The making of information nations

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Purpose
The purpose of this paper is to identify the main characteristics of what have come to be called information nations, and to identify some of the determinants of success in becoming an information nation.

Design/methodology/approach
The paper is based on a critical review of the literature and of secondary data on information technology and services from studies of the innovativeness of nations.

Findings
Success in becoming an information nation is not necessarily closely connected with investments in information technology and services by firms and policies supporting these investments by governments, or with education policies designed to support the development of science, technology, engineering and mathematics. Other factors, such as the vibrancy of capitalism, particularly the funding of new ventures, the culture of the nation, and its focus on non-scientific determinants of innovation, such as design, are also important. Governments should be careful not to take credit for achievements when their policies are merely coincident with those achievements.

Research limitations/implications
The main limitations relate to the focus of this article on two sets of nations, South East/East Asia and two Western nations. The review of their performance is relatively high level and needs to be deepened, while the number of nations included in the research needs to be increased.

Practical implications
This article has substantial practical implications for government policy makers, in terms of whether and how they should make policy at all in this area, and for companies trying to establish a long-term position in the global economy, in terms of being careful not to go against the very strong economic forces which favour certain kinds of activities in certain countries.

Social implications
This article has significant social implications, because much of the thinking about developing information societies relies on generalisations about the creation of information nations that may not hold. Governments and social commentators are encouraged to approach the idea of making "big policies" in this area with some scepticism.

Originality/value
The content of this article is not original, but the challenge to policy makers is relatively original, as too often the work of academics is sponsored by governments that are trying to legitimate the value of their own efforts.

Keywords
Information and communications technology, digital, smart city, government policy, trade, investment

Introduction

This article provides a brief overview of some key developments in the internationally competitive positions of countries in relation to information and communications technology (ICT) supply and use. It concludes that governments could be more open-minded about their policies, in areas such as education and training, enterprise support and competition policy, and how they should be wary of trying to replicate successes that seem to be due to government policies but may be due to the operation of enterprise and free trade.

Definitions

The definitions used in this article are as follows:

- Data is the raw product of information technology. Perhaps its most elementary form is bits and bytes, electronic pulses or signals. However, there is a hierarchy of data, as it becomes more meaningful to the humans and (increasingly) machines that receive it. It is usually classified using metadata, which gives information about it and/or describes it in some way.
- Information is data combined in some way to give it meaning, for the humans or machines using it. There is no clear boundary between data and information.
- Content is information arranged to be meaningful to a given audience, whether arranged by the supplier or aggregator of the information or by the audience.
- Knowledge is what people know, and so produced as a result of receiving and/or combining information in frameworks, supplied by user of the knowledge, the supplier of information or some other party. Knowledge can be tacit or explicit, and this affects how well it can be transferred through information management.
- Information and communication technologies (ICT) are the hardware and software that generates, stores, processes, analyses, transmits and receives data and information and turns data into information and content. It ranges from elementary components e.g. memory chips, to sophisticated devices and software or combinations of them e.g. geospatial mapping.
- Information management covers how information is gathered, stored, transmitted, analysed and applied.
- Information and communications services are services provides by organisations and individuals to help users (government, organisations or individuals) to make use of ICT.
- An information society is one in which creating, distributing, use, integrating, transforming and managing information is an important economic, political, social and cultural activity.
- An information nation is one where creation and development of an information society and achievement of objectives relating to catching up with or leading other nations in the size and development of the ICT industries and the information society is a formal objective of government. This definition is created for this article, as there is no accepted definition of the term. This government focus started to appear in the 1980s and 1990s and has been intensified through globalisation and the rise of giant corporations in information technology or related businesses, with market capitalisations and/or revenues larger than the economies of many countries.

Issues in information management

Increased complexity

The collection, collation, analysis, accessing, managing, updating and disposing of data and information has become more complex because of its volume and the variety of its sources and of how is used. High volumes of information about organisations, individuals and assets are produced by, for example, social media, mobile devices and sensors. Storing and managing this data has posed problems, but the ICT industry has solved this problem by providing remote storage (cloud), improved access (mainly via web services), and by providing structures and facilities via which users can interact with information (platforms). Third party companies have emerged as aggregators of information and providers of access and analysis. These developments have been enabled by standards and cooperative developments e.g. Application Programming Interfaces (APIs), allowing suppliers to combine efforts. In some cases, opening of data by governments has improved matters.

APIs allow easy exchange of data and process across people, places, and systems. Organisations can combine many providers of the same service, to achieve resiliency, service choice, or regulatory compliance. This is globalisation of a new kind, as services are often hosted across the planet, for resiliency and performance reasons. It gives access to capabilities such as artificial intelligence, financial modelling, authentication, telephony, mapping, and printing. APIs allow any individual or firm to innovate by connecting with sources of data or capability. The existence of start-ups with open-source business models and the ready availability of source code through repositories provide many entry points to individuals and companies with little expertise in underlying technologies.

In many areas, new data sets are emerging, particularly at the interface between humans and systems, such as experiential data. Other areas of innovation include real-time data on the immediate status, direction of movement or humans or assets, and the relationship/context between these as information e.g. using graph analytics, but also how real-time new data can replace longer-term batch data (e.g. in customer information). Making sense of data and turning it into useful information has led to the use of the term "insight" - extracting answers to difficult questions or aggregating different data sets in new ways. With very large volumes of data, this can lead to not being able to develop insight because more big data may lead to reduced governance, quality, and validation.

Speed of new developments

New ICT systems continue to be developed quickly, partly based on progress at component level. New suppliers emerge to take large market shares quickly (as in cloud storage and information platforms). New companies emerge to exploit new capabilities, whether as aggregators or owners of data, providing new consumer and business services. New data sources emerge, stimulated by proliferation of and widening application of new devices, sensors, the Internet of Things, and social media. New ways of interfacing between data sets and new ideas about how to combine data and make it available emerge e.g. geospatial data, digital twins, but some die away as they turn out to be premature or infeasible (at all or at reasonable cost). Large suppliers of ICT proliferate their offers, and may take over smaller suppliers, to defend their businesses, but this does not prevent new suppliers emerging, particularly in new application areas.

Models of information management

In many industries, one or more "models" of information management and use are accepted as being good ways to manage information, though there may be big differences in how far along the road an organisation is to adoption of a model. Models may be general or relate to certain industries (e.g. financial services, retail, manufacturing, logistics, travel, leisure, pharma, utilities, telecommunication, media/ creative). The models may also relate to business functions, such as such as corporate/business planning, logistics and distribution, manufacturing, finance, sales and marketing, HR, their processes and how people can or should be managed within the functions. Articulation of models of best practice has been helped by emergence of information technology analysts, but full or relatively good use of these models is rare.

An example of model change is the evolution of many companies (whether suppliers of manufactured products or of services) to become providers of information services associated with the products they supply, part of what is called "servicization" of industry. Examples include suppliers of engines (whether static power supplies or mobile e.g. in transport equipment) providing information about their products' performance and need for maintenance, using sensors and communication devices to gather and transmit information about engine use and performance. This enables them to market performance-based contracts. The same can apply to services such as banking (the information being about how users use accounts, risks etc.).

Privacy and security

Privacy is the right of citizens and organisations to keep information about themselves and their activities away from public or state scrutiny. Secrecy is keeping such information private when people might plausibly be entitled to know it and are being prevented from accessing it. As information societies and nations develop, concerns about both these areas increase, becoming a strong focus for legislation, regulation and

the activities of police and other security forces. Open source software and the ease of acquiring information management capabilities that were once only been available to large organisations have made it easy for anyone to acquire and use data. Large organisations and most governments have formal guidelines concerning legal and ethical behaviour regarding data, but individuals usually do not, so individuals can pose as much of a threat to privacy and information security. Ease of access to information and systems has increased "dark side" problems, such as fraud and data breach (Verizon, 2019).

Managing ICT

There are many uncertainties in ICT systems development and management, and this has led to a strong focus on how to manage systems projects better, how to quantify the benefits and costs of the projects, how to ensure the projects achieve their objectives in terms of providing new or changed capabilities, and thence how to ensure that the planned benefits are realised. Where new developments are concerned, quantification of costs or benefits can be difficult and effectively subjective, particularly if planned outcomes include new types of information, new ways of doing things and new products or services. For this reason, the "test and learn" approach is often deployed, but this may not be possible for major projects, especially infrastructural ones, or ones requiring very long-term commitments of resources. However, there is no magic recipe for managing change. Big centralized projects have high failure risks, and the same applies to government initiatives whether they are single IT projects or large-scale interventions in industry, and whether the government is acting as the project manager or as the customer (Dwivedi *et al.,* 2015).

Legacy environments (e.g. in government and large corporations) require systems of record, usually developed using traditional waterfall approaches. Their features are fairly static. They are hard to modify and often deeply embedded in an organisation's process and fabric. However, organisations must also respond to changing needs, e.g. to manage external change, so new systems may be needed, sometimes relying on external information sources. Development cycles are rapid, often in weeks, days, or hours and deployment is at the organisation's boundary, using mobile devices or API services. The agile approach can help combine the maturity, compliance, trust and resilience of legacy systems with newer technologies.

As companies need to combine management of high and increasing volumes of information and to manage new developments and applications, there has been a strong focus on the resources required to achieve success in both these areas, particularly given the failure rate of ITC projects (Dwivedi *et al.,* 2015). This has led to the emergence of new approaches to project management ("agile" versus "waterfall") and the idea of "dev-ops", software development practices combining development of new systems with improving existing ones. This is an aspect of "organisational ambidexterity" - the ability to combine managing current operations while exploring new opportunities, which is related to the idea of dynamic capabilities – an organisation's ability to change to address new opportunities, business models etc. The view of organisations as sets of resources deployed to achieve objectives, especially competitive advantage (the "resource-based view) leads to seeing the firm as a flexible entity which can acquire or exploit resources in different ways. ICT developments facilitate cooperation between organisations. The resources available to a firm through outsourcing are almost infinite, provided it can pay for them, though outsourcing has its own problems of learning to manage client/supplier relationships, changes in required roles, skills and competencies and the ability to manage these, especially where requirements are changing. However, the reliability and stability of arrangements between organisations and the quality of information generated and transferred within them or between them, is a significant issue, which must be managed from the beginning of any project, development, arrangement or whatever is under consideration.

Information in value chains of economies, societies, governments, organisations and individuals

The value chain concept focuses on value added by inputs. Part of value chain analysis is separating inputs or activities which add value directly e.g. logistics taking a wanted product from where it is made to where it is demanded, manufacturing transforming materials and components into finished products, from support activities e.g. human resources. However, this separation is rarely absolute. For example, a human resource

activity which leads to the injection of critical sales skills, without which the organisation could not sell, is making a direct contribution.

Information contributes directly and indirectly. It helps run operations better, and to plan and monitor activities. Better information can lead to more efficient value-adding, whether through better operations or lower overheads. It can also lead to and be part of the adoption of new business models (Parnell *et al.,* 2018), a point which also applies to smaller firms (Faghih *et al.,* 2018), or the abandonment of uneconomic ones. In making investment decisions relating to information, it makes sense to identify how improved or additional information leads to better value-added, at what stage in the value chain, and whether estimates of improved value-added are realistic.

Competitive forces in markets and industries relating to information

In the private sector, the classic forces of competition include strong incentives for companies to monopolise (or at least restrict competition) and monetise information sources and capabilities. So, while the competitive forces of creative destruction are visible in many industries that are intense users or providers of information, so are the forces of monopoly and restraint of competition. However, the nature of monopolisation has changed, with a strong emphasis on attracting and retaining customers and making the offer to them so attractive that they are unwilling to consider alternative offers. Their willingness may change e.g. Facebook losing trust and many of their customers due to evidence regarding illegal use of personal data and allegations about complicity in election rigging (Weisbaum, 2018), despite being a vital source of information and connection to friends, brands etc., and an alternate authentication mechanism for other services (e.g. log in with Facebook ID). Also, companies (and nations) may also in "co-petitive" relationships, with companies that are natural competitors partnering within well-defined boundaries.

Ecosystems for information generation and management and how they evolve

One feature of how information management has evolved is development of whole ecosystems of customers, suppliers and business/information intermediaries. Awareness of the importance of ecosystems and of keeping them open to encourage competition and creativity has contributed to the success of many new players, whose explicit agenda often includes development of a large ecosystem and clear establishment of their own role as ecosystem leader and sometimes its (tight or loose) controller.

More about companies in information nations

An information nation constitutes two main elements, suppliers of information and information technology (products and services) and users. The suppliers may constitute a mature super-ecosystem of many different types of supplier, large and small, or several ecosystems focusing on certain product or service areas, each dominated by one or two large firms, with many complex business-to-business relationships within and between ecosystems. This is typical of larger and/or most developed economies. Or there may only be a few ICT ecosystems in the economy centred on few very large firms. This is typical of smaller countries or emerging nations. Users range from private individuals to firms and governments. In some cases, users are also suppliers, and today that can even apply to consumers, who are important suppliers of information through social media, and of software through private app development. Ecosystems can and do overlap.

The position of a nation as a supplier and as a user may not be closely related but often is. For example, Hong Kong is primarily a user of ICT but a big supplier of the data used to manage trade between China and the rest of the world. Some are suppliers of a relatively narrow ICT range e.g. Taiwan - semiconductors and laptops, Sweden and Finland – telecommunications (Ericsson and Nokia respectively). Sweden is an exception in the Nordics, where in most countries the giant exporting users dominate – A P Moeller-Maersk (logistics) in Denmark, Equinor (oil) in Norway, Volvo (commercial vehicles) in Sweden and Nordea (financial services) in Finland. Even some quite large countries are primarily users – both industrial and private e.g. the oil states of the Middle East. UK is not a big supplier of hardware, but of information and communication services (Bell Microsystems, Vodafone, BAE Systems), with some very advanced users (e.g. Sky TV). France is

a big ICT supplier (e.g. Orange, Schneider), but its utilities, retailers, manufacturers, financial services, construction, transport, and general (often municipal) services companies are advanced users. Germany is the home of many of software and automotive/consumer electronics and information-based manufacturing and service companies (e.g. AEG, Braun, Grundig, SAP, Siemens, Tandberg), but its giants in similar sectors to France are advanced users. Spain is like France in terms of users, with Telefonica being a major supplier and exporter of telecommunications services, and specific strengths in air transport, being the home of Amadeus airline booking systems and now the registered office though not the operating headquarters of the International Airlines Group, which owns British Airways, Iberia, Vueling and Aer Lingus. Except for Dell, and Intel, US is dominated by software (e.g. Oracle, Salesforce, Microsoft), information services (IBM), and mobile devices (Apple).

Large ICT companies challenge the definition of nation. They are "footloose" and can locate facilities - headquarters, development, production and service operations - in almost any country, although some services businesses must locate workforces in countries they serve. India has shown that where these services are software/applications developments for clients, or customer service, they can be in the home country. China and India show that with massive populations, many ICT companies' main activity is supplying domestic users. Ireland has many ICT companies' financial headquarters, due mainly to favourable corporate taxes, and the availability of skilled personnel, so Ireland is the world's second largest exporter of IT products and services, with large firms with a strong presence in Ireland nearly all US – Amazon, AirBnB, Apple, eBay, Facebook, Google, HP, IBM, Intel, Microsoft, PayPal and Twitter. Activity in Ireland includes product work (software development, product customisation, software testing) and downstream activities such as e-learning and fulfilment. However, Ireland's position exists by virtue of the EU allowing a veto for unharmonized tax policy. When this ends (Barker, 2019), Ireland will lose its advantage.

The focus on information in the management of economies and societies

The change in focus

ICT's impact on whole economies and societies takes three main forms. The first is improving efficiency, effectiveness, value-added and (in the case of citizens) happiness and well-being, the second is through how governments (national, regional and local) can manage countries, the third through size and nature of ICT companies' activities. Sometimes, these aspects merge e.g. as in the idea of smart cities. The main interest of the government is overall performance, though where one or two companies dominate in a sector or economy, governments may take their interests into account. This is not always best. For example, smart city experiments designed partly by ICT companies may not meet citizens' needs (Stone *et al.,* 2018). However, in future these may be seen to have brought together different suppliers and users as a "great experiment" that laid the foundations of future modern cities.

Economic aspects of information nations

In government policies towards ICT, several angles can be seen. They include:

- Information technology as a technical activity, from components to hardware, software and services.
- Information as an input into general commercial processes, which relates to policy about information infrastructures e.g. broadband provision.
- Information as a natural and easily accessible, possibly open artefact of governmental activity.
- Information as an input into competitiveness and governance of industries and the nation, which leads, for example, to a focus on opening of information about companies, markets and government activities.
- Information as a critical element of a country's main industries (e.g. financial services, international trade, construction) or value-adding activities (e.g. innovation, design, marketing), which leads to a focus on information generation and management skills and resources and their availability of resources to the companies that need them.
- Information as a business activity for certain organisations, which leads to a focus on stimulating information businesses, particularly where exporting activities are concerned.
- Information as a consumption good, particularly for industries like media and telecommunications.

- Information heling improve outcomes for citizens, employers etc. e.g. in smart cities.
- Information as a contributor to the nation's business model(s) – how a nation does and will make its way in the world, and to its brand(s) - how the nation is perceived in different.
- Information as a support or focus for international or multinational cooperation.

In many of the above, governments have learned that they should focus not just on supply but also on demand, for example, whether skills or information sources are used. They may also be aware of what we call the information multiplier – information begets more information directly because value is added to it (for example, aggregators combining information from several sources and repackaging as new information), often through ecosystem activities, and what we call the information accelerator – information allows more of certain activities which are not primarily ones of information generation and management e.g. innovation, trade, and they in turn lead to increased supply and demand for information.

Given the permeability of international boundaries to information flows and the low or absent tariff barriers that apply to most information technology products and services, there is interest in the relationship between international trade in services and information-related activities. The strong relationship between a mature information industry and governance is also accepted, although in some cases this can be derailed by unethical behaviour of players or indeed intervention from outside.

As the boundaries between firms become more permeable, so they have between nations, with companies in different countries functioning as part of each other's supply chains. However, this means that companies can switch suppliers relatively quickly, including between suppliers in different nations. Losing control of one's position in global supply chains is a risk, added to the risk posed by political attitudes, for example, towards globalisation, climate change, or trade balances.

A social and cultural view of information nations

Information is a cultural and social asset, and information management activities, by individuals, organisations or governments, are part of social and cultural activity. Information is an asset for the world (the original vision of the web and the Internet) and the basis for development of individuals and countries. It is the basis for individual national cultures, particularly when used as a vehicle or bearer of culture (e.g. the Korean Wave) or even cultural imperialism (e.g. the so-called West Coast view of the world).

Part of a culture is how it relates to the generation and use of information and knowledge, including issues of trust and privacy, and what non-experts think about these topics, and how they talk about it with similar people (the word of mouth). The pervasiveness of approaches which require citizens to give lots of data about themselves to benefit from services supplied by users of information is changing people's views (Pingitore *et al.,* 2017). The vulnerability of apparently secure systems to invasion with evil intent is likely to continue causing concern of individuals, particularly in countries where such behaviour is seen as a threat to political freedom.

Competitive aspects of information nations

The extent to which a nation's economic success depends on information varies, as does the type of information which drives competitive success. The strength of industries that generate and use information and provide information technology and services in Western economies has led to a strong focus in other economies on what is called "catching up". The initial make-up of an economy makes a difference, but the speed with which transformation is possible is impressive (decades rather than centuries). For nations starting on the road to becoming an information nation, the initial make-up of the economy (industries and markets) and balance between sectors (manufacturing, business/consumer services, extraction/agriculture) has a big influence. The effect of the transitions is visible in the structure of their exports and imports. The smaller the nation, the more acute the transition.

What governments and groups of governments try to do

The possible scope of potential government involvement in creating information nationhood includes

- The regulatory and business environment, particularly ease of creating companies, especially start-ups, and competition policy.
- Education – expenditure, level and focus.
- Research and development policy, particularly subsidies and other incentives, but also provision of facilities and government contracts.
- ICT access and use, including online government services.

The criteria for success of government policy in this area include:
- Measures of speed and access to broadband and mobile telephony and rate of use.
- Currency of systems that support government activities.
- Distribution and use of an ever-changing range of (BYOD) devices and expected user experiences.
- Overall size of IT industry and its parts, especially software and services.
- Measurers of formation and growth of ICT-related small and medium enterprises.
- Innovation indicators - R&D expenditure, patents, publications relating to ITC.
- Performance in educational comparisons, including of science, technology, engineering and mathematics (STEM) achievement in schools, particularly when supported by information technology.
- Number of ICT-trained people available – overall and in different areas of specialisation, and their take up into employment by the private sector, including absence or low rates of ICT skill shortages/vacancies.
- Inward migration of ICT qualified people and retention of all ICT qualified people (i.e. not outward migration).
- Exports and imports of ICT related products and services.
- Success in information intense industries such as financial services and media.
- The number and rate of success of flagship ICT projects e.g. smart cities, information quarters.

Some of these measures are of questionable importance e.g. STEM education, not related to the success of government policies, and in some cases if there are problems, they are resolved by the private sector, as in the case of ICT skills shortages (Kolding *et al*., 2018).

What government can and should do

One debate on the role of government in creating, stimulating and developing an information nation relates to extent of intervention, with views from the most extreme laissez-faire to dirigiste approaches. The laissez-faire approach broadly consists of letting the private sector do the job, interfering as little as possible, letting it set its standards for all aspects of information management, encouraging free trade with the word's best suppliers of information products and services, letting universities and other educational institutions spot training and educational opportunities, preventing state monopolies holding back development of the communications infrastructure, while ensuring that private monopolists do not hold things back either. At the other extreme is the dirigiste approach, favouring controlling and stimulating business formation, subsidising firms, a state-owned telecommunications infrastructure, funding and directly intervening in training, setting standards etc. Countries that see themselves as "catching up" often start as dirigistes.

Many governments focus strongly on digital delivery of services. This helps attract skilled individuals into government services and ensures that government systems and services reflect private industry sector practice. In some countries, the public sector is around 50% of economic activity, and so a large customer for information services. Here, governments may assume that their role is to become deeply involved in the planning and even provision of the information-intense services. This is a dirigiste approach. At the other extreme, laissez-faire proponents argue for "government as a platform", where government provides (ideally by contracting with private sector suppliers) information platforms that allow private sector suppliers to compete for and contract with citizens for public services (Brown *et al.,* 2017). In some countries, government weakness as a provider of integrated information, due to separate data sets and systems in different government departments, causes laissez-faire commentators to be sceptical about

government involvement, but the two issues are separate, with poor past performance often the result of years, even decades, of separate development, with integration not being an objective.

Case studies of national performance

Introduction

In this section we give a highly simplified overview of the information nation situation of several countries. We focus on two areas, South East Asia and the two Anglo-Saxon nations, the UK and the US. Space limits us from covering more, though we expect to carry out further evaluations. Some data for this analysis comes from the Global Innovation Index (Dutta *et al.,* 2019). Note that information nations succeed not just by innovating at the edge of technology, but also by secure, mature operational use of ITC – they need to be ambidextrous. They also need to have companies and government departments that can deliver significant change and avoid project failures.

SE Asia

China

China is several nations, with its sheer size making generalisations about it dangerous, in terms of per capita measures. It is certainly true that much of what it achieves, or does not achieve, is due to centrally-directed policy, and this includes recent problems of the West's suspicions about Chinese ICT enterprises being used to infiltrate the West and gather data. Its heavy investment in R&D, its patent record, the strength of its university work in ICT and all science and technology areas, are notable, as is its acquisition of ICT based companies and products from elsewhere (e.g. Lenovo's acquisition of products from IBM, and the acquisition of ICT analysts IDC). but for population reasons mentioned above, its per capita ratios relating to ICT access and use are weak. If the top performing 330 million population (the US population) of China were used as the basis for the per capita comparison, a very different story would emerge. No academic can be unaware of the enormous publication rate of Chinese science and technology academics. China's single-minded objective of using its size to focus investments on catching up with the US is clear.

China can afford policy failures, given the long-term nature of its portfolio (with careful selection of focus areas), including digital infrastructure aspects of the Belt and Road project and direct investments by Chinese companies and organisations. This contrasts with a shorter-term game being played by some (though not all) US competitors and no longer by the US government. Other interesting aspects include China's parallel Internet and government control of information. Their social credit system has profound implications for how people can travel, work and function.

Hong Kong

Hong Kong has experienced rapid deindustrialisation and is no longer cheap manufacturing centre, but a trading and design hub for China, especially for the Pearl River Basin, with which it has linguistic commonality. Its well developed, free and open economy trading environment means that resources move rapidly into profitable areas, i.e. not into developing general ICT, but into support of trade with China. Its information expertise is in Chinese sources and sources for what China needs, and in demand for Chinese products from the rest of the world. Hong Kong needs the ICT to support this, so it is a big user of trading software, whether for goods, services or financial trading.

Its high achievement levels in education provides the skills needed for ICT-based trading. This is supported by high levels of ICT access and use and strength, which is also visible in high levels of mobile app creation – sign of a vibrant digital population. Recent initiatives to "re-industrialise" Hong Kong may be misplaced and perhaps based on mistaken learning about countries that have completely or partly "caught up" (Korea, Singapore or Taiwan). Hong Kong's role as the trading centre for China has a very good long term future.

India

Some of the above comments regarding China concerning size apply here – per capita ratios are misleading. India has mastered the challenge of services, being top-ranked in the global innovation index for ICT services

exports as a percentage of its total trade. It also scores well for online government service and for a country at its stage of development, for e-participation. Educationally it performs well (and has always done on this indicator) with many graduates in science and engineering. India has what may be seen as the advantage over China of a broadly capitalist approach to ICT, and in the long term, coupled with its linguistic advantage, cultural links with the west, ties to large expatriate populations, and a faster growing population, may prove to be a strong rival to China.

Japan

Japan in the 1980s and 1990s mesmerised the West as the home of unbeatable consumer and small business-targeted electronics, mechatronics and engineering - calculators, cameras, copiers, motorbikes, then cars, construction equipment, transport equipment and so on (Stone, 1984). Today, as its population ages rapidly, it suffers from severe competition from its Asian neighbours, to many of whom it exported its production. Now it must to consider itself as "caught-up with" in many areas (though not in areas such as automotive, advanced/robotic construction and manufacturing equipment, and some science-based industries such as pharmaceuticals) and trying to find a new way.

It is still a world leader on many ICT indicators, whether of creation or use. The same applies to educational indicators. To sustain its high level of income per head it must focus on high value-added activities, which it has done in many science and engineering categories, but in ICT these involve software and services, where it performs less well, as shown by its low level of ICT services exports and poor performance in knowledge diffusion. So the long-term future of Japan is slightly in doubt, as it may not have a secure focus for success.

Korea

Korea has succeeded in producing what the world wants. The success of Samsung, LG and others is due not just to being competitive in ICT products, but for emphasis on design that coincided with, but was not caused by the Korean government's focus. The relationship was symbiotic. For example, Samsung's success (and commitment to a big in-house design team) demonstrated to Korean industry that a customer-oriented design process was as important as being a leader in ICT, whether in consumer or industrial markets. The Korean Wave, a cultural phenomenon which spread through SE Asia, helped in terms of familiarising export markets with Korean products and services.

All this is supported by excellence in technical education and strength in knowledge work, a leading position in R&D and patents and in ICT access, use, e-participation and government e-services. Its weakness, if any, is less success in ICT services or advanced rather than commodity semiconductors, so if other countries can emulate its design and culturally led approach, it may prove vulnerable.

Taiwan

Taiwan specialises in hardware – mainly laptops and components, and in the latter case, semiconductors. It is one of the world's largest semiconductor manufacturers, led by the Taiwan Semiconductor Manufacturing Company (TSMC). However, it differs from Korea in that its success is not just due to large companies. Its vibrant small business sector plays a critical role in semiconductor successes, with many small companies quick to move to meet customer needs. This is critical as devices become more sophisticated and specialised, so Taiwan's lead, shared with the US, is unlikely to be challenged, particularly given the US's political commitment to Taiwan. Taiwan is a very large importer of US semiconductor manufacturing machines, exporting much of its resulting output to the US, but also to China, where it is incorporated in rapidly growing volumes of Chinese ICT products. China's own successes in this area are not insignificant, and the Chinese government tries to share in Taiwan's success by hiring away its scientists and engineers.

Singapore

Singapore has succeeded in building enabling capabilities for ICT success, specifically school and university education, R&D, the number of researchers and knowledge intensive jobs, ICT access, the government's online service, the openness of the economy, and joint ventures with overseas companies. Its stable political and social environment are attractive to Western and other companies wanting to establish manufacturing

facilities there. However, its focus is on playing a small part in large supply chains, hence the number of pure-play manufacturing plants making components for Western companies (e.g. hard disk drives).

Lack of focus on its own innovations is visible in weak performance (given its highly trained and educated workforce) in knowledge creation and ICT services exports, as well as in creative output, so it is vulnerable to changes in global supply chains. The government has recognised this and ascribes it partly to the education system's focus away from the creative and on more methodical aspects of STEM disciplines, which it aims to rectify (The Economist, 2018). Until it moves in the Korean direction, it remains vulnerable to changes in global supply chains, although its strength as a strongly private sector trading nation (like Hong Kong) is likely to help it cope with any challenges that these changes might pose.

The Anglo Saxons

US

The US still leads the world in ICT, due to the dominance of software, platform and media companies such as Amazon (and particularly Amazon Web Services), Adobe, Alphabet (Google) Apple, Cisco, Facebook, Hewlett Packard, IBM, Intel, Microsoft, Netflix, Oracle, Salesforce, and many others. Their presence and activities in other countries influence global statistics, e.g. the Irish example quoted above. Only Samsung in Korea and TenCent in China make it into the top 10 technology companies (Ponciano, 2019).

The US stimulates foundation of new companies focused on new ICT opportunity areas and encourages them to grow rapidly to dominate their markets and move into new markets. Some of the best brains from the best US universities focus on creating enterprise and wealth. The rest of the world tries to emulate this, but with little success. The dynamic nature of US capitalism and the resistance to central government initiatives mean that there is no state recipe to be followed by other countries, but enormous defence expenditure helps. Another factor is the dominance and/or size of US companies in other sectors such as aerospace, automotive, chemicals, retailing, financial services, grocery products, pharmaceuticals and other industries and their role as customers for large ICT companies. The sheer wealth of the nation makes consumers ideal customers for expensive variants of any kind of ICT e.g. Apple.

UK

The UK is mixed, with strengths in terms of the ICT access and use, knowledge creation and creativity. It is one of the developed economies with the highest level of services and service exports, so although ICT services exports are strong, they are not as large a percentage of service exports as might be expected. The UK supplements reasonably strong education efforts by attracting migrants to work in its digital industries, particularly though not solely in London, often in the offices of the US digital giants or in their ecosystems.

Although UK governments have has set up many ICT initiatives, the reasons for the UK's relative success may include early privatisation of the state telecommunications company, introduction of competition and the UK's strong focus on creative and design industries. Few UK government initiatives to stimulate ICT-based innovation in SMEs have paid off in terms of new companies or provision of new services, because this funding is rarely focused on scalability of innovations and partnering with giants that could deliver at scale. However, initiatives by state agencies of various kinds have had a positive effect. Examples include the digital relationship between the Passport Office and the Driver and Vehicle Licensing Office and the smartening of London's transport information and ticketing systems by Transport for London, including creating and opening access to the London Data Store (Stone and Aravopoulou, 2018). These successes are being matched by digitalisation of areas such as voter registration and tax collection. In many cases, the government agencies concerned have focused on innovativeness in service delivery and are seen by some as examples of how to move to a different model of agency delivery (whether publicly or privately owned) (Brown *et al.,* 2017).

Conclusions and recommendations

Conclusions

In this article, we examined the idea of the information nation, the complex ways in which ICT contributes to it, and how this works in several countries. The conclusion is that there is no simple recipe for success, but there are several business models – leadership by design and culture (Korea), leadership by energy and flexibility (Taiwan), leadership by massed resources (China), leadership by creativity (UK), leadership by services (India), leadership by enterprise culture and defence (the US), or leadership by advanced science (Japan). There may be other models. There are also two examples of countries where leadership is not (Hong Kong) or should not be (Singapore) by ICT development, but by ICT use. Smart cities, smart government policies, and smart health, and other smart initiatives play a big role in crystallising the user side of information nations and focusing on raising performance.

Recommendations

Because there is no single model of an information nation, a country aiming to catch up with leading countries must first examine its own strengths, in terms of the capabilities of its companies, its citizens and its public servants, and identify what model of success is feasible and in what timescale. Different models are appropriate to different stages of development, though there may be common characteristics, for example, skills requirements rise, e.g. for artificial intelligence/machine learning engineers, or social factors e.g. people and organisations' willingness to use or supply information. Focus on the end user, whether a business or an individual, and how they use information and the products of ICT, is an essential part of any model.

Encouragement of the development of ecosystems is vital, and this does not require direct intervention by government, but rather acceptance that large companies developing their ecosystems might at time seem to be exploiting their local monopoly power. However, they are competing on the world stage, and this should be allowed for, as should the timescale taken to achieve benefits, the risks and the failures.

The cultural and creative aspects of becoming an information nation should be considered seriously. Information nations are not built on technology alone, but on a combination of technology, culture, aspiration, creativity, energy and finance. This should be recognised in educational provision.

The progress made by countries cited in this article has not been rapid – perhaps Korea is the fastest, although even here it has been a story of at least two decades. Countries should be clear about who their short- and long-term partners will be, and what conduct they should observe for the partnership to work. Japan created competitors from its partners. China is at risk in another way, by breaking trust - slightly curious because its internal business culture is based on trust. Cynical exploitation of customers in other parts of the world is a risk some US companies have taken too, and in a world of information nations, that is unforgivable.

References

Barker, A. (2019), "Brussels pushes to scrap national vetoes on taxation", available at: https://www.ft.com/content/65327b4e-173d-11e9-9e64-d150b3105d21 (accessed 27 August 2019).

Brown, A., Fishenden, J., Thompson, M. and Venters, W. (2017), "Appraising the impact and role of platform models and Government as a Platform (GaaP) in UK Government public service reform: Towards a Platform Assessment Framework (PAF)", *Government Information Quarterly*, Vol. 34 No. 2, pp. 167-182.

Dutta, S., Lanvin, B., and Wunsch-Vincent, S. (2018), "*The global innovation index 2019"*, available at: https://www.globalinnovationindex.org/gii-2019-report (accessed 27 August 2019).

Dwivedi, Y.K., Wastell, D., Laumer, S., Henriksen, H.Z., Myers, M.D., Bunker, D., Elbanna, A., Ravishankar, M.N. and Srivastava, S.C. (2015), "Research on information systems failures and successes: Status update and future directions", *Information Systems Frontiers*, Vol. 17 No. 1, pp. 143-157.

Faghih, N., Dastourian, B., Sajadi, S.M., Henten, A. and Foroudi, P. (2018), "A framework for business model with strategic innovation in ICT firms: the importance of information", *The Bottom Line*, Vol. 31 No. 1, pp.16-41.
Kolding, M., Sundblad, M., Alexa, J., Stone, M., Aravopoulou, E. and Evans, G. (2018), "Information management–a skills gap?, *The Bottom Line*, Vol. *31* No. 3/4, pp. 170-190.
Parnell, B., Stone, M. and Aravopoulou, E. (2018), "How leaders manage their business models using information", *The Bottom Line*, Vol. 31 No. 2, pp. 150-167.
Pingitore, G., Rao, V., Cavallaro, K., and Dwivedi, K. (2017*), "To share or not to share What consumers really think about sharing their personal information"*, available at: https://www2.deloitte.com/us/en/insights/industry/retail-distribution/sharing-personal-information-consumer-privacy-concerns.html.Accessed (accessed 27 August 2019).
Ponciano, J. (2019), "The Largest Technology Companies In 2019: Apple Reigns As Smartphones Slip And Cloud Services Thrive", available at: https://www.forbes.com/sites/jonathanponciano/2019/05/15/worlds-largest-tech-companies-2019/#6ba323a4734f (accessed 27 August 2019).
Stone, M. (1984), "Competing with Japan-The rules of the game", *Long Range Planning*, Vol. 17 No. 2, pp. 33-47.
Stone, M. and Aravopoulou, E. (2018), "Improving journeys by opening data: the case of transport for London (TfL)", *The Bottom Line*, Vol. 31 No. 1, pp. 2-15.
Stone, M., Knapper, J., Evans, G. and Aravopoulou, E., (2018), "Information management in the smart city*", The Bottom Line*, Vol. 31 No. 3/4, pp. 234-249.
Verizon. (2019), "Data Breach Report 2019", available at: https://enterprise.verizon.com/resources/reports/dbir/ (accessed 27 August 2019).
The Economist (2018), "It has the world's best schools, but Singapore wants better", available at: https://www.economist.com/asia/2018/08/30/it-has-the-worlds-best-schools-but-singapore-wants-better (accessed 27 August 2019).
Weisbaum, H. (2018). "Trust in Facebook has dropped by 66% since the Cambridge Analytica Scandal", available at: https://www.nbcnews.com/business/consumer/trust-facebook-has-dropped-51-percent-cambridge-analytica-scandal-n867011 (accessed 27 August 2019).