on the changing world economy and global politics. Together with my colleagues we decided to establish the Indigo prize to explore a new measure of our modern economy. This debate about what quantifies success and innovation could prove to be very important, not just for our economies, but for the entire young generation. We need to ask how to appropriately measure the success of an economy, as well as the happiness and prosperity of people in society.

The existing model of measuring GDP is important, but isn't enough in our modern world. We have lots of examples of countries where GDP is very strong, but where society is not necessarily prepared for the challenges of the digital economy, quickly growing technological change, and the challenges posed by the likes of artificial intelligence and machine learning.

Many of the entrants focused on improving existing measures and statistics, while others approached the question from the completely opposite direction. Several suggestions focused on replacing GDP per capita with an individual's satisfaction with their quality of life, and multiply this to make a statistic from an individual's perspective.

The most important next step following the inaugural Indigo Prize is how to implement these ideas in real life; we need to understand how to measure quality of life and the ability of our countries to change and prosper in this new world, in quantifiable metrics.

On behalf of my partners, my colleagues, and fellow judges, I want to say thank you to all the participants and entrants. It was extremely interesting and our finalists were incredibly professional and brave. They have done a tremendous job.

I would like to extend my congratulations to all three winners. Their entries were each very different and they reflect different aspects of our modern economy. We will continue to further this conversation, and I look forward to these suggestions being useful to economists, academics, statisticians, business people, and society at large. ●