A Publication of Gulati Institute of Finance and Taxation

Kerala Economy

February - March 2021 Vol.2 No. 2 & 3

Special issue

Transforming Kerala to a Knowledge Economy

Edited by

K J Joseph
P V Unnikrishnan

GIFT GULATI INSTITUTE OF FINANCE AND TAXATION

KERALA ECONOMY

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Address
Gulati Institute of Finance and Taxation,
GIFT Campus, Chavadimukku,
Sreekariyam, Thiruvananthapuram, Kerala - 695017.
Phone : 0471 2596970, 2596980, 2590880, 2593960.

Email : keralaeconomy@gift.res.in

Printed and published by K J Joseph on behalf of Gulati Institute of Finance and Taxation, Thiruvananthapuram. Printed at Solar Offset, Manvila, Thiruvananthapuram. For private circulation. Not for sale.

Kerala Economy
Vol.2 No. 2&3, February-March, 2021

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Editorial

Harnessing global expert network

In the last issue of *Kerala Economy,* we articulated Kerala budget 2021-22 as a blueprint for a great leap forward given its focus on transforming Kerala to a Knowledge Economy. There is hardly any economy which is not knowledge based. However, a knowledge economy is different in the sense that it is based increasingly on knowledge-intensive activities, implying greater reliance on intellectual capital rather than physical inputs. Hence, unlike the traditional economy wherein land, labour, capital and organisation are considered basic factors of production, 'knowledge' is the key resource in a knowledge-based economy. The knowledge could be scientific which is often codified and an outcome organised scientific enquiries. In contrast to the scientific knowledge, there could be synthetic knowledge which is often experience based and remain tacit and uncodified.

If knowledge is the key resource, learning has to be the key process. Hence, the key challenges in transforming Kerala to a knowledge economy include; First, creating an institutional architecture that facilitates learning of individuals and organisations regardless of their economic and social status. Secondly, and more importantly, to ensure that all types of knowledge are fully utilised to guarantee an inclusive knowledge economy with shared prosperity. Kerala budget 2021-22 aimed at addressing these challenges through building the infrastructure for the knowledge economy, innovation system and facilitating the process of skilling, re-skilling and upskilling.

Addressing these challenges is easier said than done because the road ahead is rocky. Hence, Gulati Institute of Finance and Taxation (GIFT) organised an international consultation towards articulating the know-how of transforming Kerala to a knowledge economy by harnessing its unique characteristics. Jointly organised with GLOBELICS (an international network of innovation scholars; www.globelics.org), the consultation had the participation of the Chief Minister and Finance Minister of Kerala apart from senior policy makers and, technocrats. The deliberations and sharing of experience by the scholars of eminence from about 25 countries from Japan to Costa Rica was especially insightful.

This special issue of *Kerala Economy*, co-edited with Dr. P V Unnikrishnan, intends to present succinctly the outcome of the international consultation while full deliberation will be brought out as a book. The issue is broadly organised into three parts. It opens

with the addresses that set the context for the new vision for Kerala. The second part articulates the key pillars of the knowledge economy and the reflections from scholars of eminence followed by the last part highlights the way forward.

It is our hope that the readers will find it useful.

K J Joseph and P V Unnikrishnan

Part I - Knowledge Economy: setting the context

Democratizing digital space, prelude to transform Kerala to a knowledge economy

Pinarayi Vijayan

The government of Kerala has a vision and is committed to turn the same into a reality. Our vision is not a distant dream. But a time bound plan to realise the aims. We cannot wait long. Here and now we start our leap towards transforming Kerala into a knowledge economy. When we say this, it may appear to many that we are day dreaming or being Utopian. It is neither. We have a plan and we need suggestions and expertise to operationalize it. Our budget which was presented on January 15, 2021 had unveiled plans for transforming Kerala into a knowledge economy. When we say, Kerala has to become a destination for good quality higher education, if there are sceptics, they need to take a brief look at our history. They can see the pioneering efforts taken in making primary education universal. Our initiatives in the field of higher education have also a history of one and half centuries. We have initial comparative advantage like high literacy rates and basic technical skills in certain sectors. We need to start on this and build the base for a knowledge economy.

World is witnessing fast changes. Factories and assembling units, the face of the modern industry have given way to service sector and innovation induced production process. Internet and connectivity have brought about a sea change in the way we work and how work is being organised. One can stay connected and work in tandem with others from his home or any other place of his choice. Certain countries of the world have transformed themselves into knowledge economies and this knowledge diffused fast to other parts of the world. While saying this, I am not ignoring the inequalities of opportunities often called the digital divide, which impede the entry of many into the world of connectivity.

We fully appreciate the fact that the state has to provide the brick and mortar to build the bridge to cover the divide, which has closed the door of the digitalised world to many. The government of Kerala has recognised access to internet as a citizen's right and is committed to provide free internet to the poor and at affordable rate to others through our project called K-FONE. We recognise that democratizing the digital space is the first step to transform our state into a knowledge economy. We want to encourage research in new and sunrise areas and transform

them into innovations which will catalyse our economic growth. We propose to establish centres of excellence in various fields of learning and create an eco-system which will attract best of talents from all over the world. If we could achieve quality schooling, nothing can prevent us from upgrading the quality of our higher education and transform Kerala into a knowledge economy.

People who graduated from our institutions have become world famous. The list is long and I am not venturing into the exercise of citing names. The aim is to make Kerala a destination for quality higher education. I assure you that you have a government that cares for this. I look forward to your valuable suggestions in making our aim a reality in the shortest possible time. I am not elaborating any further. With utmost happiness I declare this meeting open. Thank you.

■

(Text of the speech delivered by Shri. Pinarayi Vijayan, Chief Minister of Kerala, while inaugurating the post budget international consultation on transforming Kerala to a knowledge economy.)

Transforming Kerala to a knowledge economy; a manifesto

T M Thomas Isaac

Most of you are familiar with the social sector achievements of Kerala which are very well known in development literature. Despite the relatively backward economic conditions, Kerala has been able to provide much better education, healthcare and social security for its citizens. These are comparable to developed countries rather than most parts of India and this has been achieved through a process of redistribution and public action. And this redistributive strategy of growth has ensured that the honorary citizen in the state is assured of the basic needs. This very proud heritage we want to take forward.

But there are problems. The economic base has remained relatively stagnant, slow growing and less productive. As a result, unemployment of the educated is the biggest developmental challenge faced by Kerala. The present employment schemes are inadequate to resolve unemployment of the educated. While the national level unemployment in the age group of 15 to 59 was 5.8 per cent in 2018-19, it was 10.4 per cent in Kerala. The main reason attributed to this is unemployment among women in Kerala. While the male unemployment rate in Kerala is 5.8 per cent, the female unemployment rate is as high as 19.1 per cent. It is shameful to note that while the labour participation rate of men is 73.5 per cent, that of women is only 28.5 per cent.

Therefore, there is always a concern whether this redistributive path could be sustained. Hence, there is an urgent need for a restructuring of the economic base and shift in the development path from low productivity. We must transform to a development path which is more in tune with the resource endowment of the state, both natural and human. Therefore, we have come to the conclusion that the most suitable industrial structure would be the one dominated by knowledge intensive activities.

It requires huge investment in the infrastructure, because for the last one century Kerala had focused on social sector spending. We are capital expenditure deficit. So, five years back we made a bold initiative to mobilize resources outside the budget through special purpose vehicle- Kerala Infrastructure Investment Fund Board (KIIFB)- that has led to unprecedented growth in the investment for building physical infrastructure. The

total amount would come to roughly half a trillion rupees.

We are attempting to do two major interventions; first one is to create the global job portal. Within this small state of Kerala, the total number educated unemployed, including women who are just forced to remain in the houses would come to 5 million. So, they will be skilled through intensive program of skilling and placed on this job portal trying to make an intervention in the new drift or shift in the labor market towards say working near home or working at home. Secondly, we would also want to promote knowledge industries within the state. So, we have a very big program of promoting innovation start-ups and knowledge industries. And the basis of all this would be restructuring of the higher education in Kerala, a very bold program to change the entire higher education sector.

The government aims to utilize all the possibilities created by work near home and work from home. Opportunities will be created for companies to recruit employees for centralized or decentralized jobs. An extensive scheme is being initiated to provide employment to at least 20 lakh persons through digital platforms within 5 years. Changes happened in global job market and the fame attained by Kerala in COVID defense will help in the success of this employment strategy. There was no other time the brand Kerala got discussed even among the common men. Kerala Development Innovation Strategy Council (K-DISC) will be restructured as a registered society with the Chief Minister as its Chairperson. The whole process of transforming Kerala to a knowledge economy will be coordinated and monitored by K-DISC. The knowledge economy in turn will be built on three key pillars- digital infrastructure with K-Fon at its center, a vibrant higher education system and finally the Kerala innovation society.

Digital infrastructure

For transformation into such a society, it is essential to have a suitable information and digital ecosystem. The digitalization of schools is a decisive step towards this goal. The new generation can develop expertise in information technology and access the vast universe of knowledge opened by it. Internet will be provided free of cost to below poverty line (BPL) families. 30,000 government institutions will be connected by high-speed intranet facility. The internet speed will range from 10MBPS to1GBPS. The government will facilitate the growth of fields such as Artificial Intelligence, Block chain and Internet of Things. E-commerce and digital services will be made available to industrial, commercial and tourism enterprises including small scale sector of Kerala. K-Fon will become a shot in the arm for our e-governance system.

Towards excellence in higher education

Our next aim is to transform higher education in line with our achievements in school education over the past five years. Several different indicators are now available globally for measuring the standard of higher education. The most prominent among them is the ranking of global universities published by Times

higher education. Only one university from Kerala figures in the list and the ranking for this is between 600-800 range. Another prominent ranking is by the Shanghai Ranking Consultancy, which ranks 4000 universities across 54 subjects. Not even one university from Kerala finds a place in these 54 subjects. Investment many times higher than the present one is inevitable in higher education. Similarly, the approach to teaching and research needs a paradigm shift. Both are not easy. We ought to move towards this goal with resolve. The enrolment ratio in higher education sector shall be raised to at least 75 per cent. The all-India average is 26 per cent. At present the enrolment ratio in Kerala is 37 per cent.

To make the higher education more vibrant, a number of fully autonomous Inter University Centres and Schools are being envisaged within universities.The appointments to these institutions will be made from experts at the national level through a search committee. These centres/schools will develop under the leadership of top-experts in the respective fields.

Further 500 'Nava Kerala' post-doctoral fellowships are being instituted with support for establishing laboratory and other facilities. These post doctaral fellowships, with a duration of two years, will be open to experts within and outside the country with a view to facilitate brain circulation.

Kerala - an innovation society

Innovation means the translation of new or existing knowledge into a new product, new process, new form of organisation or a new marketing method. Incessant innovation needs to be made at all levels for the rapid growth of Kerala. Binder-less board made of coconut pith is a product that can deeply influence the development of Kerala. This idea was born in a laboratory at the Wageningen University. Foam Mattings Limited had converted this idea into a prototype in their pilot plant. It has been proved that a strong plank can be made from the pith of coconut or from dust of dry husk of coconut without using any chemicals. When it is turned into a product on commercial basis, the change in the plywood industry of Kerala will be phenomenal. This will not only lead to industrial growth but also ensure at least one more rupee for the coconut even if it has dry husk.

This budget puts forth a four-point action plan for creating an environment for integrating innovation in all sectors. Any person who find a solution to any of the problems in agriculture, industry, service, business of their locality will have a platform to upload their innovation. K-DISC will classify and evaluate such new ideas and techniques with the help of experts of concerned sectors. In the next stage, Startup Mission and Kerala Digital Transformation Mission in unison will grade these innovations and ensure mentoring and financial assistance for developing them into products. They will take the initiative to spread these products in society as soon as they get 5-star rating. Conditions will be created for Government and Semi-Government institutions to buy such products at a specified rate without

tendering. There will also be a scheme for providing diffusion subsidy in proportion to turnover of services and technologies. This is a conscious intervention to ensure that, there will not be any digital divide in integrating new technologies.

Start-ups will be encouraged to transform the products coming from innovation promotion schemes into commercial ventures. Start-ups are relevant not only in the IT sector, but wherever innovative concepts are utilized. Kerala has remained at the top of national rankings for the past two years in the creation of environment for promoting start-ups.

■

(This article is based on the budget speech made by the Finance Minister of Kerala, Dr Thomas Isaac and the opening remarks made by him in the post budget international consultation on transforming Kerala to a knowledge economy)

Knowledge economy based on Kerala's unique strengths

Bengt Ake Lundvall

Only once before, have I been in this unique situation to have a chance to discuss the knowledge economy with a Prime Minister. It was in Lisbon in the year 2000 together with Luc Soete who is on the program later today. We were invited by the Prime Minister of Portugal to discuss how to develop a long-term strategy for Europe. One of the main themes was to establish knowledge based development in Europe. The then Prime Minister is not completely unknown to you. It was Antonio Guitteres, now the Secretary General of The United Nations.

From the very beginning, there were two competing framings over economic policies. One was a knowledge economy framing which aimed at more and better jobs through investments in knowledge and through building what we call egalitarian learning economies. But the other one was a neo-liberal framing aiming at more jobs, through structural reform and weakening the position of workers in labor markets through what's called 'flexibilization'. Halfway through the planning period, it became clear that the neoliberal view had become the dominant. Within governments it is normally propagated by the Ministry of Finance (I am happy to note that this is not the case in Kerala!). The neoliberal turn resulted in much weaker emphasis on building a knowledge economy and it implies that governments looked at the labour, not as people or humans who know things and can do things - labour is seen just as a number. And this is the view which prevailed.

In 2003 I was invited to China to become professor at Tsinghua University in Beijing. During this period, I realized that the Chinese people had inherited a culture with great respect for knowledge. When this was combined with policies promoting science and innovation, it resulted in a very strong investment in innovation and knowledge. To some degree that has to do with the fact that most of the leaders in China, had education in science or engineering, not like in the West, in economics or law. The main reason why China today can aspire to become world leader in strategic technologies such as artificial intelligence is massive investment in knowledge and infrastructure and the willingness of ordinary people to invest in education.

One of the things I think is utterly

important is to give the concept knowledge economy a broad understanding. I think that in Europe, China and United States for there is a tendency to understand knowledge as closely related to science and high technology. This means that scientists, engineers and R&D managers are seen as the main actors. In the education system, there is a strong focus on universities. I think there are two reasons why one should be aware that this perspective is too narrow and therefore problematic. One is economic and the other one is political. On the economic side, the diffusion and use of technologies which actually is what results in economic performance and social wellbeing will reflect the skills and competencies of workers and farmers not only those of scientists and engineers. Second, the political is that the knowledge strategy that only promotes academic training risks to alienate the majority of citizens and to create social and political polarization.

Knowledge is more than science and information. It is important to know about the world, scientists and experts have - what we have called know why and know what knowledge. But it is at least as important to know how to change the world. All of us have elements on know-how. The housewife's skills are important to determine the health and wellbeing of the family. Workers', fishermen's and farmers' skills are critical for making use of new technology. Skilled workers', technicians' and designer's skills are crucial for absorbing and adapting new technology. Managers' and public servants' skills are crucial for the performance of private and public organizations.

So, I want to emphasize that knowhow should be regarded as a very important part of knowledge when we talk about the knowledge based economy. Therefore, and I think very much that this is in line with the thinking of Kerala as I just heard it presented by the Minister of Finance, the knowledge economy is for all and there is a need for lifelong learning. It is important to understand that all people have knowledge. The concept of unskilled worker' is wrong. There are no unskilled workers. We are all working with different levels and kinds of skills. And everybody have a potential to contribute to the knowledge economy.

One implication is that investment in formal knowledge in the form of education and research should be combined with building 'learning organizations'. We should try to design organizations in private and public sectors in such a way that people learn from what they do and that they get strong incentives to learn from what they do. As I mentioned before, in the neoliberal economic models, labor is reduced to a number, but it's not the number. It is humans with many qualities which can be further developed. Of course, this is general, but I think fits well into the Kerala model.

Concepts such as knowledge economy, learning economy, national innovation systems draw upon theoretical reflection and empirical research from very different parts of the world. But before applying

such concepts and transforming them into political action, I think it's necessary to give full attention to the reality of Kerala. I believe very much in pragmatism, which means that the focus should be on what works best. I think this has to do with how you mix market with plan, the private to the public, and the openness of the economy versus protection. It is more helpful to have pragmatism as basic approach rather than specific narrow and rigid ideological principles.

I have had the pleasure and it was fascinating to read the budget speech for 2021- 22, which is a wonderful contrast in style to standard documents from mainstream Ministry of Finance documents. The budget speech is ambitious. There is strong focus on higher education and on research related to science, technology, engineering and management. But there's also, which I find extremely interesting, a strong gender perspective on the knowledge economy.

I think when you build a knowledge economy in Kerala; you should start from the unique strength of Kerala. You should mobilize social entrepreneurship and grassroot organizations in the transition. You should leave room for local experimentation and I think that you already do that. That is one of your specific ways of governance; you leave room for local and regional experiments and draw lessons from what works in different parts of Kerala. Make visible successful efforts for individuals, organizations and enterprises, and use them as good examples showing that it pays off to make extraordinary efforts. Mobilize knowledge and build skills with equal opportunities, disregarding gender, ethnicity class, caste and religion and build trust in society and aim at zero tolerance of corruption and abuse of power. I think these are very much in line with how things are done already in Kerala.

Social sustainability is important to transform towards a knowledge economy with social cohesion. Ecological sustainability is an important change with respect for the natural environment, not just treating natural resource in nature as kind of input in the production process, but show some respect for the environment. Economic sustainability is to eradicate poverty and create better jobs and cultural sustainability to modernize and transform society with respect for cultural heritage.

I am extremely proud in taking part in this communication. I think it is nothing less than a historical moment that Chief Minister and the Minister of Finance take time off to think creatively about how to use wisdom and knowledge to transform Kerala. It is great and I am very, very happy for this initiative. Thank you very much.

■

(Bengt Ake Lundvall is a Professor Emeritus in Aalborg University Business School, Denmark and Founder of GLOBELICS)

Strengthening the learning and research base

V K Ramachandran

If Kerala is on the map today for its outstanding achievements in the overall field of development, a large part of that progress must be attributed to the emphasis that public action paid to the State led formal education. The combination of land reform and formal education, referred to by Professor Isaac and the freedom and progress that comes from that has been the basis of the progress of our State with respect to health, social welfare, and the growth of disposable incomes. Our international participants should also know that, Kerala also has the highest per capita consumer expenditure among all the states in India. So that is developed from our progress in what we have called human development indicators. Progress has been most striking in school education, of course, in the 1980s and onwards Kerala is the only state that fulfilled investment levels in school education, that were comparable to that of South Korea, Japan, Taiwan, etc. In recent years, the impact of the present government policy and the investments that have been made in upgrading infrastructure and the quality of education, have been extraordinary.

One of the most striking developments in India's public education scenario over the last five years, and perhaps over a much longer period is that since 2017, more than 500,000 school pupils in the state of Kerala have transferred from the fee paying private system to government schools. Now this is an absolutely extraordinary situation to compare what exists in the rest of India. To the sparkling modern structure that now exists in many parts of the state with new desks and school furniture with electronic whiteboards in schools. This is surely one of the most moving and perhaps most important signs of what can be achieved by a combination of investment, political will and people's participation in the field of knowledge. The Chief Minister mentioned briefly something about experience in higher education, and I see Professor Isaac, but despite our progress, despite our history, the overall experience has been that the state is yet to establish itself as an outstanding location for higher learning and research.

The knowledge economy must be based on a strong, independent flourishing and inclusive system of higher education with systematic, that is not ad hoc state

support. It is, as Professor Lundvall said that may not be a sufficient condition, but certainly this is a necessary condition for our knowledge economy and knowledge society.

The broad themes that are of immediate importance to us in the area of higher education are as follows. One is the whole problem with higher education finance. This is an enormous problem particularly in the state in an economic structure where we are perpetually in a state of financial stringency and difficulties. Take for instance, a university that serves in the northern district, Kannur University. We spend about Rs.75 crores non plan and Rs.22 crores plan expenditure. This is what we allocate or what we spend to something else. So the plan expenditure that we allocate to a university that serves about 25000 to 30,000 people on the main campus and is accountable to about 150,000 people altogether. We spend only about Rs.22 crores in the plan and about Rs.75 crores on regular expenditure in a year. How we're going to break through this is an enormous question.

The second area is that of curricular innovation strategies to strengthen our specific disciplinary knowledge, while simultaneously introducing methodological development from other disciplines at later stages of education of the higher education system. The third area is trying to explore how new technologies of instructions moves for instance, but can best be introduced in colleges and universities and set up inter university groups for sharing knowledge. The next area which is very important for us is institutional innovation. Learning from and establishing successful institutional innovations to make Kerala's universities academically autonomous and develop flexible administrative regulations that are transparent and responsive to the requirements of teachers and students. The next area in which we are trying to study and concentrate our attention is networks for teaching, research and student exchange that is to substantially expand our national and transnational networks for teaching, research and student exchange. We are looking very seriously at how to expand innovations in libraries, technology and information availability to college students, university students all over the state. Finally, we need to retain and strengthen the socially inclusive character of higher education, which is our historical heritage and legacy.

We recognize the crucial role that skill training and development play. We have certain strengths here. A relative abundance of educated and skilled workers, a long history of entrepreneurship and exposure to the wider world. We are quite interested in some of the International Labor Organization (ILO) proposals in the area of skill development and employability, particularly the need to link training to current labor market needs as well as anticipating and building competencies for jobs for the future. A key aspect of the ILO framework is to expand access to formal employment related training in

order to equip women and men to work in the formal economy.

Let me end by saying that where there is a combination in Kerala particularly of government will from above and the civic cooperation in people's participation from below. Where these are joined together, as I believe they will now join in our striving for a knowledge economy for a better system of higher education and a huge improvement in system of skill development. Then that force in this state becomes unstoppable.

Thank you very much, and I wish you all success to this to this deliberations, and I look forward to learning from the results of your deleberations.

■

(Prof. V.K. Ramachandran is the Vice-Chairperson of Kerala State Planning Board, Government of Kerala)

Knowledge based vision for the future of Kerala

K M Abraham

Precisely eight days back, we saw a historic budget been unveiled in the legislative assembly hall. It is actually painting a vision for the future of Kerala before us. This vision is focused on the theme of knowledge economy, Kerala attaining the kind of heights and position on the international map as the frontier place for knowledge economy.

My thoughts go back to the budget speech wherein I really find that the ingredients of the knowledge economy are beautifully captured. Currently, knowledge economy is a very overused word and is underachieved as well. One of the things that has baffled me about the idea of knowledge economy is that there is no starting point and no ending point. When do we start becoming a knowledge economy and when do we end becoming a knowledge economy? That is a million dollar question and I don't think there is a very definite specific answer, at least in the limited readings that I have done. Therefore, I come to this inference that the whole idea of knowledge economy is a moving target. The target keeps moving and as a society, you got to keep on addressing that transition and dynamically pursue it.

Now in the last few budgets, I would say, you could clearly see that the state has taken some very important steps to finally arrive at a conclusion in this budget 2021-22 that it is time for the state to make this big leap.

Looking at the literature, we can find that Kerala is approaching close to the necessary condition to move towards knowledge economy. Most of the knowledge economy transitions, we find in states, in regions and in economies, where the service sector is a predominant part of the domestic product. And here we have exactly achieved that. The other one is the society that promotes a learning culture. And I can say in Kerala, probably one of the thing that stands out is it's questioning mind, it's discerning mind, it's very insightful mind that the society in Kerala as such can collectively boast of. The third element is about the society that is willing to make significant investments in higher education. The fourth ingredient I would say is, what is the level of evolution of connectivity in terms of internet connectivity, in terms of telephone connectivity that characterizes the society. I think on all these four ingredients, we are

at a stage wherein we will be soon achieving the degree of necessary conditions.

Now, at this juncture, assume a scenario where we would not have focused on knowledge economy. Kerala at some point in time, like any other society, will become a knowledge society. So what this budget, actually does is to compress the gestation period for this big leap and that is where the tricky part comes. It is not an easy job. After the budget was announced, a few of us have been meeting and deliberating about what is the next step.

We are particularly happy that our efforts in the last three years are bringing in innovation in several spheres. We have now about 1000-1500 students selected for their innovative projects. We have a couple of social projects which are happening in various districts of Kerala. We have some innovation programs for the differently abled children, and we have about 20 very high-tech emerging technology initiatives and innovations, that's going on. Perhaps one of the reasons why the Honourable Finance Minister chose K-DISC as a coordinating agency for bringing in the various aspects of skill, or meeting skill deficiencies and improving the skill base of the state perhaps comes out from this recognition. The K-DISC that we are going to get transformed into is going to be chaired by the Honourable Chief Minister, it will comprise of very key ministers of the Council, and it will have the Vice-Chairman of the planning board, the Vice-Chancellors of the universities and the directors and the CEOs of the key skill or research institutions of the state.

Now, over the last eight days I would say me and my colleagues have been trying to find out the appropriate design for a skill portal that will essentially focus not only on conventional skills, but on what are the things that we need to clearly address in when we plan for the transition of the state into a knowledge economy. One of the mandates that the Honourable Chief Minister has given us in the meeting is that we have got to hit the road running and we got to start and launch this program in the first or the second week of February. We are gearing towards organizing a very generic skill platform without getting ourselves logged into rigidities or into specificities, so that the platform can grow organically, interact with the thousands of institutions and local communities in Kerala and probably, be one of the first decentralized skill platforms in the world. That is the aim that we have set for ourselves now. I am confident and sure that the deliberations of this seminar will be of great and of invaluable strength.

Thank you very much. I wish the seminar all success. Thank you.

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(Dr K.M. Abraham is the Chairman of Kerala Development and Innovation Strategic Council (K-DISC))

IT stimulus for the knowledge economy

Deepu Zacharia

I would like to first start off by saying to Dr. Thomas Isaac, the promises and the very foundation for laying down this knowledge economy as a roadmap for Kerala is welcomed by the IT industry of Kerala, thank you Sir. Before I go into the very ideology of emerging economy, knowledge, tourism or IT, all this will need a stimulus to start the growth and the stimulus is exactly what Kerala as a state is searching in all of us. The budget is certainly aligned towards this stimulus. And for a better understanding of what I'm going to focus on this special address today and I'm supposed to be focusing on the IT industry because I come from there.

I want to put down some numbers. The IT spends globally, if I look at traditional and new technologies put together for the year 2019, stood at staggering 3816 billion US dollars. In 2020, it had a small dip and it went to 3609 billion US dollars. But in 2021 it is supposed to be growing to 3755 billion US dollars. In India, the market size for IT in 2019-20 was about 191 billion US dollars aiming for 350 billion US dollars by 2025. This means that 8 percent of India's GDP is being contributed by 0.34 percent of the population (4.4 million IT techies). This is the highest in the world for the concentration of IT talent in one single country.

Where does Kerala stand? Three billion in revenue from IT, 1.5 percent of the Indian IT population comes from Kerala. Developed markets are high cost and high revenues, but Kerala is high cost and low revenue. How do we counter this? This is the bigger question that we have in front of us on how to derive this knowledge economy.

Let me compare two geographic locations- Kerala, and New Zealand. The population of both these locations are spread like 34 million in Kerala and 5 million in New Zealand. The GDP of Kerala is at 140 billion dollars, whereas in New Zealand, it is 193 billion dollars. The productivity is that 4,170 US dollars versus 38,600. What are the sectors that we work in? The sectors that we are work in Kerala are agriculture, tourism, IT and manpower exports whereas if you look at New Zealand, it is agriculture, tourism, and dairy products alone. So IT is the biggest boost that we have in Kerala that needs to be tapped for boosting the economy.

About 30 percent of the total population of companies like Infosys, Microsoft, and Wipro consists of Keralites. We need to capitalize and increase our footprint in Kerala to take it to 10 percent or more of GDP. We have got few connectivity issues which the government is definitely working on. We should have them resolved quite soon. This opens up easy air connectivity to the Far East and the west. The potential for Kerala's IT opportunities are still unexplored. We have to speed up and for this we need to increase the availability of supporting infrastructure of the state to bring out the talent that we have inside of us.

Now, transforming our state to become a knowledge economy is key in ensuring that we meet the targets of goals that the state is set to achieve in 2020-25. And some of the visions that I would like to table for 2025 are the vision to make Kerala IT a 10 to 15 billion dollar industry in the span of next 7- 10 years. This will directly create 3 lakh or more IT jobs and 15 lakhs indirect alternate jobs. For this, the government needs to invest in consolidating existing IT parks and infrastructure around it. We should make it attractive for large investors to come and pick a space like what Andhra Pradesh is doing. We need to support local companies to set up shops and these costs needs to be looked at and we need to bring down the cost that becomes more attractive for people to set up shops here in Kerala. Incentivize industry-academia partnerships. We need academia partnership for driving innovations. If I look at it, India is a top most offshore destination for IT companies across the world and it is just going to grow and the dependency that the world is going to have one India to provide outsourcing is going to grow in the coming years. The industry is expected to grow by 350 billion by 2025. Kerala needs to be a key contributor in this space and for this we need to transform the state into the best knowledge economy.

To close my remarks for the day, I would like to open up this thought to everybody. The pandemic did not put the IT industry in the back foot. Instead, it has accelerated the need for states like Kerala to wake up and run faster. Thank you.

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(Deepu Zacharia is joint Secretary, Group of Technology Companies (G-TECH) Kerala.

Part II - Pillars of knowledge economy

A. Digital Infrastructure

S Somanath

I am really happy to be with all of you and the panellists to chair this session. In building up a knowledge economy for the state, I'm really glad that a lot of people are showing enthusiasm. I had the opportunity to listen to all those people in the inaugural session. It has set the ball rolling with regard to what the government is looking for. It is really very interesting and I'm really happy that we are discussing on the infrastructure for knowledge economy in the first session. When we talk about the infrastructure of the knowledge economy, there are many elements to it. In this session we are talking about the two of the important building blocks. The first speaker will deal with the telecommunication networks and the second speaker will deal with the electronics manufacturing activities that the KELTRON stands for.

Infrastructure, however, is not limited these two areas alone. There is much more in this area. Of course we can build into it the networks and connectivity, the servers, the storage systems, the satellite networks that actually can bring about the real connectivity. These are all part of the important IT infrastructure. Now, for building IT infrastructure, it is not enough to import a lot of these equipment, assembling them and provide the type of services that we hope to provide. The market is much more in building those ground infrastructure by ourselves in our own industries. So we have to look at how the need for this network or the infrastructure will actually enable the industries to grow. This is one area which we should address.

Similarly, when you want to look at the space-based infrastructure, there is something that is coming up very fast. How can we give the required connectivity directly from the space. And this is one area which we are all interested in looking at how the new thought process in providing network connectivity directly from the space routes. When it really happens there is another area which is going to develop. This is basically the ground-based data reception systems that the networks and the corresponding equipment which are required for those type of nano systems. In addition, there is a large amount of infrastructure requirements which don't directly deal with the IT and IT enabled services. But there is quite a bit of other

establishments that we need to look when you talk about the infrastructure which was discussed earlier. This is basically the educational system, the transport network, the services sectors, among others. Now, all of this really contribute to building the right type of infrastructure for this knowledge economy to start.

I don't want to make a big talk on it. I only want to point out some points which could be deliberated upon. To begin with, there is the need look at the investment that is needed in creating such an infrastructure. The question is whether we go ahead and create it in an incremental manner and then grow to a bigger size? Another important issue which we need to tag is about the obsolescence and hence the update that is required for the infrastructure. Is it not enough that you actually put in place some infrastructure which could be updated periodically? Such an outlook is justified especially because we are dealing with a fast-changing technology. Yet another issue is related to scalability. Of course, you cannot plan a massive network to start with. You start with something, then progressively increase it to cover larger areas and what should be the architecture in such a system? And how do you really look at the performance and how do you really manage it? So, the technical and organizational structure of this whole system that we are thinking about is something which actually puzzles me. How do you really want to create it on our own, and not to merge with overall global system? I'm really sure that the eminent panellists are going to deal with it.

It's not enough that we create all this infrastructure. We should also create the specific knowledge, which is required for serving the whole knowledge society. In fact, the creation of the knowledge is also requiring its own infrastructure. For example, the type of the data that you want to create; when the lockdown came, we are short of the lectures which are required to be delivered to students; we were finding it difficult to create required materials for them. For creating those large amount of data, which is required for the changing world, we need to look at what are the type of infrastructure needed to create the information or the knowledge itself to serve the needy people. So, these are the points which I want to highlight today and I don't want to elaborate.

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(Author is the Director, Vikram Sarabhai Space Centre)

Design and vision of Kerala-Fibre Optic Network (K-FON)

Jayasankar Prasad and Santhosh Soman

Kerala government wants to create a knowledge powered digital society through digital empowerment of citizens and promote digital lifestyles and e-commerce. This is possible only if we have a proper information infrastructure in place for effective communication, processing, and dissemination of information. Kerala Government has done a study on existing TELCO infrastructure and found that there is only limited fiber infrastructure in rural areas. 4G services in many places are not proper available. The Government / Educational institutions are now getting broadband services from various TSPs. Existing Kerala State Wide Area Network (KSWAN) infrastructure provides connectivity to nearly 3800 offices. KSWAN infrastructure is not scalable to provide connectivity up to 30,000 institutions. Department of Telecommunications (DoT) has conducted a comparative study with respect to broadband density among these high teledensity states and Kerala is not in a back position. In urban areas, we have 92 and rural areas it is 57. This is not sufficient to achieve the vision of Kerala Government's "Knowledge Powered Digital Society".

One of the main reasons why Kerala is not having proper 4G connectivity across the state is the poor fiberisation of the telecom towers. Nearly 36% of the towers are connected to fiber and remaining are connected through microwave which can provide only limited bandwidth (50 to 100Mbps). So fiberisation of all the towers with the existing fiber infrastructure is not possible.

Hence, Kerala Government has decided to move forward for building a proper fibre infrastructure to bridge the digital divide and provide proper connectivity to all Government institutions and leverage the infrastructure for TELCOS so that they can deliver proper broadband services in all parts of the state. The main scope of the K-FON project includes the creation of a highly scalable and resilient core fiber infrastructure, provision of high speed connectivity to 30,000 Government institutions and to be an infrastructure provider and share the infrastructure for TSP/ISP/MSPs.

While designing KFON infrastructure, main considerations are 1. Reliability and availability perspective. 2. Optimize the fiber consumption and also optimize the cost and time. Considering these points, KSEB infrastructure has been selected as the

platform for laying fiber since KSEB infrastructure reaches most of the areas of the State. Accordingly, it has been decided to lay fibre on KSEB Poles (Transmission and Distribution network) and construct PoPs in KSEB substations, because the power failures in substations are very rare. Having decided to lay backbone fibre over transmission line which is more safe, there is only a remote chance of Fiber cut over transmission line.

In order to cover the entire geography of the state, it has been decided to go for tiered architecture which includes Tier I (Core), which connects all the districts, Tier II (Aggregation), Tier III (Pre- Aggregation) and Spur for the inter-district connectivity. Also while choosing the technology we had a lot of deliberation on various technologies currently available and conducted workshops with major technology providers. Finally, it was decided to use DWDM technology for the inter- district traffic, IP-MPLS for intra-district traffic and GPON technology for access network.

Expected outcomes of K-FON include bridging the digital divide by providing free internet to 20 lakh households, leveraging K-FON infrastructure to TSPs on a non-discriminatory basis so that they can provide high speed broadband connectivity to households in rural areas, providing a scalable bandwidth from 10Mbps to 1Gbps to the government institutions, depending upon their requirement, providing high speed connectivity to Start-ups, IT Parks, airports, and Wi-Fi Hotspots. K-FON also provides free access to the e-learning, e-health, e-Governance applications which are hosted at SDC.

5G is the upcoming technology. TSPs are in the final stage of designing and implementation of 5G in India. 5G requires large number of towers/ small cells because it is high speed connectivity and it is operating at a high frequency. So we need to have more number of 5G towers/ small cells to cover the entire geography. Since we have fiber infrastructure across the state and it is laid over KSEB poles, small cells can be installed on the pole itself. TSP can reduce a lot of CAPEX on 5G Roll out.

With this infrastructure in place, we are expecting many benefits to the citizen which include 1. Human capital development**:** Remote delivery of education, job creation, skills enhancements and remote access to health care etc. 2. Infrastructure development**:** which basically smart cities, smart villages, smart grids and transportation management all can be addressed using KFON infrastructure 3. Infotainment**:** Proper information sharing and best practices related to e-governance, agri-techniques etc. Also building a platform for delivering services like IPTV, OTT, Content delivery services etc. 4. Innovation will happen with the collaboration of communities like researchers, developers, product development etc. Hence KFON is going to be the key enabler for the knowledge-based economy.

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(Dr Jayasankar Prasad is the Managing Director of Kerala State Information Technology Infrastructure Ltd (KSITIL) and Mr Santosh Soman is the Implementation Head, BEL.)

A vision for electronics systems design and manufacturing

T R Hemalatha

I would like to deliberate on the dream or vision of Kerala State Electronic Development Corporation (KELTRON) and how the electronics can thrive in the state because, more than manufacturing we are supposed to be an umbrella organization which is to promote other segments of other suppliers in the state.

The demand for electronic goods in general, especially that of mobile phones and computers, are growing in an exponential manner and India is emerging as a second largest market. Of late, in Kerala also there is an uptick in electronic system and design manufacturing with 268 new units were established since 2014. Our Hon'ble Prime Minister said by 2020 India's import bill for electronics will be more than petroleum. I think we are fast approaching to that state. If the country is not preparing itself, we are going to find our foreign exchange eroding in a very big way. I think that both the state and the Centre are taking the right steps in identifying drivers and providing encouragement to establish a stable and robust electronic manufacturing eco-system. The rising middle-class population is surely again a driver and improving the infrastructure is important. I also would like to dwell upon the R&D eco-system in the state which is of paramount importance for this industry.

Then, second is the current challenges of electronics industry. Ford is shutting down the plants in India for want of microchips. Due to chip shortage, laptops production is getting delayed by five months. This is typically a pandemic situation because the global demand for laptops and mobile phones have gone up and everybody wants to be at home with the classes and work from home. Similarly, the delivery period has increased from 26 to 30 weeks for microchips and power device.

Expanding Kerala's footprint in electronics, KELTRON, as everybody says was the dream company in India itself during 1970s and now due to various reasons it slipped back. The slippage has not been with the KELTRON alone, but for the country as a whole. Hence, it's not that the KELTRON alone but the entire country has gone back. In this process why not Kerala's electronics takes the lead. This is especially important given

the commitment of the government to provide employment to all those who are educated but remaining unemployed.

Why not the state promoting Make in Kerala brand for the electronics. It should finally contribute to the economic growth of Kerala. This is especially important because our good talent is going outside the state and outside the country to grab the opportunities. Why not we create an R & D and innovation system so that our talent stays here and contribute to the state. There is a lot of potential in all segments of electronics; consumer electronics, industrial electronics, strategic electronics, communication and broadcast electronics, computer hardware and electronic components.

Let's come to the plan and strategy. We can build a good ESDM ecosystem. So, what is this ecosystem? Encourage ESDM start-ups and MSMEs while existing companies are given support from the industry and institutions in Kerala. Build the skill and quality talent pool along with electronic manufacturing clusters by encouraging domestic and FDI funding. Establish three, at least minimum two, electronic manufacturing clusters in South, Central and North Kerala. Let us ensure that FDI and major players are invited to the state so they are part of the consumer, components and computer hardware which are going to be in heavy demand. The State can incentivize them so that they come here and give the mass employment which is a key requirement of the state. The MSMEs could be expected to play the feeder role. I have seen 88 new chip design companies located in Bangalore itself. So why not Kerala also have an ecosystem in which big companies establish their R & D and chip design and other electronic design facilities which doesn't require much infrastructure. This is something which we can really focus and develop easily.

Then let me come to the manufacturing. Develop three clusters on a focused approach. Why I say focused because while the requirement of each sector of electronics is specific, the common facilities are almost the same. We could list certain things that may be required here. Then the FDI and other large companies should be incentivized to make additional investments.

Finally, I would like to summarize, stating that this is not impossible, given the right focus we can develop the much needed manufacturing ecosystem. Thank you.

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(T R Hemalatha is the Managing Director of Kerala State Electronics Development Corporation Ltd)

Reflections from experts across the world

Hideki Esho
Professor, Hosei University, Tokyo, Japan

Although I am a Kerala lover, my knowledge on Kerala is quite limited. So my remarks on Budget speech of Dr. Thomas Isaac are quite general.

My first remark is on the object of transforming to knowledge economy. I should say the final object of transforming the knowledge economy should be placed on an enhancement of quality life of the people. In other words, transforming to knowledge economy is means of enhancing quality of life of the people, not the object itself.

My second remark is how to make use of uniqueness of Kerala society and economy to transforming to knowledge economy. Transforming to knowledge economy could be attained by making use of competitive advantages of Kerala, such as highest literacy rate (93.1%) or the highest human development index (0.779), relatively higher income per capita, low poverty incidence (BPL 7.05% in 2011-12, compared with 21.92% in overall India), gender-bias free society (1,084 female per 1,000 male), and abundance in tourism resources.

Also transforming to knowledge economy could be attained by making use of historical, and cultural heritage and uniqueness of Kerala, such as the highest overseas remittance economy (20.7% of NSDP in 2013-14) and the highest per capita consumption economy among Indian states, a highly service sector dependent economy (62.1% of SGVA), and a highly urbanized society (47.7% of the total population of Kerala), higher population ratio of Christians (18.4%) and Muslims (26.6%), and a decentralised government.

And finally, transforming to the knowledge economy could be attained even by making use of disadvantages of Kerala, such as second highest unemployment ratio and the highest income inequality among Indian states (Kerala's income equality is driven by the super-rich, top 1%), highly dependent on inflow of migrant labourers from other states especially in construction sector, the highest labour cost and the lowest population growth rates among Indian states. Kerala is approaching to an aging society preceding other states.

All these things show that Kerala is an exception among Indian states. So I would say all these competitiveness,

uniqueness, and disadvantages of Kerala clearly indicate the necessity and inevitability of transforming Kerala to knowledge economy to further strengthen competitiveness as well as to overcome the weakness. Brand Kerala campaign would be required in a big way to attract foreign as well as domestic investment. Also knowledge economy should be inclusive.

Now, I would like to present some suggestions. Maybe these are already on the agenda or are in progress. The first suggestion is to set up Kerala platform, which means a collection of open API, depending on Aadhaar. The main purpose of this digital platform is to promote innovations of private companies.

My second suggestion is to make use of Non Resident Keralites, their knowledge, expertise, and savings. It is necessary to create some mechanism to channel overseas remittances to entrepreneurial activities.

The third suggestion is to promote practical use of ICT knowledge in many fields, not only in medical services, nursing, health care, education, but also in tourism (including medical tourism, Ayurveda tourism, domestic pilgrimage tourism, Kerala cuisine tourism), food processing (including marine products), and plantation crops (such as cashew, coir, spices, coffee, tea, rubber) where competitive advantages of Kerala lies. The purpose is to upgrade the quality of goods and services to the global standard, that means to realize a "higher quality-higher profit" economy.

And fourth suggestion is to further promote the Kerala start-up mission. Kerala is ranked as one of the top performers in the start-up ranking. Under the banner of KSUM there are more than 2,200 registered start-ups. However, presence of IT/ITeS companies is still limited compared with other top performers such as Maharashtra or Karnataka. Availability of funds and skilled workforce remains a challenge. To develop applications corresponding to smart phone is one of the most promising area in start-up business. Especially promoting e-commerce is required. E-commerce has a huge potential of regenerating employment, especially that of women. Women are able to work from home, which is enabling them to simultaneously meet demand of their home and their carrier. E-tail creates not only direct employment opportunities, but also create employment in logistics and warehousing, and also create technology and corporate jobs.

That's all. Thank you very much.

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G Vijayaraghavan
Honorary Professor, Gulati Institute of Finance and Taxation.

Two interesting presentations, one on connectivity and the second on looking at Kerala as a manufacturing base.

On the connectivity part, it is an interesting proposition. But the revenue models for K-FON need to be carefully looked at in terms of how to generate the revenue for constantly upgrading the obsolescence that technology goes through. It is important to have clearly defined financing model to make it sustainable without depending on funding from the government. It is also necessary to ensure that the TSPs do not exploit the situation, as the government will most probably be giving the bandwidth at a very reasonable price with the expectation that TSPs will give it free or at a very low cost.

Looking at Kerala as a manufacturing base for electronics, we will need to definitely define a clear policy on the role of the public sector – what they will do and more importantly what the public sector will not do. We will also need to look at the joint sector, where the public sector and private sector come together. We will also need to clearly specify what we expect from the private sector if the project is owned fully by them.

This is important because when it comes to Government business, very often the public sector companies end up competing with the private sector in the state many times selling products manufactured by companies from outside the state which creates an issue by which the private sector or the joint sector is actually impacted.

Look at Coconics, a joint venture between KSIDC, KELTRON, UST and a small company associated with Intel. What happened was, in the first major tender itself, you have the public sector competing with the joint sector. So you had partners competing with each other. And the problem there was that the product offered by the public sector was not manufactured in the state. We need to have a clear policy on how we are going to support companies that set up manufacturing units in the state.

Although we have the largest number of start ups in the country, they is a tendency among them to move out of the state because they believe that there is no ecosystem in the state. Hence, I am happy that the presentation on manufacturing talks about creating an ecosystem. Let us

look at China, where you see a lot of small companies and start ups coming up. A company out of Shanghai, which I visited two years ago, is able to prepare a design for a product and the product prototype is ready within a day, not in Shanghai, but the manufacturing is happening in Shenzhen, where there are companies who will convert this design within a day into a prototype. For us, anywhere in the country, it will take at least two weeks plus. Ultimately, the prototype comes from China. Many a time if it is to be made in India we have to ensure that we only use certain components, we don't have the facility for quick changes to prototypes.

The other important part of the ecosystem mentioned is the need for quality testing. Here we have a big advantage as we have the Electronic Regional Test Laboratory in Thiruvananthapuram.

What is important is to try to network with the central government institutions, the state government institutions and public sector. Look at some of the university departments who do good work the start-up companies. How do we get all of them together and then say, look, this is what the state has and this is what the state lacks today?

There needs to be a big impetus for the start-ups in this area. I see Balagopal on the call. And, you know, the kind of manufacturing, which they were able to do, the quality of the of the product which came out of the Penpol, now Terumo Penpol, was of the highest international quality.

We need to be clear as to how the state is going to support business here. How do we support companies to get out of the state orbit to get into the national level and how do we then get out of that orbit for the products of the company to be competitive internationally. In the absence of tariff walls, you cannot anymore be manufacturing for Kerala or the Kerala government, you have to be manufacturing for the world and internally competitive, for which the ecosystem is very important.

I conclude by saying that the most important thing is the ease of doing business. I know the government has put in place a system wherein one could start and then get the approvals within three years. I don't think that is going to work because within three years the bureaucrat will find something somewhere and then you're going to be at their mercy and have to pay up a ransom. So, we need to look for a clear model by which all approvals come in 30 to 45 days. These are the areas, which I thought I should cover.

Thank you very much.

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Raja Rasiah
Distinguished Professor, Asia Europe Institute,
University of Malaya- Malaysia

I shall address a few points in relation to the knowledge economy, and I am sure having been to Kerala many times, a state popularly referred to as Gods own Country, and, of course, having read Amartya Sen's very articulate book, the Argumentative Indian where he glorifies Kerala, I believe that the structures are there. Quoting what Deepu Zacharia mentioned in the earlier session, 'that 30% of the skilled personnel working in IndianIT firms are actually are from Kerala. Hence, the latent potential is there for hiring, provided you can offer the ecosystem that Vijayaraghavan mentioned just now. Now I think even that can be created, but let me just put it in the context of how I have done my research on this topic.

Looking at the proliferation of IR 4.0 technologies, the digital infrastructure required, especially broadband infrastructure, along with the other important instruments like cloud computing and a range of other things that are done in Malaysia, I believe adapting what countries are doing higher in the technology trajectory will help Kerala cheapen and quicken catch up. Malaysia started early in 1999 with smart schools but was overtaken in this area by latecomers, such as Taiwan, Korea and Singapore.

Taiwan and Korea did not just lay broadband digital infrastructure and provided computers with internet support as in Malaysia, but importantly connected and enabled the members of society, including school children with the knowledge nodes in their countries. Listening to Dr. Hemalatha, I see that she has a good idea as to how that can be done in Kerala. I am speaking from meeting hundreds of design engineers I met while giving a public lecture at IIM Bangalore in 2005. Kerala very much has the capability for appropriating synergy from that experience and provide the initial incentives to attract a critical mass of such engineers, which should then snowball into a viable IT supporting community. Connections and coordination between firms, intermediary organizations and related government instruments are very important.

The transformation of Taiwan to embrace robots and drones began intensively since 2017, which even

extended to agriculture. They intensified self-sufficiency strategies aggressively from 2017 when Trump declared trade war with China. Similarly, in manufacturing Trump's trade war literally forced Taiwanese from selling microchips to Chinese firms, including Huawei. Hence, Taiwan re-shored food-based agriculture and manufacturing well before the COVID-19 pandemic struck. While drones and robots are extensively deployed in farming, manufacturing is increasingly driven by robots in Taiwan. I think you will need to look at why and how they were able to have robots milking cows, ploughing fields, and drones playing a key role in farming. Small farmers and small firms engaged in farming and agriculture in Taiwan remind me of the organization of industrial districts in Italy, though the structures and players are different.

My kind of research requires me to visit the place, I go into the firms and farms, and also map the links between all the components of the ecosystem in which they operate in, including the incubators in science parks. Instead of completely reinventing the wheel, something we members of the Globelics advocate, we can shorten, cheapen, and simplify the catching up process by looking at successful organizations higher in the development trajectory. Keralites can and will of course create new stocks of knowledge but in a manner where they evolve collectively with adapted knowledge from abroad.

I am confident that this God own loving country will do well to achieve IT integration with positive synergies in the space of little time. I encourage the intelligent leaders of Kerala to visit both successful (e.g. Taiwan and Korea), and not very successful (e.g., Malaysia) countries to develop a profound understanding of how effective ecosystems can be planned to support the development of digital infrastructure to appropriate IR4.0 synergies.

Thank you.

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Sreejith Nair
CEO, Coconics Private Limited, India

Taiwan and Kerala share a lot of geo-political or rather demographic equations. Taiwan is just 90 per cent the size of Kerala and where were they in 1970s, and where are they now. So this point rises to another interesting part - why I believe that Kerala has much to do with fourth industrial revolution? Kerala has a DNA of electronics manufacturing system and also the DNA coupled with something which is suited for hardware manufacturing or assembly. I like to use the word finger dexterity; workers of Kerala are very good at traditional business like cashew, spinning wheels etc. We have a unique skill of the finger dexterity. We do have an ecosystem. We have skilled people. We are going to create skilled people, to create a lot of skilled manpower. Are we going to just use them for human resource export? Are we going to remain as a region with four airports and we are going to export this skill abroad or are we interested to create some industry in this state, whereby these people can get jobs? The answer is, yes. Electronics industry is the answer to this.

We have a few other electronics manufacturing sectors. Why can't all this come under a cluster town or a country of manufacturing clusters. There are huge electronic manufacturing clusters, led by Original Design Manufactures (ODMs); which are those huge companies that use the design or what is known as the master reference design given by big corporations and produce. They are not Original Equipment Manufacturers (OEMs), they are ODMs. Foxconn, the third largest company is not an OEM it is an ODM. So we need to have a concrete steps to attract Foxconns, Restonds and Pegatrons. We could have been somewhat near Taiwan or Malaysia when five or six years back when the multinational companies started the strategy of China plus one. China is no more labor cheap. The industry started moving out of China clearly shows the higher cost of assembly of electronics. Kerala is at par or cheaper than China and we can do quality products better. At least 100 companies have moved out of Taiwan and China. They have moved to countries like Vietnam, Malaysia and Mexico. They moved to Thailand and many of them are moving to India. We should have a clear cut strategy probably led by K-DISC to attract those companies to Kerala. Kerala has everything, like people who are

spending abroad. Lot of people are coming back to Kerala, not only with money, they are coming with skill sets also. These people are willing to work at much affordable sideways in Kerala. So there is a market which we need to tap. The government has to demarcate what the government is going to do, what the private enterprises going to do and what is private- public participation going to do, so that there is no conflict of interest.

Taiwan caters for approximately 60 per cent of the production of electronics equipment and Taiwan has only a population of 24 million. The question is demand aggregation. If an industry has to thrive in Kerala, there has to be demand aggregation. So when you start to crawl, you are in the nascent stage and that is when the government has to pull and don't expose you as the world is not fair. The competition is not fair for the company to have commercially viable operation; you will take at least two to three years. The first two years you need nurturing from the government. If an industry has to come to a state, you need firmly committed nurturing from the government. Secondly, you need to make sure about investment flows. What is not available in this country is working capital. Young entrepreneurs have ideas, they have skills, why they cannot scale is due to unavailability of affordable, or rather easily available working capital. So, I request the government or the policymakers to facilitate finances. When we have a knowledge economy, we should also have an electronics industrial base for which you do not need huge investment, you don't need big area, you are not polluting industry. All you need to have is consensus decision by the people.

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Rasigan Maharajh
Professor Extraordinary, Centre for Research on Evaluation, Science and Technology, Stellenbosch University, Republic of South Africa

I want to preface my comments by sharing with you all that I am speaking to you from a continent of approximately 1.4 billion people in the midst of the global covid-19 pandemic. As I speak, much of the core capitalist economies of world systems and many from the semi-periphery, including Brazil, Russia, India and China are preparing their citizens for vaccinations. Africa has neither the vaccines nor the productive capabilities for their production. Whilst we face the gloomy prospect of being left behind or relegated to back of the queue, we all know that none of us is safe from covid-19 until all of us are safe. This sad reflection at this time in our contemporary conjuncture provides a useful segue to the comments I want to offer on the presentations by our colleagues on the electronics sector and the knowledge economy.

I want to emphasise the contextual and historical nature of our developmental experiences. I want to challenge the misstatement that suggests we in the global South missed the first industrial revolution. I would like to raise five main points arising from the presentations by our colleagues. Builds upon the previous pertinent and critical comments already submitted by my fellow eminent panellists. These concerns are: 1) the importance of planning, and development; 2) the essential function of high-quality and ubiquitous public infrastructures; 3) recognising the significance of social shaping of technology and continuously improving the progressive engagement between science and society; 4) redefining and expanding local productive competences within planetary boundaries, and most generally: 5) learning from doing, and doing better through learning.

Firstly, the State of Kerala is universally acclaimed as a strong teacher of developmental praxis. As we now venture further into the 21st Century of our Common Era, skills require nurturing and upgrading to meet the technological advances and economic dynamics that inform world systems in our contemporary conjuncture. We, in the global South, look to Kerala to learn more, and benefit from, the lessons generated in praxis of state capability improvements through planning.

Secondly, high-quality public infrastructures which are universally accessible and ubiquitous perform an

essential function in world systems that are in the main, essentially neoliberal, and underpinned by global corruption and the malevolence of private accumulation.

The South African situation stands in stark contrast to the positive depiction of progress in the Kerala-Fibre Optic Network. We must also learn how to better align our propensity for innovation with the mundane yet crucial requirement of maintenance and upgrading of critical public infrastructures. Have we put in place the necessary apparatuses, equipment, and software interfaces to allow and encourage greater utilisation of high-quality public infrastructures and are these reconciled against our internal demands whilst advancing our possibilities of enabling autonomous sovereign policy and technological choices based on our revealed realities? Establishing and maintaining critical public good infrastructures such as the fibre network of Kerala must be lauded and protected from the predatory and rent-seeking instincts of private entrepreneurship and as well, the stagnancy of bureaucratic state capture which serves to maintain the semblance of power whilst disempowering the masses.

Thirdly, in recognising and acknowledging that technologies result from social shaping, we must consistently seek to expand and improve the progressive engagement between science and society.

Fourthly, we must embrace a continuous process of defining and redefining our developmental trajectory to keep within the ecologically defined planetary boundaries whilst simultaneously seeking the expansion of domestic productive competences. The comparative advantages of Kerala suggested by our fellow panellists reveal a wealth of capacities, capabilities, and competences forged over a long period of development. As Kerala has been a knowledge economy for most of its existence, ramping up the intensity of knowledge production and utilisation suggests even exploring a circular vision even for the digital ecosystem.

Fifthly, and finally, Kerala's equitable development history need to sustain and advance in the current epoch through more learning from doing, and by the utilisation of knowledge, doing even better through improving our competences for shared learning. History has afforded Kerala the brand value of progressive values and this stands the State in a better position than other brand-labels that are unfortunately marred by their respective exploitative praxis. Our localisation of productive capacities, capabilities, and competences offer many more advantages to Kerala and these also require further attention and support. We are all proud of Kerala and its developmental pathway. As a guiding light to us all in the global South, we look forward to learning more from you and your experiences. Thank you all again for the opportunity to participate in this significant engagement and I wish all the best in advancing a better life for all through ICTs.Thank you

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Prince Joseph
Chief Information Officer, SFO Technologies, India

I believe that the speech by Honourable Chief Minister and Honourable Finance Minister has laid the background for a digital platform for Kerala. What sparks our interest and catches the signals on our antenna is things like the explicit mention in the State's Budget about Digital Platforms and trying to pave the way for a whole new set of job creations in this area.

Enabled by the understanding of what happened through the pandemic and the '(WFH) work from home', '(WFA)' work from anywhere kind of culture, there is a readiness now for the new normal. This means a great commitment for ensuring that the K-FON project goes through seamlessly, and the socially ambitious plans such as provision of laptops and internet connectivity across the state to all the families that need it. There is a real drive and momentum in this space.

How do we keep that production line running? That disruption actually forced us to start innovating, to start thinking about how to improve, to think about how to reduce the dependency on some of these risks that we encountered, which will affect our bottom line.

We are now looking very seriously at the industry 4.0 solutions. This is the time to get hyper-connected. So internally we are a vertically integrated manufacturing company in all sense of the word, for products and for process. And now, we want to expand on that, spread out and become horizontally integrated, linking our supply chain with higher integration and data sharing with our suppliers and our customers. In fact, our approach went through a couple of iterations and we finalised at the moment on seven streams, where we actually need to focus on for our core business.

We have heard of Foxcon and Keltron and SFO and they have all had different journeys in the past two and a half decades. The way ahead requires a new set of thinking, capability, skill set, and strategy. There is a need to migrate from a legacy mindset into a growth mindset. What is needed for the future and by our next set of customers is to demonstrate industry 4.0 capabilities.

On exactly what can be reused, optimised, one example is a better view on inventory, across locations, sites, divisions and production stages and utilising this

knowledge on material availability to gain benefits. There was a study and analysis that we did and, we came up with a solution that to a good degree of accuracy projected what output we can produce based on the material at hand irrespective of demand. So, how much can we potentially convert at any given point of time.

So a lot of that is gone into Integrations of data systems and tuning of processes. So I was listening to Madam Hemalatha and the plans at Keltron and I was also thinking, there are some battles. There are some lessons. There are however some important steps that we can probably work on at the moment. My focus has always been about trying to ensure that the operations are geared towards our customers' needs and most of our target customers are overseas or export oriented.

Another critical element, I think nobody touched on till now is on the cyber security. One of the areas where we need to have a heavy focus is on cyber security as we are stepping more into OT, which is becoming automated and integrated to the IT layers. You can't do that without having segregation and a good layer of cyber security coming in all these elements. So the investment suddenly on that front has also garnered more weightage.

The helpful fact is that investment in IT and IT projects or technology projects which is going to be enabling new lean modern production operations is not hampered; there is recognition of that from all stakeholders. There's an awareness and an appreciation that, it is necessary for us to maintain even the position that we have today. And only then can we even imagine or expect to have future growth.

So, I look forward to listening to more of the expert panels. I went through the names and I thought this is an incredible array of experts from across the globe who is weighing in with their inputs. I probably don't fit in this elite academically brilliant panel. So I'm really humbled and these are the thoughts that I just wanted to share and I'm happy to take any questions or participate in the future discussions. Thank you.

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Keun Lee
Director, Center for Economic Catch-up, Seoul National University, South Korea & Vice Chairman, Presidents Economic Advisory Council

Actually, I was supposed to be in the session one, but I had a meeting with the Council (of Economic Advisors), so I couldn't join that time. Now I'm glad to be able to join this last concluding session. As introduced by KJ I have been recently appointed as the vice chairman of the National Economic Advisory Council of Korea, which is like the CEA in the USA. Mr. President himself is the chairman and I am the Vice Chairman from this week.

As a policy response to the Covid-19, the Korean government has proposed a new policy line, called K-New Deal, which has three components. One is the digital infrastructure, and the second is the new growth engines including bio-technology and the third component is new social safety deal. So, the government is putting a lot of budget on these three aspects of the new deal.

Today, we have had many discussions about the importance of education and re-skilling and up-skilling in a knowledge-based economy. In this context, one essential issue is making education more accessible, and e-learning system by digital technology is one of the most efficient means to achieve this. You can make education not only efficient but also based on mass customization. Another thing is digital labor market. Nowadays, there are many web or app-based service matching between tasks and people supplying that task or service.

Another topic we can discuss is about start-ups and entrepreneurship. Every country tends to have its own policies for start-ups and we may learn from experience in China or Thailand. They are creating something like a start-up centres or spaces where they supply potential entrepreneurs with basic devices like 3D printing machine, laser cutters, and other basic devices for new entrepreneurs.

In the meantime, when we talk about knowledge-based economy, it is often useful to distinguish two types of knowledge, namely scientific knowledge (represented by academic articles) and technological knowledge (often represented by patents etc.). Then a related issue is how to translate them into practical usages by industries, namely the issue of commercialization. Unless there is an effective national innovation system, scientific knowledge tends not to be

utilized but remain within the ivory tower.

Last, I would like to mention that to be effective in policy making and implementation, one simple but effective approach is bench-marking preceding success stories from neighbouring countries. In this regard I would say China might be an obvious bench-mark case for India to derive and take some lessons. As is well-known, may policies in Korea used Japan as a benchmark, which is cost-effective way.

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B. Innovation system

M S Rajashree
Vice Chancellor, APJ Abdul Kalam Technological University, Kerala

I am extremely happy to participate in this international consultation on transforming Kerala to a knowledge economy and feel privileged to chair this session dealing with innovation system, the key pillar of a knowledge economy. The need to innovate is the basic prerequisite of a knowledge economy. Kerala has the history of chartering an innovation system centered around its people. Education and health were the primary emphasis for development. Along with public funds, private funds were also channeled for affordable health care and education thus making Kerala a development model in these sectors for rest of the country.

Innovation and technological changes are the key drivers for knowledge economy. In order to leverage from these two elements Kerala needs to develop an ecosystem based on an efficient knowledge system. A knowledge system that connects industry, education, research institutions and government is a critical element in contributing to regional and local innovation system. The efficiency of this knowledge system is predominantly determined by how well the knowledge is organized to contribute towards development at the local and regional level. Once the industry is enabled to use the knowledge created from education and research the industry will be able to offer knowledge intensive businesses and service activities. Studies have shown that manufacturing industries, especially MSMEs, are becoming increasingly innovative with higher R & D expenditure and greater integration with knowledge providers viz educational institutions and R&D centres.

Knowledge System can be strengthened by the creation of common infrastructure and developing missions/entities responsible for facilitating greater connect between components of the Knowledge System. Kerala has demonstrated this through the establishment of Kerala Startup Mission (KSUM) and Kerala Development Innovation and Strategy Council (K-DISC). KSUM has developed a vibrant startup ecosystem in the state. The state has initiated a startup movement through the KSUM for forging and implementing forward-looking policies related to startups. KSUM supports the startups though a plethora of activities

for strengthening them in the state through infrastructure, funding, linking startups to businesses and by providing all other support services. The present focus is to foster the growth of innovation led, technology startups. Kerala possesses a unique model of connecting academics, industries, R&D institutions and startups through the KSUM. KSUM is also responsible for the setting up of major infrastructure facilities and other allied services necessary for startups. The facility thus set up is shared by all the stakeholders across the state.

Kerala Development Innovation and Strategy Council is a strategic think-tank and advisory body constituted by the Govt. of Kerala. K-DISC brings out strategic plans, identifies new directions in technology and creates a conducive ecosystem in Kerala for fostering innovations through various engagements with academia, research and development organizations and with the government.

In knowledge economy, research priorities and policy issues should be explored by a group of institutions which form part of the knowledge system. 'Knowledge' as a concept should be unfolded into elements that can be analyzed and applied to both industry and regional innovation. Fundamental research is needed to understand how knowledge is transforming innovation processes enabling sustained economic development. The outcome of this research will lead to improving all the components that are part of the knowledge system. This will lead to the understanding of new interventions required in furthering developments of the economy through infrastructure creation, policy making etc.

The competencies required for driving innovation and embracing technological advancements towards the development of all sectors require a robust Higher Education System. The Higher Education system should (i) enable the creation of talents with innovation mindset (ii) produce agile work force with competencies in digital technologies (iii) lay emphasis on IP based research (iv) facilitate strong industry connect (iv) generate entrepreneurs capable of creating businesses which can bring in sustainable economic development with access to national and international markets. These issues I hope will taken up in next session.

Industry 4.0 is transforming the way businesses work and also the manufacturing landscape as a whole. Adoption of digital technology in all sectors, empowering such sectors will be a game changer in Kerala's journey towards Knowledge Economy. In this effort, Inclusive development can be made possible if the digital divide is properly addressed. Kerala's proposed infrastructure for connectivity will address this. Traditional manufacturing technology will be accelerated by the Industry 4.0 technologies such as intelligent robots, autonomous drones, sensors and 3D printing which are proven to be exponentially growing technologies. The convergence of these digital technologies and existing industry

will have positive impact in the local and global value chain. The innovation activities around these converged areas will need to be channeled to the global innovation system thus creating open innovation culture in Kerala.

An open innovation ecosystem which is connected to global innovation system especially in high technology areas will be a promising base for Kerala's growth and development based on Knowledge Economy. Such a vibrant ecosystem will reinvent itself with the dynamics of each of its components and also reorganize the organization of Knowledge and its flow in the value chain from time to time for the state's economic development. With this background I would like to invite Dr P V Unnikrishnan.

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Evolving an innovation ecosystem for Kerala

P V Unnikrishnan

I shall start off with some brief comments on Kerala Development and Innovation Strategy Council (K-DISC). It's a rather new organisation initiated in the state in 2018. It is only one of its kind because, State Innovation Councils established at the instance Sam Pitroda in 2010 in all other states have been wound up throughout the country. The only state with the remnants of the State Innovation Council is Kerala where it has been remodeled. That is how K-DISC originated. Brief introduction about K-DISC activities has already been made by Dr K. M Abraham, our founder Chairman. Hence, I will not attempt to make a comprehensive overview of K-DISC activities.

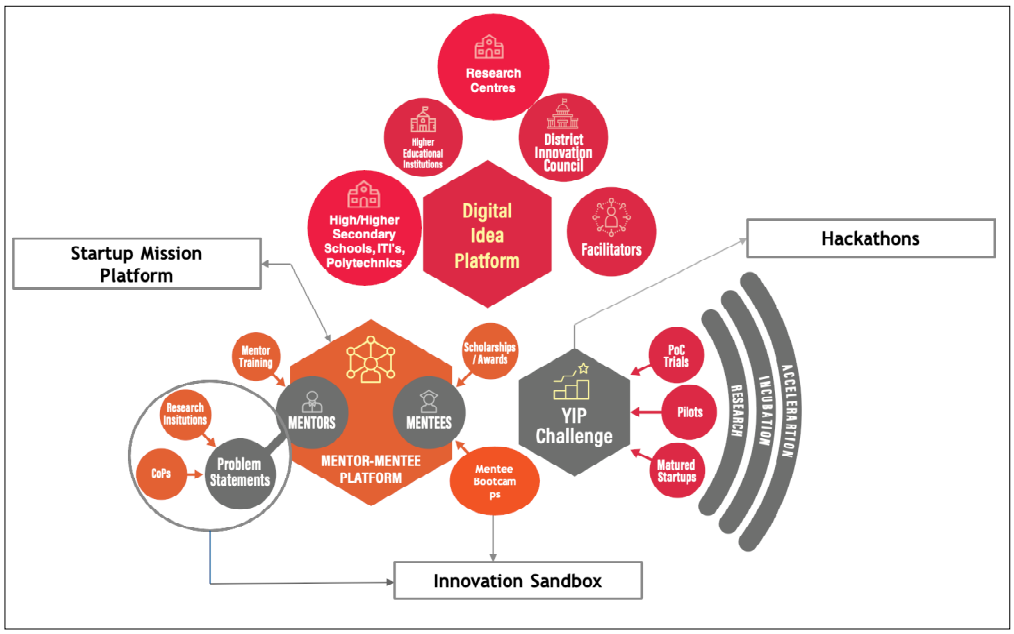
To give a taste of the activities leading to innovation promotion in government done by K-DISC, I will touch upon three projects; a project called the Blood Bag traceability, where we work with the General Hospital and the Parasalla Community Health Centre. They work in a hub and spoke mode to meet the needs of blood transfusion. In this project we have used a technology developed by Bagmo Private limited, a startup in maker village to reduce perishability of blood bags using IoT devices. The second one is a collision avoidance pilot with Intel for KSRTC wherein using telematics the possibilities of collision between vehicles is reduced. This is going to be implemented in new vehicles for KSRTC financed by KIIFB. Third one is a real time retinal image quality assessment and feedback system for government ophthalmological hospital Trivandrum. This is done with support of C-DAC. These projects undertaken by us belong to Industry 4.0 technology adaptation in government departments.

My focus however is on the innovation ecosystem, which is primarily for democratizing the innovation system in the state. It's a flagship program of K-DISC. The objective of this program is basically to nurture young talents interested in pursuing avant-garde research academics and business model building. We have promised a three-year hand holding for idea creation, prototyping, testing and launching. Prominence is also given to social innovation, along with business development. We partner with the Startup Mission. Capacity Building of

mentees is around the Stanford University Methodology of design thinking which has now become the de-facto standard for real life problem solving. We have a program for mentoring of mentors specially developed for us by the IIM Calicut. This looks at a new product development framework integrated with a fuzzy front-end. Basically, we are trying to draw practices from the industry for product development, trying to weed out the fuzziness of the ideas and to put the process in the discipline of new product development.

We have a program in which any new innovation can be fostered with its focus on democratising innovation, it cannot be a blueprint program. It has been continuously evolving. Over the years, there has been an increase in the number of ideas that came up; 1391 ideas in the first year (2018) which increased to 2000 during the second year and almost doubled that in the third year. We have a very strong funneling approach of removing ideas which might not work and which are not worth pursuing. Thus, we had to reduce the ideas in 2018 to 204 which increased to 371 in the second year and 800 in the third year. We have put in a mechanism of generating ideas from schools, colleges and universities. We have a network of 1143 institutions during 2018 we just now enhanced this to 2900. Around 400 of them in our network are professional colleges and university departments and the rest of them are schools, polytechnics and other institutions. From each of these institutions we have, two facilitators who are our ambassadors who have been trained in the industry 4.0 and the innovation methodology. We have tried working out a hub and spoke mechanism wherein eventually the hubs would emerge as Centers of Excellence. This would be linked to various partner institutions making the spoke mechanism. We have developed a very clear methodology not only for screening the ideas, but also for improving the group dynamics within the ideas through group techniques.

This is the architecture of the young innovation program which we have built up. We have a completely electronic platform for doing all our operations. We have a digital idea platform, which is connected to high schools' polytechnics and higher education institutions and research centers. We have District Innovation Councils, which are going to come into action from this year onwards in the evaluation programs. We also have a mentor mentee platform, which is completely electronic. One of the very important things that we have found as a part of the first few years of the program is that very systematic mentoring is required, both from the industry experts as well as from the academia for translating ideas to clear targets. We have not been able to put that in place during the first year. But during the second year, we have been able to put in place an electronic platform for this. We hope that the quality of delivery would substantively relate to mentoring. The mentors have been trained and positioned.



One of the weaknesses of the program is that we don't really get good ideas. Essentially people pick up ideas from the google and them; these are not really real-life ideas. So we have brought into two methodologies, one a methodology of creating real life problem statements with the help of practitioners through community practices. This is an internationally renowned methodology of situated cognition. Then secondly, we are trying to create a process of innovation sandbox, which is a methodology of improving the real life, real time, problem solving experience using crowdsourcing and open innovation and bringing in vital user experience.

Now, thanks to the efforts of the Honorable Finance minister, who has made an evaluation of the program. He wanted us to scale up this programme substantively and we are restructuring YIP in 2021 to meet his dream. YIP is a mix of challenges. Right now, following the idea challenge, we have the accelerated the innovation track. But beyond that, we are also now bringing in team-based hackathons, and a coordinated programme of rapid proto-typing jointly with fab-lab and startup mission. With this we are hoping that the Young Innovation Program is going to make a major transformation.

The outcome so far; 31 products have been structured for priority funding and we could hardly spend 1 million rupees for this process. That is one of the limitations of the programs. We have been able to do the democratization reach out to the campus, bringing together the teaching Community and the students, but in terms of converting the ideas into innovations, we are lacking, and that is

why we want to get into a sandbox methodology for deepening the innovation process.

Now, coming to the next program which caters to the ecosystem building in the MSME sector. In One District One Idea Program, we have identified 266 clusters throughout the state. It covers handicraft handloom Kudumbasree service clusters, Kerala Bureau of Industrial Promotion manufacturing clusters and other manufacturing clusters. These have been selected for a challenge. Digital University had come up with an excellent training program for the core group. We have brought in professors from commerce department, economics department and also from the engineering college to work in the field with these clusters and develop innovation action plans for them. Thus, we are bringing in academia in a big way to work with the industry to solve their problems- Making the triple helix model a reality. The objective is to come up, not with the incremental growth as the Honorable Minister was discussing in the previous session. It is not incremental growth but exponentially growing clusters, that we are focus i.e., innovation clusters.

Now, coming to the one local government one idea program. The design of the program is similar. We start off with a shelf of projects which have been identified by local governments, run hackathons across specific domain sectors, go to a local government marketplace, select products for support and then theses goes back to the local government for implementation.

And the last programme is the local innovation program. The design of the program is as follows. We crowdsource ideas from anyone capable and interested. There is a panel of experts at the State level and at the District Level. There is a rating scheme and based on which we come up with a local market place for the POC and the pilot and which will be taken up through various local governments and public sector. One of the most important things is that the first product which K-DISC has initiated is ready to get into manufacturing. Rajeesh Rajan, a Polytechnic diploma holder, who had developed a ragas engine. A two-stroke elliptical IC engine. We had sent his design for computer fluid dynamics studies. And basically, this has helped him improve and patent the engine. He wants to take it up to the aircraft engine manufacturers and to work with DRDO. Yesterday he came and presented that to us. And so, the local innovation promotion program, which we kicked off three years back, has just started bearing fruits.

Let me conclude by talking about the three pillars of focus in the budget. One is the Innovation Economy, the Digital Transformation and Creating the new workforce. The innovation economy component is the one which I talked about primarily. I also briefly touched upon digital transformation, because the ODOI program looks at digital transformation of MSMEs. The local government One idea one Local Government program also takes up digital transformation. We have been involved in a small scale in developing the

new knowledge economy workforce. We have been working with KBA and ICT Academy for developing the Accelerated Blockchain Competency Development program. Now the new knowledge workers skilling program has been also passed on to us. So, this is a great opportunity for K-DISC along with its partners to have been involved in the three pillars, so our final objective would be essentially to involve with the Kerala Knowledge Economy building process through skilling of knowledge workers, driving innovation ecosystem, innovation collectives and startups and also moving towards digital transformation of various sectors.

Last, but not the least, let me touch upon the very specific critical point which Professor Lundvall had raised in the first session- if we focus only on scaling the Knowledge Workforce and strengthening the ICT industry, there is a possibility of alienation from a section of the non-digital economy. A huge section of the citizenry will be left out of the knowledge revolution. It's a very important point. Through the higher education strengthening, digital transformation, innovation building programme as well as the Social Security initiatives we have looked at this in totality in the budget. I would congratulate the Honorable Finance Minister for coming with such an excellent blueprint for the Kerala Knowledge Economy. Thank you.

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(Dr. P V Unnikrishnan is Strategic Advisor, K-DISC)

Kerala start-up ecosystem

Tom Thomas
Project Director, Kerala Start-up Mission

We are always leading the way. In 2019, we launched one of the largest startups in the country with 1.80 lakh sq. feet area. In 2016, the policy came on, and the objective was to create organizations that create jobs and wealth. Kerala unfortunately, have a huge brain drain that comes in terms of qualified people moving for job as well as good startups moving out of the state looking for larger market. We have been trying to solve this; how do we attract the talent back? How do we create more talent that are really aligned with the new knowledge economy? How do we inspire people to take newer technologies? To address these questions, the first is to kind of evangelize about technology and startup. Second, is to create programs that make use of new technology and this includes digital fabrication, block chain, augmented reality and virtual reality etc.

Then how do we make sure that there is a good talent pool being developed? So we work a lot with KTU and other universities to make this happen. How can we encourage youngsters and professionals to start building solutions? We do a bunch of challenges; we create innovation zone and may try to make sure that there is always something new happening in the ecosystem. One week of the supporting experiment, then grow into startup and that is the way we have launched. We help them get into incubator give away the early stage funding so that they have a launch pad.

Finally, we look at how we help them to work with the government. How do we make sure that there is a large capital available for the startups to grow? In terms of the evangelization part, we have four flagship conferences around the year; one focuses on student summit. Then we ensure that more women take up entrepreneurship. We have also formulated the women freelancer development program, where we are trying to find women who have left jobs due to various family circumstances and would like to get back. How can they have the flexibility to work from home and thus contribute to economic growth?

The second part is the educated; primarily what we have done here is that set up a network of 200 plus innovation cells in various academic institutions. This kind of helped buying those small breakthrough ideas from these colleges.

Maybe, a student who is really good in technology and we tried to get them into other programs like FAB Academy summer school for the various universities across the world. The FAB academy programs are very important. The reason is, we are considered one of the top two centers across the world to run this program and so far had about 60 graduates and all of them placed in good companies and many of them working with hardware startups to build their own product. This program is possible because we have a large network of fabrication lab across the state. We have two main labs in Kochi and Thiruvananthapuram. We have 20 smaller labs across the state. This essentially gives students and youngsters access to the new technologies like 3D printing, laser cutting etc. We can really allow students to build and that is an essential part of both learning as well as creating newer company. What we have recently done is to work with MIT to set up a super fab lab. So this is MIT fabrication lab duplicated here. The journey of fab lab is the kind of a long journey. What we have also realized is that there are other newer technologies that we need to look at.

Unfortunately, Covid came in and we had a step back and see how we can offer online. Here, we give access to the advanced machines, gadgets and learning capabilities. This also gives access to high powered GPU and the provider is that of mentoring and training program or started working on these future technologies. Going forward, this is where we really need to be, because if you look at the state you have a favorite of software coming up. We are starting to be known as the startup hub but that is not enough from our perspective. We need to be known as the hub for one of those technologies so that we can attract talent interested in those technologies and startups based on it.

What we also do with the various government departments is to create innovation zone. For example we work with Water Authority; found out some of solutions for their problems. We do this through running various idea challenges, throwing out problem statement and finding good ideas that can be developed. For the products and ideas that come up, we have specialist incubators that take them in and help them finish engineering prototypes and go to the market. We have one for hardware, and bio-technology. We also have one that will take mobile based technologies which basically give launch Space Technology incubator in Thiruvananthapuram. This is in collaboration with ISRO so that we get access to technology and products of ISRO. In addition to this, we have our own incubators across five cities in the state, all of them provide mentorship and various networking opportunities for startups. What we have started doing additionally is to link them with industries so that they get good, early adopters and good business.

We also provide early stage grant through innovation grants, seed loans, patent support and R&D grant for companies. In addition to this, we provide

marketing support. We used to take them outside India for various conferences and that have been a really good platform for many startups to learn global business.

We have also created venture fund, with the support of the government. So far about Rs. 74 cores of funding, that our startup can have access to and for that we work with a variety of leading partners across the world. It is very easy for departments to procure from various startups at the tender process. Through this, up to Rs. 1 core of product can be purchased by departments from the state. Some of those key projects are also being handled by K-DISC. Today, we have about 2.6 lakh sq.feet incubation space spread across the state.

We are probably the only state that has incubation space available throughout the state. Other states have a concentration in one city like Bengaluru or Hyderabad. Kerala is making sure that startups across the state had access to information space and mentoring. We have about 1463 startups and for them the support of Rs. 50 core of funding is available. Last year, we launched the integrated startup complex, which is a 1.8 lakh sq.feet building. The key question for us now, how do we get startup in, how do we create newer technologies. How do we get them enough skill and talent? If we can find some of those key opportunities and build around, this would attract larger companies to the state.

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(Mr Tom Thomas is the Project Director, Kerala Start-up Mission)

Reflections from experts across the world

Xiaolan Fu
Director, Technology & Management for Development Centre,
University of Oxford, England

Looking at the first presentation which has given a very comprehensive introduction about the various programs introduced in Kerala that included among others, young innovators program of the K-DISC, one district one idea, and the local government program. I am really impressed to see that you are doing all the right things. I think Kerala may become another star in India, like, India has Bangalore. I think Kerala will be another star in the fourth industrial revolution. All the technologies for the future and the ecosystem for the start-ups are being set in place.

India's economy has taken off since 1990s. It's really going very fast, and India now is one of the emerging countries and I believe India will continue to grow very fast. India has a lot of world class minds and it has not reaped the potential. I have been thinking about how to help in this aspect. Here one of the major aspects is the implementation of the great plans. Implementation issue is not something that is confined only to the innovation or science and technology sector. We need the right institutional, economic, and political background to enable all these bright plans to deliver.

These are excellent plans, but they are very much focussed on the domestic activities in India. My research about innovation in China explains why China has been able to catch-up. One of the lessons that we could learn from China is the role of an open national innovation system. In my book, China's path to innovation, I described that Chinese national innovation system is linked with the global innovation system and global knowledge pool through various links such as international trade, foreign direct investment and both. You are aware that India is becoming an attractive destination for the MNCs and Indian MNCs are increasingly investing in other countries.

We could observe the active involvement of Indians in some of the major innovating countries and building their national innovation system. This is facilitated by the movement of people. Such mobility of people facilitate the exchange of ideas especially the tacit knowledge that otherwise rarely cross the borders. And then looking at China's experience in trade, it is evident that China has the highest level of trade to

GDP ratio among major developing countries and it's higher than Japan and the US. China is the largest recipient of foreign direct investment and in recent years, also become a large investor abroad. Further, China has also benefited from diasporas exchange in the recent years.

I think India's experience is the same while during the early years there was much worry about brain drain, which now increasingly being brain circulation. It's also correctly used to teach the technology to accelerate the knowledge exchange and also innovation. Another key factor is international collaboration. Now countries, increasingly using international collaboration to foster innovation. This is not only for developing countries to stay where they are. They want to collaborate with the advanced industrialized countries for innovation. So industrialized countries like OECD, European Union and US very much emphasize on collaborative innovation and what my research which part published last year also finds Chinese firms benefit from innovation collaboration. So, this kind of open national innovation system in China uses both the domestic and international resources, talents, and markets. There are two major drivers in this process. One driver is market and another driver is the state, although they have different roles. The role however changes at different stages of innovation. The state in the early stage plays more important role in heavy investment and high risk activities and that of market is more at lower end of commercialization. So, I think this open national innovation system approach and could be considered in Kerala.

In UK and in many of the other innovative countries, the Indian scientists are excellent. They are good in science and good in management and the leading role in the technology companies. I think the start-up ecosystem design is also brilliant. However, it is also important to bring the international dimension and put it in the broad context. I think that the support needs to come from the whole country, especially the industrial foundation and infrastructure to make it really deliver the full potential.

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C Balagopal
Founder and Former Managing Director, Terumo Penpol Ltd

I want to specifically talk about one aspect, which is from the perspective of high-tech manufacturing industry operating in Kerala. More specifically, what kind of support and what kind of synergistic role the state can play with the innovation ecosystem? I think the biggest user of all the innovative science and technology products and facilities which are sought to be created by K-DISC and by the Kerala Startup Mission is going to be the MSMEs. I have been associated with the startup Mission right from it's very beginning and I am impressed at the progress which has been made, but I think we are losing something by this almost exclusive focus on startups. As I said earlier, the biggest user of knowhow and innovation is going to be the existing high tech manufacturing industry. There is a saying in innovation, that necessity is the mother of invention! So somebody must be feeling the pressure. Somebody must be feeling a problem burning a hole in their balance sheet so much so that they are always seeking a solution. That burning 'necessity' to innovate can never come from a young guy who's studying in college or younger or someone who may have some idea.

The second thing is the ability to recognize the value of an innovation as a property of business and industry. Only when you're looking for something, will you be able to recognize what you're seeing. So the problem here is we have a dichotomy. We have R&D centers and high tech labs of research institutions which are working on projects, and somewhere else we have industry, which has got problems. And the two are not talking to each other, not meeting to discuss these problems. So my recommendation is that both K-DISC and Kerala Startup Mission must create such a platform to bring industry and the institutes together. I'm talking from first-hand experience because I set up a small startup, that later grew to global scale before I sold it as the world's largest maker of high quality blood bag systems. I had the great good sense to develop a personal excellent working relationship with Sree Chithira Tirunal Institute research labs. I also used the Keltron tool room, which today houses GIFT. I used the facilities and expertise of the Indian Institute of Science, Bengaluru, and several other top R&D establishments. So I think what's very important is that the

platform must be created which will enable MSMEs which are already successfully working within Kerala to be able to access and continuously have an interaction with research institutions, research labs and even the Maker Spaces, Maker Village and all the other facilities.

The second proposal, which I have, is related to the first one. These MSMEs include companies with revenue up to Rs 2000 crores and which are globally successful, with huge balance sheets, operating in very diverse areas ranging from steel casting, medical device manufacturing, electronics hardware, medical diagnostics, dental prostheses, etc. Now, here you can have a system of internships, fellowships and sponsored projects for which the platform can again be provided by K-DISC. These industries will be very happy to welcome young bright students from engineering colleges and science research laboratories to go over to their facilities to work on their projects and learn by working on the shop floor with their scientists and technologists. Similarly young technologists from industry can go to R&D institutes and do such programs. Unfortunately, today they are all working in silos.

Third, if you take the successful high tech manufacturing sector already operating in Kerala, they can be grouped into certain clusters that may or may not be contiguous. And there are natural clusters already existing: you can have a medical device cluster around Trivandrum based on TPPL, HLL, and TTK Healthcare; a steel casting products cluster around Calicut around PeeKay Steel Castings; spice extracts and food processing cluster at Kozhencherry, and then a garment cluster at Kizhakkambalam. If you create these clusters, then I think that would enable some common facilities to come up, which K-DISC can provide which will be beneficial to these clusters, since it will be difficult for an MSME to set up a lab or a testing facility.

To sum up, many elements of science, technology, and innovation eco-system are already existing here. The point is to connect the dots. So you have elements of a beautiful startup ecosystem, you have very successful high tech companies, you have one of Asia's premier research institutes in Trivandrum for medical devices, and so many others in other advanced fields, if you can create a platform for them all to talk to each other and exchange ideas, you will find a tremendous amount of cross fertilization of ideas happening which will lead to very good things. Thank you.

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Erika Kraemer-Mbula
DST/NRF/Newton Fund Trilateral Chair in Transformative Innovation, the 4IR and Sustainable Development, South Africa and Vice President, Globelics

It's really fascinating to hear and to learn about Kerala's experience. It's also given an opportunity to reflect from the environment in South Africa. It is also helping to think about our own ecosystems and highlight how important it is to have this collaboration and sharing of experiences.

I was very glad to listen to the presentations about the innovation ecosystem. Two initial presentations that spurred the discussion and it appears that the state has done a lot in pioneering to support the startups at various levels. I can see from the presentations that there is quite a good and deep understanding that supports the local innovation system, not only about creating incubators and accelerators but also requires the broad understanding of the resources and the actors at different levels that they are, and also have an in-depth and real time understanding of the challenges affecting the business community and the local entrepreneurs. I think, this has become very evident in the time of COVID. I just had a quick look at the news which show that the support for entrepreneurs has been quite intensive during the pandemic in Kerala.

I would like to just make three points and some of them have been raised by the previous commentators. The first point relates to the time span of the commitment that we need to build local innovation ecosystem. Supporting an innovation ecosystem is not a once off initiative. It requires a long-term commitment, and it is quite challenging when the conditions are changing. Sustainability of this effort is also being raised by others that has to do with implementation. I would like to emphasize here that for local ecosystems to be sustainable in the long run and survive the changes over time in terms of prioritization and financial resources, it's important to empower not only the local businesses, but also the whole constellation of organizations and actors that's around. This includes the entrepreneurial centers, training organizations, the chambers of commerce, the NGOs, the tech communities, the centers of institutional

research, the providers of funding and so on. The empowering and supporting of these organizations is essential because they will carry the load and they will fulfill the functions that are needed for a local ecosystem to thrive and survive even in the absence or in cases where government support may be weaker than others.

I think from my point of view, there is a very important role that government can play in terms of empowering the constellation of actors that surround firms. Another important role that government can play, as raised by others, is to guide the direction of this local innovation ecosystem. So, a lot has been discussed about the outcome. Preserving the quality of natural and social ecosystems must be a part and parcel of the way in which innovation systems are conceptualized, supported and maintained. Others have talked about environmental sustainability as the natural environment and society cannot only be seen as resources but also as part of the outcomes. So, do we maximize profit only for firms? or do we also maximize profit for environment and for society? Here we bring up all dimension of inclusion and this is a point that I would like to reflect on the context in which I am.

We often talk about the needs to create entrepreneurs and I usually sit uncomfortable when I hear that expression. Because I only need to step out of my house and go and buy bread and I walk past at least 20-30 entrepreneurs. Many of them are informal and many of them are survivalists but some others are testing and trying new ideas. And we often leave these actors out of the way in which we think about entrepreneurs in local innovation systems. And again, I think there's a lot of room to think about how do we bring in this new and emerging technologies, including digital technologies but also more advanced technologies that we are referring to here. And with this large pool of entrepreneurial resources that we have in our context in being formal economy and this brings us ideas about how to make our local innovation systems more inclusive and how to think about upscaling reproducing and so on. Some of these businesses and connecting them more successfully with their new and emerging technologies.

The final point that I want to say again is a stronger rooting of our local innovation systems with the reality that we live in, in the sense of connecting to the informal economy and bringing that inclusion into it. I don't think there is a contradiction between supporting and routine local innovation systems with the global dynamics. I think there's a lot that can be gained in terms of exchanging ideas. I see a lot of room for south-south collaboration for fusion of ideas and social innovations. There is quite a lot of similarity and a lot of room to share and to learn and embedding these dynamics in how we conceptualize and support local innovation systems is also very important. I'm going to stop there. Thank you.

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Srikumar Chattopadhyay
ICSSR National Fellow, GIFT

Kerala's achievements in the social sector have met most of the criteria envisaged under social sustainability. However, on the ecological front, there are perceptible gaps that warrant due attention in the course of transiting to a knowledge society.

The natural resource base provides the foundation for economic development. The nature and type of these resource use, changes with the progress of civilization and technological advancement. The social, cultural, economic, and ecological orders of the world are changing with the production of knowledge and its useful application. The transformation from a resource-intensive society to a knowledge-intensive society is deeply innovative, dependent on the use of human knowledge, sensitive to natural and environmental resource use, and ecologically resilient.

Kerala is blessed with strong natural resource endowments. The state has successfully harnessed the traditional natural resources including hydropower generation. However, management of natural resources is not prudent always. There is a complex ecological interdependence among the components of natural resources. A linear approach often fails to take into account this complexity. As a result, several problems crop up and ecosystem services are affected. The change that is taking place with respect to natural resource use in Kerala warrants proper attention to improve the knowledge base. Natural resources-based economic development trajectory in several countries underscores the importance of combining useful knowledge with strategies to develop capabilities by transfering technology and knowledge from other (leading) economies as well as local scientific organizations relevant for natural resource-based industries.

It is important for Kerala to examine the present use of natural resources and reorient present practices, wherever necessary, for contributing to the knowledge economy. Here, we attempt to briefly indicate some of the areas to initiate actions.

1.Bridging the knowledge gap in existing natural resource useed sectors

Bridging the knowledge gap assumes great significance in pursuing a natural resource

based knowledge economy. For example, it is important to search for a coastal tract to site a seaport, which is neither accreting nor eroding. Accretion and erosion along the coastline are related to sediment movement. The sediment transport pattern along the Kerala coast varies temporally and spatially. Some parts of the Kerala coast experience domination of net northerly drift whereas in some cases the movement is southerly. Although, there are some studies pointing that the site-specific knowledge is lacking in many cases. It is important to generate a detailed knowledge base to suggest appropriate locations for siting of ports, particularly fishing ports. Otherwise, the port may be affected and will need huge investment for keeping it operational.

2.Precision management for traditional natural resources

Precision management is an emerging area in traditional natural resource management of land and water. Agriculture is one sector where precision management has brought out significant results manifested in enhanced productivity and optimum use of inputs. Irrigation, water management, fertiliser use and cropping system are areas warranting the introduction of precision management.

3. Harnessing new natural resources

Kerala has a long coastline of 560km. The exclusive economic zone spreads over 2.18 lakh K.M. There is huge scope for developing the blue economy. It not only the fisheries sector, tourism, and maritime transport but also the offshore renewable energy, aquaculture, seabed resources, marine biotechnology, and bioprocessing. The tapping of wave energy deserves urgent attention. Experimental data have been gathered for the Vizhinjam area. It may be explored for other areas also. Solar power is another energy-producing sector with huge potential for the state as it enjoys long hours of sunshine.

4.Green economy

Knowledge-based economy, green economy, green technology and creation of green jobs are interrelated. The importance of a green economy is well appreciated to transit into a low carbon economy and reducing environmental risk and ecological drawdown. Many countries are gradually shifting to a green economy as part of the knowledge economy. It warrants the involvement of higher education centres and sustainability-oriented research departments.

5.Reorientation and building of institutions

To accomplish all these tasks it is necessary to set up processes that support interactions among the existing organisations, facilitates access to the existing knowledge, creates new scientific knowledge, build-up capabilities and new institutions for interactive learning, and disseminate and share knowledge. One of the strengths of Kerala is its education system and academic base with stong focus on science and technology. There are professional organisations dealing with every major sector of natural resources like land, water, forest, fisheries, minerals, etc. University departments are imparting higher education in many of these sectors and allied disciplines. Natural resource-based industries are set up. However, there is hardly any meaningful interactions/ collaborations among these organisations. Strengthening of collaboration and sharing of useful knowledge is important. Thank you.

Thankom Arun
Professor, University of Essex, UK

It is good to see the Kerala state is taking many steps in developing a knowledge economy framework. It is undoubtedly a much-awaited one, and Dr Isaac's budget would be considered a game-changer to the States' vision in explicit terms. The presentations are awe-inspiring, and I have learned quite a lot about innovation in the State's ecosystem. The term knowledge economy brings the images of Silicon Valley, the tall rise buildings and high-tech startups. But these are part of a wide range of activities that foster economic growth based on the knowledge economy.

We may need to support the knowledge economy concept in a more holistic spirit, and the entire society needs to embrace the idea. The European Bank for Reconstruction and Development (EBRD) considers the increase in total factor productivity as an indicator of the knowledge economy. Most times, more than the leading innovations, what we require is technological dynamism and a broader approach to innovation. The development or adaptation of a new product, process, marketing methods, and organisational structure changes is part of a more comprehensive innovation approach. We can relate the knowledge economy idea in Kerala's context beyond a narrow and measurable path.

Paul Romer, the economist who got Nobel Prize has published two seminal articles in the Journal of Political Economy in 1986 and 1990 on long-run growth and endogenous technological change. He approached the knowledge economy like the one built around ideas that do not have a diminishing return (Jones, 2019). This is a turning point from our understanding of Solow's growth model and diminishing returns to capital. Kerala is a unique case in this context. Over time, the state popularized many ideas with people's help; the most common feature of these ideas is the generation of networks.

The networks across individuals and institutions need to be further developed into sustained knowledge hubs. Our universities and research institutions have the daunting task of knowledge production. Ideally, this has two steps.

The first one is to achieve the local knowledge's full potential, followed by engaging and contributing to global knowledge production. We have transformed and made some significant inroads in utilizing tacit knowledge and local ideas compared to many other regions in the world. However, considering our underutilized infrastructure of public sector enterprises, there is further scope for developing research collaborations with the Universities and other institutes. Many public sector enterprises can provide domain support to begin start-ups with the University talent using their unspent resources, opening up new ideas. Our mammoth global exposure as a community would be a useful asset in linking up with global networks. Taking advantage of digital technology, we may link up more closely and regularly with the leading knowledge networks.

The fact is that markets provide less finance for innovation that would be socially desirable. The venture capitalists are not willing to invest significant amounts in startups in India. That is why many governments use different intervention types to increase the amount of finance available for innovation activities. Although institutions such as KIIFB can address some of these issues, it's a long way to go. Over time, Kerala built a fantastic alternative model for social and economic development, and our ideas attract global attention. The pandemic reveals the gaps in the public health system of very advanced economies. But the management of the pandemic and states preparedness with the limited resources is an indicator of our inherent strengths and the right policies. So I wish the same applies to the knowledge economy in the coming years. Creating an inclusive knowledge economy should not be a technical agenda, but it's more about enhancing an individual's potential or a household or a society through collective imagination.

Thank you, Professor Joseph and GIFT, for arranging this kind of session with industry, policy and academicians.

I hope this will support the comprehensive development of an integrated environment for policies and practices on the knowledge economy.

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Anoop Ambika
Chief Executive Officer, Clap Research and Genpro Research, Kerala

I think the whole industry as well as the young and the old of the state are equally excited about the possibilities that Dr. Isaac opened up through the budget. And I think we have a lot of work in implementing it. I think there is a disconnect between the industry and the innovation ecosystem. We have tried multiple methods and some of those methods included, presenting these innovations to the corporate in the past. Kerala Startup Mission has introduced a process wherein companies can come and present their problems to the existing innovators and see if there is an already existing solution that can be provided but none of that seems to be working very well.

We had some reasonable success in the past, but I don't think it has worked to the extent that we needed it to work. Product sustainability or the product market fit is not often tested before developing. We need to have an early fail mechanism where the customers will validate the idea and say that it has a potential to bring in revenue to sustain in the future. One of the things we need to implement as part of the innovative ecosystem is that connect with the early adopters, or the industry or whoever is going to be the users of the innovation.

Often innovation is misunderstood as IT or software or digital technologies. We need to have a serious campaign, saying that Kerala Startup Mission is not just a technology mission. It's beyond that. You can go into manufacturing, solid waste management, go into any kind of innovations that happen across multiple processes. There needs to be a campaign that happen either from K-DISC or from Startup Mission which will empower people to try out things beyond technology.

IIT Hyderabad recently came up with a model, wherein they will provide a professor, along with three or four students as part of a course curriculum wherein they can engage with a startup. The startup can tell the problems and they will build the prototype for you. There are various sensitive issues like IPR, involved in this, but that could be possibly one of the easy ways of getting a product prototype without spending too much

money. If our higher education institutions like KTU can come up with such a plan it is going to be an easy method by which we will be able to prototype some of the products.

A group of entrepreneurs said that they have a product and got orders and something to do with testing of machine. But they had no clue that they had to apply for startup India and they had to get a unique ID in order to get access to capital . I suggest startup mission to come up with a handbook which can be an electronic booklet so that people can later modify and circulate to entrepreneurs.

Mentorship is another area. We have had very poor experience in finding mentors and holding the companies. We should also seriously consider providing equity for these mentors. Based on a discussion between the startup founders and the mentor if they see value of this mentor being involved in the startup company. I think we should have a formalized mechanism by which we will be able to give equity to these mentors.

We have to identify some of the sectors where we had huge success and then put more trust on those sectors, and this is where the cluster concept will come into the picture. A lot of companies have already started their innovation centers in Bengaluru. We should have a mechanism by which we should be able to engage with these innovation centers of the large companies and expose our innovations to those on a routine basis.

IQ has tremendously multiplied over the years and some of the future innovations could even come from the 10th or 12th standard students. We need to have an ongoing mechanism by which we will engage with centers like Atal Tinkering Labs, which will be established in schools, pick up innovations from them and create an innovative or an entrepreneurial ecosystem within schools. We are putting a lot of spotlight on Artificial Intelligence, Machine Learning and analytics. We need to start seriously thinking about collecting data. We have a lot of data; we have data coming in from satellites, data being collected about our livestock, our flora, fauna and all that stuff. Unless, we have this data curated, collected and stored in a data hub, nobody will be able to develop what is called an Artificial Intelligence model. We need to have this data collected and stored in a cloud platform which can be controlled by the government and open to everyone so that people can come in and do innovations on top of that data. A data hub is something that the government and industry can join together and create which can be used by everybody to create AI and ML models.

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Rainer Walz
Deputy Director, Fraunhofer Institute for Systems and Innovation Research, Germany

I want to start with some remarks, picking up what has been said earlier in the first comments about taking up the international dimension. From my perspective, a transformation process, and each program within it, has to think about positioning itself within the global megatrends, which are taking place all over the world. I see the following important aspects: First, when we talk about transformation, it is not only about technological innovations. It is also about social innovations and indeed the Corona crisis shows the importance of changing behavior. Second, we see changing patterns of trade. South-south trade is increasing. Third, in a lot of countries, we see that digital competencies are seen as a key enabling technology which has to be combined with very specific competencies within each country.

In my country for example, in Germany, the machinery industry is a core area of competence. Thus, a lot of the emphasis put on digitization is its application in the machinery industry, and the slogan of industry 4.0 is a very important aspect in Germany because it reflects the specific combination of the sectoral and key enabling competences. Fourth, we also see that innovation policy is changing with regard to the goals we have. We have the newly debated paradigm of mission-oriented innovation policies. We have the sustainable development goals, and innovations are a key issue if we really want to address the grand challenges.

Another major issue is that it is not enough to look on the supply side of new innovations only. With regard to the application of the competences, which are building up in the programs, it is very important that we have an early demand for these applications. Start-ups need a perspective, that there will be demand for their products. But also from a systemic perspective, learning in the market is a key prerequisite; you need communication in the innovation system, and producer-user interaction to improve your innovation continually. Finally, early market demand, or even better, announcement of future market demand which specifies the characteristics of products or services in advance, at the start of the innovation

process, are also important. And here I see the need for an integrated policy of the state of Kerala, to think about a whole set of products with challenging new specifications for which Kerala would be willing to promise procurement if the innovators are able to come up with new solutions which fulfill these specifications.

Applications of the innovations also involve different sectors and segments of the economy. It is the combination of the ideas developed in high-tech industries together with the competencies in traditional sectors what makes an economy successful. But we also know from the experience with a mission oriented innovation policy, that this poses a big challenge for governance. With regard to policy making, you have to integrate policies which support innovations with policies for specific sectors. There is a need to integrate the policies of different Ministries. And steering such integration also means that you need strategic intelligence and institutions coordinating different ministries. Finding the successful combinations of existing competencies in traditional sectors, new competencies to be developed in innovation programs, and strategic positioning within the megatrends becomes a key challenge for transforming Kerala to a knowledge based economy.

Green innovations are increasingly coming from countries of the South. Some research at our institute also shows that especially the role of frugal innovations in green innovations is increasing, India as a country has a very important history and very high competences in developing frugal innovations. Thus, I think it would be a good opportunity to look into the programs you have established, what the role of such frugal innovations could be. So again, it is combining the strengths of Kerala with global trends and with the build-up of a knowledge economy, where future success can be found. Building a combination of programs which make Kerala into something like a hub of sustainable frugal innovations - would that not be a vision to go for?

We have seen that the knowledge economy is associated with many innovations. What does the goal to transform Kerala into a knowledge economy mean to the "Kerala modelof development"? I have pointed out the need to combine key enabling digital competences with innovations and traditional sector strengths. I think the same holds for the "Kerala model of development". If Kerala is able to enhance its successful development model now with the competencies of a knowledge economy, it might come up with the "Kerala model of development 2.0". Thus, Kerala might become a very important role model for achieving the SDGs. Surely, this requires a lot of work to be done, and does not come easily. I think Kerala has done quite a lot of good things with regard to establishing the "Kerala model of development" already in the past, and it will be doing so again, if it successfully combines the "Kerala model" with the new opportunities of a knowledge economy.

Thank you very much.

Rasmus Lema
Department of Business and Management,
Aalborg University, Denmark

The sections of the Kerala budget 2021-2022 that pertain to 'Transforming Kerala into a Knowledge economy' contain vision of a knowledge economy which is both ambitious and laudable. This vision is unfolded in the budget speech by Dr. Issac and among various important elements, higher education and innovation features prominently. My intervention will be focusing on transforming higher education for the knowledge economy.

I saw this consultation as an opportunity to read through the budget speech and come with some quick thoughts. Importantly, when I hear the notion of the knowledge economy, then the question for me immediately is: knowledge for what and knowledge for whom? Certain types of knowledge, more important than others and certain types of knowledge are more strategic than the others in any given context and point in time.

From my perspective, starting from the societal challenges that Kerala is facing is critical. Both economic, social and environmental challenges. Thinking through these challenges and their implications for types of change that are needed can help us determine what kinds of knowledge that the Kerala knowledge economy should produce and diffuse and role that higher education can play in doing so. The strategy for the Kerala knowledge economy needs a clear identification of needs. The first step is mapping of challenges and prioritization of them. The next step is thinking about implications for innovations.

There was considerable attention paid to the need for transforming higher education in line with Kerala's recent achievements in school education. The speech emphasized that to make progress towards the knowledge economy, higher education is key:

Undoubtedly, transformation to a knowledge economy, requires a lot of investment - huge investments - in higher education. Investment in higher education will increase, as is clear from the budget. But how teaching and research will shift to a new paradigm and what the paradigm is, is less clear. Naturally, this is also something which is beyond the remits of the Ministry of Finance, but I think we should appreciate

that it is highlighted in the speech.

I would like to propose the heading of a challenge-driven higher education system which plays an active part in mission innovation. It should include both teaching and research. It is about making closer connections to other stakeholders in key challenge-driven missions. When reading through the budget speech, a very good example of what such challenge-driven learning can achieve is the example of the bandicoot robot (page 35). From the starting point of a key challenge, which has to do with the sewage system in Kerala, a group of engineering students sat together to try to deal with the problem and invented this robot. They worked together with users, private sector stakeholders and others to produce this invention. This is exactly the type of challenge driven innovations I have in mind. It can be used for all sort of problems and include many different types of teaching and research.

What does it require for the higher education system to think in these terms, to reorient the entire curriculum towards such societal challenges? Now, of course, we cannot completely move away the existing curriculum elements. They have to be in place. But nevertheless, the ties with the users of university graduates - in public and private and social sectors - are very important. The ties should be built into teaching. University students working together on real-life problems are very important. And they should be students working from different disciplines. So, transformation of the curriculum is important, including also how students can work together across different disciplines and how they can connect much closer to the needs to 'burning platforms' of the private and public sectors. So, the key elements are: (a) forging closer ties with 'users' of university-graduates in private, public and social sectors and (b) transforming curricula, including interdisciplinarity and project work. These could be fundamentals of a new paradigm university teaching.

Innovation efforts should not only seek to address local challenges but also to bring these innovations to markets with similar challenges. Research and teaching could connect closely to both local problem-solving and to national and global commercialisation of innovations. This is about how to enable the business side of local problem solving.

I am thinking about this in connection with some work we have been doing together with Xiaolan Fu who was speaking just a few minutes ago. We were looking at 'green windows of opportunity' in China: how Chinese enterprises were able to benefit economically from addressing local and global sustainability challenges. Government and other stakeholders implemented institutional and technological innovations to address of sustainability, local pollution challenges, energy security etc. Starting with local mission-driven innovation, the next step was exports of these green technologies to the rest of the world. Universities should be engaged in both steps, working with the key stakeholders. They can play key roles in a challenge-led

window of opportunity creation strategy for economic and social development.

In sum, I applaud the ideas in the budget and suggest that we think about how we can situate transformation of higher education to match with a strategy where key challenges and mission-driven innovation programs guide the transformation to a knowledge-based economy.

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Nanditha Mathew
United Nations University – MERIT, Netherlands

In my presentation, I hope to show how Kerala can climb the ladder to a knowledge economy. The economic growth and development of a country do not happen in one day. It involves different steps. One could think of a ladder, where at each step, individuals and indeed the country itself, learn and accumulate knowledge while moving towards a knowledge economy. And likely, you cannot jump to the final step directly from the first. Here I will talk about the capability approach to development from a micro or firm-level perspective. Indeed, when we talk about production, firms are the actual actors behind the production and they play a crucial role in the accumulation of knowledge at a macro level.

It's intuitive to think that business firms know how to build things: they let us fly from one continent to the other, build computer networks to communicate from different parts of the world and they have a central role in the mass production of vaccines to fight a pandemic. Let's take an example of the firm Luxor. Luxor produces pens now. If it were to enter a new market, likely it can produce sophisticated calligraphy pens for drawing and likely, it cannot produce trucks. Instead, BMW India that produces cars, could use their capabilities to produce trucks as well. So, it's very important to understand the "already existing capabilities" to understand where one stand in terms of firms, individuals, to see where one can go next, which is the step that Kerala can take next given where she is now?

Capabilities and skills are difficult to measure. Even though we don't observe capabilities, we know which firms produce which products. From this information, we can try to derive the capability structure of firms. Such a data-driven approach helps in measuring relatedness between products and overall coherence of the production of the firm i.e, how related are the products they produce. Here relatedness (or proximity) of products depicts proximity of capabilities, (or ability to produce products). For more details on this measure, please refer to Dosi, Mathew & Pugliese (2020). We find that firms producing a coherent set of products perform better because when they expanded their production, they moved to products that were similar in terms of capabilities to the ones they were already producing. This is why it is important to understand the existing capabilities of

firms in Kerala to understand where Kerala stand, to look into which are the next steps in the capability ladder she can move to.

On one side there are firms who provide jobs, and on the other side, we have a lot of educated unemployed. Clearly, there is a lot of discrepancy between these two, or in other words, a matching issue between the jobs that are created and the skills that people have. The problem of educated unemployment is one of the biggest challenges in Kerala. The question is which kind of policies can absorb all these educated unemployed people? When we look at the opportunity space in front of us, we should not only look at firms, but also what people in Kerala can do. I believe that the Government of Kerala is on the right path with the idea put forth in the budget on providing the right skills to the people. However, one should be very careful in understanding which are the right skills. The skills should not only relate to the individual abilities of the people but also relate to what organizations or firms want, relating to what firms and organizations do now and what they can do in future.

In the same way we measure capabilities of firms, this can be done, also at the individual level - given the abilities of an individual, which are the skills that will help her to - let's say - climb the next step of the ladder. To repeat, it is important to understand which step of the ladder you are in, because, only then you can evaluate which is the next level you can achieve. This is true for both firms and also for individuals.

No doubt, there are several challenges ahead. But what one could hope to build is an ecosystem that will foster innovation and growth. As Marianna Mazzucato argues, states should create markets rather than fixing them and when the state wants to create markets it will be able to when it has the ecosystem that surrounds it.

I want to conclude by emphasizing this point - at a policy level, it is important to create all the building blocks necessary. What is required is to prepare a fertile soil to be able to grow a seed when a chance arises, because "chance favors the prepared mind" (Louis Pasteur). What one expects from Kerala is to lead and show the way forward so that this model can be used also for other states and for countries around the world.

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C. Skilling, reskilling and upskilling

Saji Gopinath

It's an honor to be among this eminent panel on this International Consultation on Transforming Kerala into a Knowledge Economy. We had two very excellent discussions which were looking at two key aspects of a knowledge economy; the infrastructure aspect and later on the innovation ecosystem aspect. Now, I think the third and perhaps one of the most important aspects is what we will be discussing in this session - about people. In the budget, honorable Finance Minister has basically looked at three key aspects of how we actually develop the people to drive the knowledge economy. This includes focus on the creation of the knowledge and on the knowledge workers. And in this context, I think one of the key elements if our strategy, proposed in the budget is to strengthen the higher education institutions by creating research centers of excellence and augmenting the infrastructure in higher education institutions. In the morning, Prof Lundvall presented as how China has actually made a very successful model in the knowledge economy. I think our model is also very similar to that, where we are looking at enhancing public investment in the higher education sector.

We are also looking at setting up a large number of post-doctoral fellowships in the areas which are going to be very relevant in the context of the current Kerala's development puzzle. Now, in all these discussions today, I think one key element which has come out is that for any development to be inclusive, the knowledge economy or knowledge society has to be extremely inclusive. Perhaps that was one of the reasons why there is a focus on setting up of key centers of excellence in areas which are going to take Kerala forward. The centers are expected to be in areas which are going to affect multiple sectors of Kerala. Be it the areas of disaster resilience or the area of marine development or on to support the traditional art forms, how do you actually look at doing high-end research to enable high-end knowledge creation so that these sectors can actually move up in the value chain. This, I think is the second key proposed in budget. Unfortunately, we may not be discussing these two aspects in this session; perhaps may be the last session will discuss these in more detail.

The third element of knowledge society proposed, I think may perhaps solve a paradox, which Kerala was facing all these years. So, creation of a large number of

knowledge workers or knowledge resources is actually going to be the key challenge, when we wanted to create this knowledge economy. We know that the higher amount of state investment in education will create more knowledge workers. We already have very high level in secondary education; even in the higher education GER(Gross Enrolment Ratio) of around 37% is much more than the national average. And the attempts are being made to raise it to 75%, which means three out of four people in Kerala will actually have access to higher education. While this enhances the numbers, we are also concerned that we have a high unemployment rate and the lack of participation of educated youth, especially women, in the economic activities. This basically is the one of the key areas, this session is going to address.

The knowledge economy is basically different from an industrial economy which all of us know pretty well. We know that from large industrial centers which basically concentrate work in a few places, there is a transition happening in the work place with the work is getting distributed all around, through new work from homes and work near homes modes. Distributed employment centers are actually getting created in many places, provided you have people with the right skills in those places to take the type of work which is available across the globe. I believe that this is an area where Kerala should actually focus in serious manner. The budget has put some very ambitious targets to do that.

We have a large number of educated youth, but they may have to skilled. I think Dr. Nandita rightly pointed out in her observation in the last session, they have to be skilled in the right things and there should be a continuous feedback between the industry, the work givers and work demanding units, in a continuous manner. This is another aspect, this session is going to discuss.

Based on this broad theme we have two presentations. One which looks at what would be the type of skilling strategy for the state and going forward, how do we actually ensure that we will make the correct number of knowledge workers and exploit these opportunities which is emerging from different parts of the globe. The second part is how we create decentralized workspaces, so that the people can actually remain in the state, even though they may be delivering their work output elsewhere. They can contribute to the knowledge creation; they can actually look at the jobs around them. At the same time, they could also look at the participation in the global economy without even moving out of the state. So, these two things are basically getting presented now. And then we will get into the comments from the various members of the expert panel from different parts of the world. So let me first invite Sri Santosh Kurup, the CEO of ICT Academy of Kerala. ICT academy a public private partnership which looks at skilling on various levels of knowledge economy. So over to you Mr. Santhosh.

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(The author is the Vice Chancellor, Kerala University of Digital Science, Innovation and Technology)

Kerala workforce strategies for the fourth industrial revolution

Santhosh Chandrasekhara Kurup

I picked up three important trends that are happening in the new work force evolution. I wanted to say about the progress of internet mobile and social media, especially in the country stands number 2, compared to the rest of the world. In fact, we are sitting in a state which is having the maximum density of mobile penetration in the whole country. So this is one interesting trend that has revolutionized the digitization process, new business models and the whole world transforming into the new internet economy. The second part of it is the impact of industry 4.0 which is again sometimes being misunderstood or misconstrued as an IT revolution. But this is not; this is actually an industrial revolution that is happening quickly. I think we have seen three industrial revolutions and this one is about converging the physical world to the cyber world and the biological world. Primarily because the cyber world has grown so much and on an average, there is a statistic which states that people spend around six and half hours on mobile these days.

The World Economic Forum 2020 report say that around 85 million jobs would perhaps get displaced or shifted. But the beauty is that around 97 million new roles would emerge as part of the industry 4.0. So what I mean to construct is the fact that there is a huge change in dynamics in terms of the roles and responsibilities and in terms of the work that is going in the Industrial Revolution 4.0. Second construct is not about information technology related jobs. This is about IR 4.0 interfering and intervening successfully into multiple sectors, agri-business to mining to petroleum and natural gas businesses. So, this is going to spread across multiple domains and that is the reason why new jobs are getting created in different sectors, not just IT.

The third one is about the digital acceleration and innovation, primarily driven by the pandemic. One of the interesting trend that has come in as part of it is the acceleration of the digitization that has happened. But thanks to Covid-19, it became the biggest transformation agent in bringing a lot of acceleration in the digital space.

So the physical world interactions became digitized and we are connecting more virtual. Companies like Zoom, for

example, has grown 35 times during this time. So, there are a lot of changes that has happened into the digitization process. Telemedicine, for example, is another interesting case which grew by 400 per cent as per one of the reports.

It also created a new set of innovations into it. Frugal innovation became a little more accelerated during this period. In Kerala, we had a very interesting trend, whereby the startup mission sponsored companies came together and created the ventilators that were produced at very affordable price. They used technologies like 3D printing and IoT for creating such mechanism fairly quickly. So frugal innovation is another area that picked up as part of this strength. Lastly, the changing workforce dynamics, such as work from home and remote working became the new normal. Approximately 84 per cent of employers are set to rapidly digitize their workforce, so that the work can be pushed remotely. Even after pandemic sets in and goes out, it is likely that this trend will continue and approximately 44 per cent of workforce will remotely operate permanently.

The next context is higher education. Even though we call it as a higher education paradox, as the famous scientist says in the midst of every crisis lies great opportunity; so we feel that this issue of having low participation, especially women participation into the economic activity. Secondly, in terms of skills development, Kerala has been in the forefront on many areas when it comes to various indices that we talked about. Kerala started these skills development activity long ago before a lot of other states picked up. We have a number of initiatives focusing on sector wise skilling and development activity. Approximately hundred thousand participants go through the skilling program every year from Kerala. Interesting fact is that 23,000 new self-employed enterprises were generated during the COVID pandemic. 2500 plus active startups work in the state and is considered to be one of the top performers in the country.

Another important issue is the return of Keralites, with international exposure. Nearly 600,000 people came back and had to stay back due to the pandemic, but these are people who have got not just skills, but an understanding of the international work culture. This is what is going to create a new set of job roles and new set of job opportunities. Second one is about the gig economy push, even in India. This is picking up fairly big, in fact 50 million Indians work on gig already from India. We are on the seventh position and there is a lot more potential for us to look at this.

So, on the knowledge enablement right from literacy to research, is a set of enablement that the state is undertaking that is leading into an outcome of jobs of various types. From an industry perspective, it is also important for the state to look at what industry needs, especially in the new technology area and talent ecosystem. Government support and benefits are some of the areas that the government is looking into. There are 3 broad contours workflow strategies that Kerala government is pushing

forward and it was alluded by the Finance Minister also.

When we were looking at employment targets we look at only permanent jobs, but now the strategy is not just look at the permanent jobs alone, but look at work and effort based career types as well. The second dimension is that when we look at again, employment, we look at creating employment in the offices within Kerala. Now remote working has enabled people to work from anywhere. So we are not looking at just the statewide employment opportunity, but going global and looking at the global opportunities and how enable our youth for the same. The third dimension is that the career is not just about information technology on IR4.

We are talking about 60 to 65 million jobs being created in 2025. Of which, around 25 to 28 million jobs are going to get newly created with these three dimensions within India. Kerala is super poised towards achieving that target. One of key enabler is obviously the infrastructure backbone. Some of the IT infrastructure backbone, which are required for remote working and the distributed workforce management is also provisioned. Government supported skills training is also another important element of our strategy. But in this strategy, the fundamental differences are that we are actually on boarding the work types ahead of time and then working reversely to skill our candidates by matching it to the work types. So, it is much more collaborative and synchronized compared to the skilling programs that we have seen in the past. There is going to be a huge IT push connecting both the work seekers and the providers. I believe a lot of legal frame work have been developed on the new work type activities across the world. But providing social security and other government benefits is something which is going to be very unique for the whole strategy that the state is trying to build up and that's the core of the strategy. There is a lot of operational layers which we are working on and there is a huge set of targets that we are aiming at.

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(Mr Santhosh Chandrasekara Kurup is the Chief Executive Officer, ICT Academy of Kerala)

Work near home infrastructure for Kerala

P M Sasi

I will start with work from home. It has been there for quite some time, but the difference is that the work from home facility was offered by very few companies and was offered to very few people. Techno Park had plan for constructing a building, and we had surveyed on the demand for space. We had a lot of the discussions with many industry leaders, who stated that work from home will become popular in the coming years, which has to be taken into account. Covid 19 made these changes happen all of a sudden. We postponed our decision to have our own building.

Most of the IT companies in Kerala are working from the IT parks set up by the government. There are three major IT parks- Techno Park, Info Park and Cyber Park, accommodating about 900 companies employing more than 110,000 employees. Due to the pandemic, most of the people are now working from home and only 5 to 10 per cent are working from the offices. We were expecting that by early 2021 most of the people will be back to office. But the pandemic threat still exists and the IT companies have postponed decision on working from office.

The productivity of work from home has been reported to be very good by almost all the companies. Apart from productivity, some of the companies are also saving many of the other expenses like transportation costs, administrative costs, etc. And some other companies have scaled down their rented office spaces as they are not using the complete space now.

But there are certain concerns also starting from the issue of infrastructure at homes to the connectivity issues, issues of working overtime, issues resulting non- socialization of people, etc. One of the main concerns which has been raised by the companies is in developing the organizational culture and the organizational values. Normally these are developed when people come to the office, they interact with others, they collaborate with each other, they create a bonding, they also learn from the seniors, and so on. But in the virtual environment when we you are working from home, these do not happen and it is very difficult to imbibe the culture and value among the employees.

Dr. Santosh was saying that 44 per cent will be working from home even after COVID 19 is controlled. But there are various research / studies conducted on this and the general consensus is that between 70 to 90 per cent of the people will be coming to office, once

the situation is under control and the remaining people will be working from home. Demand for huge campuses may not be there in the short term, especially in the case of IT.

But then it is going to be the hybrid mode of working in the future, as we discussed, some of the employees will be working from home or other places and some of the employees will be working from their offices. This may be on rotation basis also.

The industries are now hesitant to commit for long term investments. They are looking for minimal commitments in the short term, till the COVID scare is over. They're also looking for space on demand so that they can upscale/ downscale the space availability as per the requirement. This will be of immense help to industry as they have to pay only for their usage.

This is the same situation where we migrated from own / dedicated infrastructure to the cloud infrastructure. For the dedicated infrastructure, we had to pay the cost up front, for the whole infrastructure. Even if you are using the infrastructure for possibly a day or an hour, you need to pay for the whole infrastructure and the infrastructure will be with you whether you are using it or not.

The cloud facility offered the flexibility for user community to procure resources as per demand without any upfront commitment and the flexibility of paying as per usage. I think this is coming in the physical infrastructure space also, these days. Now the industry is looking for flexibility of usage, such that space may be utilized by any of their employees as per the requirement. They also want to use the facility temporarily or for a longer period as the demand rises. They also will need the facilities like conference rooms, training facility other services on demand.

The new age employees are looking for facilities where they can walk to work, so that they are not far away from the comfort of their home, and they also don't have to worry about issues of commuting to their workplaces. They also are looking for proximity to all the amenities so that they can walk to buy and the time for commutting can be saved.

The traditional jobs have been regular, full time or part time. But in gig economy, people can take variety of short-term jobs and projects. Indian freelancer market is expected to grow to US dollars 20 to $30 billion by 2025. Work from home may not be suitable for many because of the issues that I said earlier.

Interestingly, companies are turning to tier two and tier three cities for their expansion, which was never the case before. Earlier, many of the companies were looking for places like Bangalore and Hyderabad and the tier two and tier three cities were not in their plan, which has changed now. It is also understood that majority of the freelancers in India are from tier two and tier three cities.

In the Kerala context, there is abundant talent available. Because of the reverse migration, from many of the foreign countries, mainly from the Middle East countries, there has been a jump in skilled and high skilled human resource. There is a big push for digital economy, as we have seen in the recent budget. A skill mission is planned, for meeting the

requirements of the knowledge economy.

The work near home facility is a proposal for interconnected centers distributed across Kerala. All centers are connected to the cloud and these we will offer flexible workspaces to organizations as well as individuals. Definitely this will strengthen the freelance ecosystem in Kerala, because the freelancers may not be comfortable to work from home for various reasons as explained above. If they get a space where they can work with sufficient security, sufficient safety, with high level of connectivity, definitely, this could be the place where the freelance workers can operate from.

This will attract employment to Kerala, as employee can work from anywhere in the new mode of working. So, a Keralite staying in Kerala can get work anywhere in the world, yet still work from Kerala. With the support of proper infrastructure, Kerala can be a centre for freelancers working for organisations anywhere in the world. For organisations, this gives the option to scout for the best talent and they can optimize the cost for human resources.

The facilities proposed to be available in these centers may be available from other coworking centers also. But what makes it unique to the Work Near Home concept in Kerala is the service support which will be offered to the users, especially the freelancers and startups. They will need lot of support in legal assistance, taxation and filing, company registration, consulting, among others. These services will be offered to the users as a central facility.

We plan the WNH centres to be small modules, so that occupancy and return on investment can be ensured in minimal time. We have identified that 5000 square feet is the minimum space which would be economically viable. This can seat around 60 to 70 people. As demand grows, this can be replicated in other places in the same town. We had a lot of designs from the Indian Institute of Interior Designers. We are planning to go for all digital operations so that this can be scaled up at minimal time based on demand to anywhere.

We had the first level demand assessment through two sources. We conducted a survey among the IT companies, where we asked them which are the cities they would like to have smaller facilities like this. We also had feedback from individuals working outside Kerala to see what kind of environment they are looking for and which cities they prefer. We have created the heat map of demand across Kerala. We start with the cities of higher demand and then go to the next cities in that order.

We are convinced that this is going to be the infrastructure facility for the current and future generations, working in the knowledge economy. This will definitely help in giving a boost to the industry, stimulating the growth, creating employment and for cost optimization for the users.

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(Mr P.M Sasi is the CEO IT Parks and Director, International Centre for Free and Open Source Software (ICFOSS), Kerala)

Reflections from experts across the world

Charles Edquist
Ruben Rausing Chair in Innovation Research at CIRCLE,
Lund University, Sweden

I will raise a couple of issues that are a little more generic, that are related to the knowledge economy, and that are of relevance also for Kerala. The issues are highly relevant for the future of the knowledge economy in Kerala, particularly for policy actions that will be necessary to realize objectives in this field.

I want to place my comments in the context of what I call activities or functions in innovation systems. As I see it these activities are the following:

1.R&D, 2. Education and training, 3. Formation of new product markets, 4. Articulation of quality requirement, 5. Creating and changing organizations, 6. Interactive learning, 7. Creating and changing institutions, 8. Incubation, 9. Financing of innovation processes and 10. Consultancy services

These activities are the hypothetical determinants of the development and the diffusion of innovations. Together they may be said to define an innovation system.

This is a very wide definition of a system of innovation. It may be noted that policy is not a separate activity - but a part of all ten activities. Today, I want to deal briefly with two things that have been neglected very much in research and policy related to innovations, innovation systems and innovation policy. And one of these is education and training. In the literature on innovation systems, you will not find much about education and training. So, education and training is a very important thing to focus upon - which you are obviously doing here in Kerala, as we have also heard from other speakers in this consultation.

But another thing that also has been highly neglected in innovation studies and innovation policy is the demand side. And that's number three and four in the list, i.e., "formation of new product markets" and "articulation of quality requirements".

Activities three and four include what I call functional public procurement. This is an enormously neglected issue in policies in the field of the knowledge economy and innovations in basically all countries of the world. Public procurement is around 15% of the global GDP, i.e., an enormous sum. This means

that public procurement is much more important than global Research and Development (R&D). These enormous resources are being used by the public sector to buy things from private firms. This made me interested in how this could be used as a policy measure for getting more innovation dynamism in the economy. And I found out that this 15% of GDP is almost not at all used to enhance innovations. The reason is that when public sector agencies buy things from the public sector, they describe a product and they get the exact that product. And it cannot be an innovation because you cannot describe an innovation - since it does not (yet) exist. What they should do instead is that they should describe a problem that they want to get solved by means of the products which they buy. If they describe a problem instead of a product, then they get many proposals for how that problem can be solved, and some of the proposals are innovations. This is potentially a very important thing. We argue that such functional procurement is potentially the most important public innovation policy instrument that can be used in all countries.

All the 10 activities listed above: R&D, education, demand side, institutions, organization, financing - are all necessary for a dynamic innovation system to operate. From a policymaker point of view, it's a matter of identifying those activities that are not working well. If something is working very well, the policymakers do not need to do anything about it and should instead concentrate on those things that are not working well.

Some people call this market failure. That's a too narrow term coming from economics and I think it should be used in a wider sense and it could be called policy problems, that should be addressed by innovation policy. That is being done to some extent. But in many cases public policy is just duplicating what private actors are doing. And that's not needed. That's not a good use of resources. Public policy should be additional to what private actors are doing. In pursuing innovation policy, it is important to make a distinction between policymakers and politicians. And it's the politicians who are pursuing innovation policies. I want to conclude by mentioning the establishment of a new kind of actor that has been created in Sweden: The National Innovation Council (NIC), chaired by the Prime Minister and including four additional ministers and 10 external advisors.

Thank you very much.

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Zhang Liyan
Professor and Director, Center for Innovation and Entrepreneurship,
Tianjin University of Finance and Economics, China

Hello everyone. The earlier presentations mainly discussed on the theory part, I would like to give some feedbacks from the practical aspects. I will share some institutional arrangements in China and propose some suggestions accordingly.

1. "Challenge cup" competition

About 30 years back, when the concept of venture capital came into China, the "Challenge Cup" National University Students Extracurricular Academic Technology Competition (hereinafter referred to as the "Challenge Cup" Competition") was co-sponsored by the Central Committee of the Communist Youth League, the Chinese Association for Science and Technology, the Ministry of Education, the All-China Federation of Students and local governments. The "Challenge Cup" competition has two parallel projects in China, one is the "Challenge Cup" Chinese college student entrepreneurship plan competition, and the other is the "Challenge Cup" national college students' extracurricular academic technology competition. The national competitions of these two projects are carried out alternately, and each project is held every two years. Since the first competition was held in 1989, it has grown from 19 colleges/ universities to more than 1,000 colleges/ universities with more than 2 million students participating each year.

Achievements display, technology transfer, and technological entrepreneurship have brought the "Challenge Cup" competition from campus to society, and promoted the transformation of scientific and technological achievements of colleges and universities into real productivity. "

2. "Internet+" innovation and entrepreneurship competition

With the widespread penetration of the Internet into all aspects of the Chinese economy and the emergence of the importance of innovation and entrepreneurship, the China "Internet +" College Student Innovation and Entrepreneurship Competition was launched in 2015. As of 2019, a total of 9.47 million college students and 2.3 million teams participated in the five competitions, and a large number of high-quality projects with high technological content, large market potential and good social benefits have emerged. According to the survey data of 528 projects that won the gold and silver awards in the previous four years, about half of the companies that established companies after the creative projects completed financing, and

19% of the projects completed financing of more than 50 million yuan; the annual income of practical projects in 2018. The proportion of more than 50 million yuan is 13%, and the annual revenue of the highest project exceeds 200 million yuan.

Since 2019, the Internet+ Contest has evolved from a national competition to an international one. In 2020, college student teams from 100 plus countries participated in the competition.

The sixth competition (2020) hosts a series of competitions, which are for the university students, the vocational college students and high school students. The poverty alleviation competition is also organized. The competition mainly adopts the three-level competition system of school-level preliminary competition, provincial semi-finals, and national finals. School-level preliminary competitions are organized by each school, provincial semi-finals are organized by localities, and national finals are selected and recommended according to the quota determined by the competition organizing committee.

3. Innovation and entrepreneurship platform

In China, every university/college has a maker-space, and almost all the universities of science and engineering have science and technology parks. An university S&T park is more like a transitional entity between an incubator and a science and technology park, which is run by a company. In addition, all schools offer innovation and entrepreneurship courses in China.

4. Suggestions

Kerala is building a knowledge based economy. An innovative eco-system is critically important, so are the involvement of the university students, young people full of energy as they want to contribute to the society. The challenge both for the youth in China, India and other countries is that they are far away from the real society. Government organizations try to narrow the gap. Therefore, I'd like to propose 3 suggestions:

(1) Organizing innovation and entrepreneurship competitions

Competition may become one of the solutions for building a knowledge based economy. Organizing innovation and entrepreneurship competitions is a low-cost, quick-effective, highly-participated and easy-to-manage activity.

At the same time, attracting companies participate in the competitions. They will give challenges they are facing to the students and let them provide solutions.

(2) Providing innovation and entrepreneurship training

Innovation and Entrepreneurship training is to train people with the intention of starting a small business and small business managers in the aspects of business creation ability, market management quality, etc., and give them certain policy guidance in the process of business establishment and operation.

(3) Providing Platforms

Innovation and entrepreneurship need a platform and an environment. The government needs to provide support to encourage colleges and universities to use existing facilities to set up maker spaces, offer courses. Both maker spaces and courses should be open to society.

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Sushil Khanna
Professor, IIM Kolkata, India

Skilling is needed for a knowledge economy, to go back on it, we have some very renowned international scholars. The focus here is to improve, what we call, the ecosystem. Here, we are looking at the educational, skill level for a knowledge economy .

We should not focus too much on just digital issues or remote work and teaching. I think many of these trends will be short term and reverse. I do think universities and everybody wants to go back the old the face-to-face kind of thing. Offices will be working in an year or two, but I want to go back to the whole idea that Mr. Balagopal was talking about in the earlier session that we need to have a system for high tech manufacturing, high tech production in Kerala.

Roughly we have tracked about Rs. 4000 crore worth of shipment out of Kerala, high tech products and high tech is fined by OECD, What is high tech is that they have some HSN codes they call the high tech industries. But Kerala, like in other products has a huge deficiency in high tech products including aerospace and stuff like that must be going to ISRO.

But there is a great opportunity to enhance that sector which requires new kinds of skills and new kinds of innovations. I will talk a little bit about the education system in Kerala. We have the highest literacy in this country. We are very good primary and secondary education but Kerla actually has not been able to keep pace with the tertiary education. This is a major setback, I think needs attention from the policymakers .

Kerala has very few accredited colleges compared to your neighbors, for example, roughly about 200-250 colleges. It has a disproportionately large number enrollment. The higher education survey from 2011 to 2018 shows a sharp increase of 10-12 per cent in enrollment.

Some very interesting facts come when you look at it. Firstly, the enrollment of woman in undergraduate colleges are twice that of men and in post-graduation education, it is three times higher. But a very few women then get into the labor force and more than 35 per cent of them stay out of the labor force and have a higher unemployment rate. Only 9000 postgraduate students Kerala produces, which I think is very small compared to Tamil Nadu and Karnataka. The State's

population is double, but the number of accredited colleges are four times or five times higher. Post-graduate education is far more widespread. So, I think, the kind of skills that these colleges are imparting are disproportionate to what I want to call general education. While we do fairly well with respect to B.Ed, nursing and the like, with respect to science, technology and higher education, there is much to be desired. There are more than 100 engineering colleges. None of them are not known nationally. So there is a great need to improve the quality of higher education, tertiary education in Kerala. Then also an opportunity to the large number of Kerala scholars spread all over the world and outside in other universities in India and there is an opportunity to attract them back.

There is a burst of new innovative industries, artificial intelligence. Industry entrepreneurs, I met around Kochi and they were not the people who are returning from the Middle East, most of them are Kerala NRIs from North America and Europe. Many of them have come back and starting, some are collaborating with their former employers in USA and starting the hardware production using artificial intelligence and advanced chemicals and stuff like that. So there is already a small trend during the last five to ten years and this needs to be strengthened. It needs a substantial improvement in the tertiary education. Kerala spends a lot of money on the budget. All private colleges also get grants and support, but I think we need to use this support more judicially to push them towards to get better standards, to get accredited, to change the kind of courses and curriculum that they do and so on.

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Mammo Muchie
DST/NRF Research Professor, Faculty of Management Sciences,
Tshwane University of Technology, South Africa

First and foremost, I give my great appreciation for Kerala. You are a progressive state, you're doing many interesting things. The interesting thing now is that the digital world, the virtual world is becoming universal. Even in agriculture, even if you don't know how to read and write, you can still use mobile phone.

What does it mean to have digital skill? Do we do it through school or through otherwise? How do we do it is a very interesting challenge. In other words, our people who are in agriculture, they can do digital agriculture. So is digital manufacturing and digital services. So, the skills, the reskilling, the upscaling issue is a serious one.

I just want to tell you that in South Africa, I have been running Technology venture creation course this semester, and I did it virtually. I formed the students into groups, they have created certain new venture startups. Also, I suggested them not work on the previous activities, but on the new ones. In other words, the sustainable Development, the green ones. Be innovators, inventors, creators of venture, create the startups, and things like that.

And then the idea is, I don't want the students to just get grades. By writing papers, I want them to do something practical. In other words, they produce some venture. I must tell you what one of the groups did. The initial seed capital they needed was not available. Sometimes if they don't get, they used to get some support from my networks. But you know what they did.? They sold their cars and started building their own venture startups. Can you imagine something like that is happening now?

So, an interesting time is on us. So, what I'd like to do is that even the courses we are developing now, we're thinking of making it global virtually because when we did it virtually, it is possible that the whole world can join our courses. So, I'm now thinking how I can motivate my university to see if we could make it next time. So that all of you could get involved. So, I like some collaboration, very genuine collaboration, where all our students if they're all engineering students and they're all interesting students, and they're all motivated, and I like us to develop some news skills, and it is where we collaborate. And I think Kerala can come

into this picture and I think we could do that. The other interesting thing is what our Professor Charles Edquist said, the concept of holistic Innovation system. I'm not interested in national innovation system since in the digital world, there's no boundary, boundaries are finished!. As humans are becoming machines, machine learning is more important.

All activities are changing and the work world is also changing. The speakers also put it how many new jobs are created that is digital. Things are different for the physical world and the physical work, what we used to do are changing dramatically. Our classrooms are changing, what would be very interesting now is the innovation system should be developed more with the theory of unassigned.

And there is loss of jobs from our young people, we must be careful because if you lose jobs, unemployment comes, poverty comes and inequality comes, it means danger comes. For people many risk comes like environmental challenges, many things. So to avoid it, we need to rethink, unthink innovation system by using what I really like what Charles Edquist said, the concept of holistic innovation system. I prefer to call it differently. The social innovator.

Let's get a few more names. Earlier we used to have regional and local innovation systems etc. Let's move from geography to the social world, the unified world. The validation criteria should not be economics, economics for profit alone is not good. What does it do? When you create some job, you lose some job you create sociological loss. We must make a win-win link. Some new approach, some new vision, some new idea.

I must tell you, I call Kerala my homeland I must say that from all the progressive things you have been doing. Can I just challenge you now? Now with this digital knowledge economy, you create a new innovation system. The new concept, the holistic one, the social one, the social innovation system, not the local Kerala innovation system or anything like that, or Indian innovation system. Let's move towards that. Let's change. I'm saying to rethink. Unthink to rethink, unlearn to relearn, un-engineer to reengineer, un-science to re-science and un-economics to re-economics. So, we're in a new world. Going for the new world. Kerala, Thank you so much. Thank you, all of you.

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Glenda Kruss
Research Director at HSRC, South Africa

I shall begin with by raising a few points in comparison with policy processes in South Africa that we are grappling and similar to that of Kerala. After 1994 South Africa moved towards a democratic government. In 1996 we adopted a new STI policy that foregrounded the knowledge economy and the national system of innovation. In 2019, we designed a new white paper that sets out the framework within which we are working with policy instruments and mechanisms and so on. Our policy aims to promote innovation for inclusive and sustainable development that promotes transformation in the society and we also have foregrounded the fourth industrial revolution. Our presidential commission has submitted its completed report in December 2020.

There are a lot of parallels with the processes in Kerala. Our presidential commission has also foregrounded the investment in human capital and highlighted the need to design, streamline and align our education system through a coordinated multi stakeholder process. What's happening here today in Kerala is such a coordinated multi stakeholder process. Very differently to what you've said about Kerala, where you have a problem of unemployed graduates and skilled professionals, in South Africa, we have a large pool of unemployed that do not have the right kinds of skills for the new kinds of jobs. I'm making that point to compare some of the strategies we are adopting.

Over the past four or five months, I've been involved in a province to develop the economic and social development strategy and we are part of a panel that is developing our housing strategy and central to that is skills. I just wanted to share two points that came up in our strategy. One is that we need to develop our paradigm and our framework for thinking about skills development. We have a framework for economic development and then we elaborate that into thinking about our skills development.

We have also identified high growth industry sectors like you have in Kerala, but slightly different. Apart from ICT and digital services, food, beverages Agro processing and Agro businesses, we have also highlighted sectors such as cultural and creative services and the cannabis

industry. But then what I thought could be quite useful to insert into the discussion here is what is the groupings of the types of skills that we need to grow.

There's a big list of the types of skills that need to be developed in Kerala. In our strategy, we have grouped these into four. One, the technology skills related to physical, digital and biological dimensions. So we need to develop advanced digital skills to design, develop and support our technologies that are underpinning new ways of doing things. But what is equally important is the society dimension and the digital society. In that regard, we need to make sure that we are developing the right skills so that people can thrive in the workplace, of the future. But equally in the business skills, the business dimension is critical. So, we see the omnipresence of digitalization the need for digital trust and the need for new models.

So, we need to develop new skills to take advantage of new ways of managing and doing business, and that's equally important. And then finally, at the governance level, we need new kinds of policy, new regulation and we need to be ready to respond to the new opportunities and demands of globalization as being stressed here today. Hence, we need to develop skill development programs. We have to include governance skills to can take into account rapidly changing technology in an increasingly global world.

The second point I wanted to make is about the nature of teaching and learning. The example that I wanted to quickly talk about is a proposal for our skills development that enabled apprenticeships in South Africa. I know that the Kerala strategy talks a lot about technical and vocational education and financial commitment to apprenticeships. In South Africa, we typically have our apprenticeships focusing on theoretical knowledge on practical skills and on workplace experience. The way that we do is very different because of technology and innovation and because of the innovations that we need in business models and processes. So, for example, we have open courses that use blended learning accessed from Global universities .

We can use digital portfolios for data informed decision making. Blockchain gives us new tools for accreditation. We've got new tools for digital identification and authentication and so on. These technologies could support multiple learning and pathways. I just want to point that besides those three aspects traditionally of theoretical knowledge, practical skills and workplace experience, we actually need new kinds of skills to be developed. To enable apprenticeships life skills become much more important, and we need to extend that training to include critical life skills like financial literacy, psycho-social support, etc. Particularly if you're going to be talking about work from home and work near home, we need to extend that training to include digital skills. So in a country like South Africa, perhaps less so in Kerala, we need to skill young people very much in the use of advanced technologies in the workplace

digital safety cyber security, etc.

There is the need to extend our training to include entrepreneurship skills. So ,if we have high levels of self-employment, we young people coming up with skills in business management and financial management, etc. I must say I was so impressed with the depth of the planning that you had which is evident from the excellent budget speech. Very clear planning in terms of numbers and approaches and that's something we envy. We are trying to even build our capacity to use digital means for more effective skills planning. I think that to deepen the process and going forward, it's very important to theorize and conceptualize a bit more tightly; how it's linked with the framework for the economics growth strategy and how our skills development itself can use digital means to deepen what is possible? Thank you colleagues and we look forward to engaging with you and if it would be valid, we would love to engage through this state level process,to compare how we are grappling with these very similar challenges, in significantly similar but different contexts. Thank you.

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Dinesh Abrol
Professor, Jawaharlal Nehru University, New Delhi

The two points that I haven't so far heard are one, the "who-whom" of knowledge economy and two, the guiding notions of knowledge economy in use by the professionals and policymakers. Professor Khanna reminded us not reduce knowledge to digital. The "who-whom" of the outcomes or the use values being gained need to objectively assess the possible contribution of digital economy in making. The contribution of IT enabled services are catering to our own economy in a limited way. They're upgrading the US or UK economy. And the workforce has remained confined to low value-added activities. While the significance of high-tech activities is well understood, the outcomes need a critical evaluation. Take the investment in very large scale integration (VLSI) design activity going on in Bangalore. India has not been able to create a high-tech economy due to the lack of investment in the required complementary manufacturing activities. Is the state government in position to bring such complementary investments to Kerala?

Prof. Khanna drew our attention to the transient nature of trends like working from home, online education and other such services. However, we have opportunities and potential in the possibilities of upgrading the system of resources and knowledge of economic and medicinal plants. There is the possibility of upgrading the manufacturing capabilities associated with the development of traditional health systems. We have opportunities in the services and tourism industry as well. Kerala will have to invest in the local system of education and competence building to further develop these resources and capabilities; a higher priority to the building of spaces for interactive learning to attain transformative innovation outcomes is the positive answer. This will ensure that the benefits are not confined to just a small section of the upper echelons of middle class.

The challenge of developing local resources and capabilities requires the relevant actors to co-produce knowledge and co-design solutions. System development rather than heroic approaches is the way forward. But the process of formulation of science, technology, and innovation policy (STIP, 2020) has completely bypassed the states. The STIP 2020 draft available for public

discussion has been worked out without interacting with the states. A progressive government is in place in Kerala, and it is expected to make the investments in science, technology and innovation to serve the people. In the given context, the question is how the state government of Kerala should be investing in the local system of education and competence building to enhance the absorptive capacity of the state and formulate policy programmes for the upgrading of knowledge economy of Kerala.

The progressive tradition of promotion of collective action in Kerala is her strength. Local self government capacity for the benefit of people's planning has been attempted in Kerala. Kudumbshree, the largest woman solidarity and social economy programme of the world, is in place in the state of Kerala. How is the state government planning to link these components of the existing ecosystem with the upgrading of knowledge economy? How can the state government encourage these strengths to actively participate in the development of the knowledge economy?

There are the challenges of climate change requiring distributed capabilities but networked to undertake disaster management. Health and environmental challenges require the knowledge economy to contribute to build on the resilience shown during the COVID-19 crisis. Information and communication technology (ICT) skills and capabilities need to be harnessed for the benefit of disaster management and climate risk reduction. Can Kerala harness the ICT skills and competences to develop unique strengths and become the source of knowledge and capabilities? Can we create a platform economy for the benefit of providing producer services for climate risk reduction and agricultural services? In Kerala, the knowledge economy should be connected with the processes of people planning and the development of the role and contribution of local self governments. Let us innovate to create a universal basic infrastructure capable for a sustainable urban economy.

The vibrant local self governments can enable the social cooperatives to develop as social carriers of a circular economy in Kerala. Development of the nodes of a networked system of group enterprises is also the key to the development of universal basic infrastructure and a pro-people platform economy. Kerala should not be in the hands of Uber and Ola, Monsanto and Bayer and so on. The private parties could participate and contribute by following the rules of game to be determined democratically. The notion of innovation has been misused and abused to capture the direction of development process, and so also the notions of knowledge economy and knowledge society. Whose knowledge should count is not an unimportant question? Kerala can provide leadership in mobilizing the higher and secondary education system to participate in the tasks of mapping, analysis, planning and implementation activities. All over the world there are models available for the integration of education and economy, and we should be open to their import. However, we should be evaluating the "who-whom" of the proposed models.

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Edward Henry Lorenz
Professor Emeritus, University of Nice- CNRS French National Centre for Scientific Research, Paris, France & Vice President,Globelics

I was reading the budget report and the aim of combining a knowledge economy with social inclusion and creating good jobs which was actually the key objective of the Lisbon Agenda, which unfortunately, as Bengt-Ake was saying got turned towards a more liberal austerity-oriented kind of strategy. So, I really congratulate you and I hope this alternative will continue to succeed. I understand that poverty has already been reduced substantially over the last decade. And I also gather your manufacturing sector is increasing. So, you aren't facing increasing deindustrialization, but actually you have a growing manufacturing sector, which is quite an accomplishment in these days.

I worked a lot on the fourth industrial revolution. One thing that is interesting about the data coming out of the research sponsored by the World Economic Forum is that unlike a few years ago, they're now saying Artificial Intelligence is going to create jobs. If we go back five years, most people were talking about the pessimistic prediction that we're going to destroy jobs. And especially for AI and robotics researchers didn't think very much farther beyond that to consider the potential for these technologies to create jobs, transform employment, to create new skills and actually to be positive.

Large firms of course are important drivers of change. However, one thing that we've learned from the survey evidence that's coming out - I would mention the UNIDO surveys presented in the Industrial Development Report for 2020 - is that there's a lot of heterogeneity between large and small firms. Basically, SMEs, and micro firms even more so, are not adopting these technologies to the same extent as large firms. This is an important issue to address as SMEs create jobs and are an important part of any economy.

Kerala of course, has an important population of SMEs which it supports through its innovation and entrepreneurial policy. The problems SMEs face can be multi-dimensional. It can be finance and there can be lack of skills, lack of knowledge, and even lack of awareness of what these technologies can do.

In some cases, new technology is not adapted to small scale production. You aren't going to invest in large industrial robots that are suitable for producing thousands of identical pieces in the

automobile industry for a small shop that's doing customized work. But in other cases, it's finance and knowledge. So, I think there has to be a real focus on policies that are partly focused on increasing awareness, and party on skills development.

And I think that the development of innovation hubs is one way to do it, to bring these technologies more deeply into the economy and to make sure as the UNIDO survey show that they impact on more than a small number of larger firms. Even in the case of Brazil, it's just a small minority of firms that are really at the cutting edge of what we call the Fourth Industrial Digital Revolution.

In a sense Kerala is very well placed because of its inclusive local banking system wherein, virtually every family has a bank account and this is exceptional. When we look at many developing countries you may have 50 percent or more of the population that are still primarily using cash, where cash economy dominates. So, I think you have a lot of things that are positive: good infrastructure and financial inclusion. You have an approach that stresses at the same time the adoption of new technologies and new methods, but with social inclusion and I think this is very important.

A last point I want to address is on the educational side. Yes, we need STEM skills. We also need lifelong learning, which is provided often by the employer. A lot of the training that takes place, it is over one's career. It's not just initial training in the universities. It may be provided by external training institutes, but it's also provided within the firm. So I think the employers have to be bought into the educational training policies and be encouraged to adopt policies that are appropriate for developing these skills. We've seen this in our work on Denmark where surprisingly training on the job through interactions with peers is seen by most of the people as the most important source of skill formation. This, of course, wouldn't be true for data engineers or data scientists. We are talking about people using these technologies in daily work activities. So, it is important that investments in STEM skills are balanced with investments in professional skills and experience-based training.

Vocational technical institutes play an important role and are often neglected. I want to stress that innovation does not just depend on science-based skills. It also needs applied skills, experience and skills that are acquired through work activity which we refer to as DUI mode innovation (Doing, Using and Interacting), as opposed to STI (Science, Technology and Innovation). You need both.

It's been a pleasure to be able to talk with you. Thank you.

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Anna Kingiri
African Centre for Technology Studies, Nairobi, Kenya

My presentation is going to focus on a few lessons for knowledge development and diffusion and how this can enhance our national innovation system. I would like to draw some lessons from M-Pesa innovation, which is a mobile money service in Kenya, very popular in Kenya and is also being used in East Africa and other parts of Africa. Of course, questions have been asked why this mobile money service has been successful in Kenya but not in other countries. For those who are aware, this is a service which was introduced in 2007 and to date it has revolutionized the operations not just in the financial sector, but also in other operational sectors in Kenya. When it was introduced, it was targeted at inclusive financial access, particularly by the grassroots communities. Some of the lessons that I would want to share I would imagine that they would also be useful for other sectors which are critical for Kerala. Like renewable energy sector, biotechnology sector, and, of course, other sectors within the Fourth Industrial revolution.

Starting with a very first factor that has been found to be very critical in Kenya for the development of dynamic technological innovation like M-Pesa, there is this new need to consider the aspect of product development. And of course, these would relate to a number of areas, but mainly on research and development. This is very, very critical. That is what has been found out in relation to M-Pesa and the other factor has to do with our development of the market related innovation. And this particular aspect of innovation has been associated with incremental innovation, the need to build the capacity of entrepreneurs, the need to build the skills of young innovators which in turn contributed in a great way in the growth of M-Pesa in Kenya.

The other area that has been found to be very critical is the aspect of product development that is driven by continuous adaptation that users demand. And of course, this is key to the process innovation. But more important is learning and capabilities development; regardless of being a grassroots actors, SMEs or academic institutions. The capacities and learning must be commensurate to the needs of both the technology developers, as well as the uses of the technology. This is yet another

factor found to have driven the growth of M-Pesa.

The other aspect which I think very critical for the Kenyan case is the policy innovation, where the government has contributed in a very large way in promotion of, young innovators and young entrepreneurs. This has been found to have supported the ICT curriculum development across different sectors and also in the development of supportive STI policy that promotes the other areas that has been found to be quite critical for the growth of M-Pesa. It ensures resource for R & D, market innovation and research, and for policy innovation.

Finally, for a functional technological innovation system, it has been found that policy should actually support the factors that target system failure. That is something which has been very critical for the Kenyan digital innovation. And it has been found that these areas must change to their capacity and their skills need of the different state. Therefore, technologists, as well as the developers of the technology must consider the skills and the capacities. So, I believe some of the factors that contributed to the growth of M-Pesa could be of relevance in the transformation of Kerala to becoming a knowledge economy. I do hope that the policymakers as well as the researchers can draw from the success of M-Pesa and inform our discussions and conversations. Thank you.

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Part III -Towards a way forward

Reflections from experts across the world

Aurora Fernandez Gonzales
Advisor to the Minister of Higher Education, Cuba

I will share some views on Cuba regarding what we are doing on higher education and also on science, technology, and innovation. Maybe you are aware that our government is giving high importance to science, technology and innovations in order to solve many of the big problems of Cuba with respect to social and economic development. We have a National Plan for Social and Economic Development until 2030 in which one of the axes is human potential, science, innovation and technology. The vision of our nation of Cuba 2030 defines us as sovereign, independent, socialist, democratic, prosper and sustainable.

Those important goals demand, of course, strong scientific and technological capabilities. We want to promote our socialist project, guaranteeing sovereignty and independence. We want to generate high levels of prosperity with high levels of inclusion. And we want to promote sustainable development. Those are very ambitious targets and demand strong connections between the State, the production sector and the scientific sector.

I want to highlight the importance of the role of university in a society that needs human talent and knowledge to promote its development. Universities are very much involved in what we want to achieve in our country. They produce more than 60% of science and technology results, of the scientific publications, of the postgraduate studies, including long life learning for most of our population.

In recent years, we have worked towards strengthening training and research agenda to contribute to the objectives of our national plan to 2030. We have more than a dozen universities that have already created science and technology parks, companies, start-ups, foundations, which seek to facilitate university`s connection with society. This is something new for us that started only two years ago, but is now giving initial results.

Very important, and relatively new is the role that universities have in our local development. The Constitution of the Republic in 2019 declared the autonomy of the municipalities. That autonomy requires creating capacities. In each Cuban municipality we have a University Municipal Centre, closely related to the major universities and their research centres and networks. Each municipal

government has a local development strategy that must be supported by knowledge and innovation to produce, food, improve habitat, multiply renewable energy sources, among other benefits. The role of the university municipality centre as the most important ally of the government is recognized.

The direct participation of our President in science, technology, and innovation through a direct and systematic dialogue with groups of researchers and experts has worked well in the battle against the Coronavirus pandemic. Of course, universities are present. This dialogue has made possible to advance much faster in solving several problems. In particular the development of new technologies. For example, Cuba has today four vaccine candidates against the Coronavirus. One of them is in phase two of clinical trials. No other country in Latin America has vaccine candidates of their own with this advance. This year Cuba will produce no less than 100 million doses. So, our entire population will be vaccinated this year and we will be able to help other countries that need help.

The innovation also helped to produce lung ventilators that our country had to import at a very expensive amount of money. Almost all the drugs that we use in Cuba in the battle against the pandemic are developed and produced in our country`s biopharmaceutical industry.

The technical direction of the pandemic management rests on an Innovation Committee, which is composed of more than 20 institutions. This committee meets every week with the President and started in March 2020. The President himself chairs these meetings to discuss medical protocols, advanced techniques, and to know what are the results, what is happening? He raises questions such as: why are people are still dying? What else we should do? As of now, we are achieving relatively good results in the control of the pandemic, of course, much more than the media of Latin America, which is our region.

These experiences have been shaping Cuba's a government management system based on science and innovation. I want to share with you that during this year a National Innovation Council will be created directly subordinate to the President.

As you see, we have huge challenges ahead, we are a very poor country, we have human talent formed by our revolution and we have confidence that we will win. So, we applaud the aim of Kerala to transform to a knowledge economy. We're sure with all I've heard today that they will achieve this objective. Thank you very much.

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(Dr Aurora Fernandez Gonzales is the Advisor for the Minister for Higher Education and formerly Vice Minister, Higher Education Cuba)

Luc Soete
Professorial fellow, UNU MERIT

The most striking feature of Kerala highlighted in the budget and received much attention in the discussion is the highly educated labour force in Kerala. At first sight, it made me think of Richard Freeman's much acclaimed book of 1976 the "Overeducated American".[1] A book which led to a lot of discussion in the United States and was more or less proven wrong subsequently. But let me quote from Dr. Isaac's budget speech: "Unemployment of the educated is the biggest developmental challenge faced by Kerala. The present employment schemes are inadequate to resolve unemployment of the educated."

So clearly there is something like the "Overeducated Keralite". But (s)he (she might be even more appropriate) looks today more like the successful outcome of Jan Tinbergen's [2] "race between education and technology" in favour of education. If the race is won by technology as it did in most rich countries, inequality would increase: technological change increasing the demand for more skilled workers.[3]

If like in Kerala, the race is won by education, the outcome could indeed result in an overeducated workforce with relatively limited income inequality. However, as outcome, this is one which most policy makers in the world would only dream about. It is an outcome which makes Kerala probably the best placed economy in the world today to win the next "digital" Tinbergen race: to outperform the speed at which a whole range of new digital technologies, including artificial intelligence, are likely to be impacting today and in the near future all sectors in society.

In short, the overeducated Keralite is actually the main guarantee for Kerala to become over this decennium one of the most advanced digital economies and knowledge societies in the world.

It will though, as be highlighted in Dr. Isaac's budget speech, requires some specific policy action to exploit this specific higher education comparative advantage. First and foremost, addressing the high levels of unemployment of highly educated females; second, raising the quality of higher education; third, paying attention to the need for continuous technological upskilling and life-long learning (the Tinbergen race is never over…); fourth, invest in the availability of IT equipment

and accessibility of IT infrastructure for all. A broad spectrum of actions needed.

A second factor complementary to the overeducated Keralite, consists of attracting (foreign) capital to Kerala. It is a factor which again has been given a lot of attention in Dr. Isaac's budget speech with the creation amongst others of the K-DISC, the Start-up Mission, the Kerala Innovation Challenge, the S.B Sen Innovation fund, a venture capital fund and even paying particular attention to the remittances of non-resident Keralites. So one can only encourage the Kerala government to be creative with measures activating capital, both based on public funds, domestically generated private savings and foreign capital.

In conclusion, I quote from the last 2006 Globelics slide:

"Knowledge sharing… shifts the attention away from the purely technological aspects of research to the broader organisational, economic and social aspects which are today in many cases a more important factor behind innovation, than the technological ones.

This holds a priori for countries with large populations where the potential for innovation, once users/consumers are identified as source of innovation can easily be enhanced. In doing so, innovation is less driven by the continuous search for quality improvements, typical of the old mode of technological progress, identified with the high-income groups in society, but by broader user needs across society. These needs are also evident in the poorer, bottom or base parts of society."

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(Prof Luc Soete is Professorial Fellow, UNU MERIT and formerly Rector Magnificus of Maastricht University, Netherlands)

[1] Freeman R. 1976. The Overeducated American. Academic Press.
[2] Tinbergen, Jan. 1974. Substitution of Graduate by Other Labour.Kyklos,27 (2).
[3] For more recent analyses see a.o. Sauer, P., N.D. Rao, S. Pachauri, March 30, 2015. The Race Between Education and Technology Revisited: An Integrated Approach to Explaining Income Inequality.

Sabu Thomas
Vice Chancellor, Mahatma Gandhi University, Kerala

I strongly believe that start-ups are the strongest engines for wealth creation, employment, and development. Start-ups in Kerala is about creating prosperity. Many enterprising people who dream of starting their own business lack the resources to do so. As a result, their ideas, talent and capabilities remain untapped - and our state loses out on wealth creation, economic growth and employment. I am glad that our Finance Minister looked into this issue very skilfully and made required budget allocations.

Coming to the domain of skilling, reskilling, upskilling, I am of the opinion that this is extremely important for the state. Probably you all know that, for any nation, productive and formal employment depends on the availability of a skilled labour force through sustained investments in skill development and entrepreneurship. Skill development and employability are interrelated. Universities and schools should teach life skills, technical skills, and soft skills. We should also provide vocational education, training schemes, internships and on the job training. Students have to be taught excellent skills during their study. That can be done through excellent internships. I can tell you the story of a great polymer chemist and a good collaborator and friend of mine in Belgium, Prof. Gabriel Goeninckx. He is a great polymer chemist, at the same time he is a great plumber, great painter and a great mason too. Professor Groenickx told me that he has learned all these skills during his college and school days. China's skilled labour force helps in boosting its economy. China has made several industrial parks in the universities. Hundreds and thousands of Chinese students are being trained in the science park at the universities and industrial units. My good collaborator Professor Yang Weimin, is a well-known polymer engineer, he is a consultant to many polymer companies in China. He gets a lot of funding by consultancy for the university. As a result, the companies grow and ultimately, universities, faculty members and students are benefitted.

Let me talk about the incentive system in the universities. In Chinese Universities, if you publish a paper in Nature, they get 20,000 US dollars. I think we should also give some sort of incentives to our faculty members. So we have to make dramatic changes. I think universities have a very

big role to transform Kerala into a knowledge-based society. Universities should be the centres for the production of knowledge; they should be centres of disseminating knowledge to society. Universities have to build up excellent infrastructure. They should interact with industry and society. I think Dr. Isaac has succeeded in that; he gave a lot of funding to universities through KIIFB. All our academic programs should have well defined in-built internships, as in Drexel University in the US. We should teach the students extra skills; inculcate the power of creativity, critical thinking and innovation. If you look at the Global Innovation Index, we are much better. We are actually ranked 50 in the Global Innovation Index. We should teach our students to take risks, encourage them to ask questions, experiment, observe and network. We should teach the students how to manage and plan multifaceted projects. Universities should have incubation cells, science parks as in China. If you look at the American Chemical Society (ACS) statistics, 80 per cent of the products that you see in the market are spin-off from the universities. I think we should transform the universities into excellent places where produced and knowledge is transformed into value added products.

Finally, I think Kerala has never witnessed such a beautiful budget giving tremendous thrust to higher education. Finance Minister tried his level best to strengthen our universities in a big way- by building massive infrastructure, providing faculty and post-doc positions. If you look at the GER of Kerala, we are actually behind Tamil Nadu. The GER of Kerala is 37 per cent and that of Tamil Nadu is 49 per cent. I request Dr. Isaac, we should try to build a GER of 75 per cent for Kerala, how can we do that? We must really build up excellent schools, we don't need any newer universities, but under each university we should have excellent schools, departments and centers. Look at the student strength of our university campuses, it is less than 2000. If you look at leading universities in the world, the strength is 25,000, 50,000, 100,000… and so on. If you look at the University of Pennsylvania (UPENN) in the US, the strength is 80,000. So, we need to have excellent schools/departments/centres at the universities, we need to have excellent colleges, we need to have state of the art polytechnics and ITIs. We also need to have excellent nursing colleges, para medical colleges and if you can do that, definitely our GER will go to 75 per cent. I'm sure our higher education can do extremely well if you look at these points carefully. Thank you so much. It was a wonderful conference. And I'm very happy to cooperate with Finance Minister and your team in all your endeavours.

Thank you Dr. Isaac.

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Judith Sutz
Professor, University of the Republic of Uruguay &
Former President GLOBELICS

The budget document is an evidence-based policy proposal, oriented by a normative vision convergent with the Sustainable Development Goals. One of the strengths of such document, in my opinion, is that it is rooted in what Kerala has achieved so far, in its traditions: it is not one more of those wishful-thinking texts that pile goals without much contact with reality. Of course, another strength of the document is the clear identification of difficulties and constrains to go along the proposed road. This said, I would like to make five points.

1.- As is rightly put in the document, universities need to be part of the effort of transforming Kerala into a knowledge society. Of course, quality is of paramount importance here. However, assuring quality is weakly related to international rankings. These rankings fulfill a very precise role: they are the commercial showcase of higher education systems that have evolved towards business services. Quality is not always measured by the number of publications in high impact factor journals. There is an international effort going on to change the prevailing research evaluation system, DORA (Declaration on Research Assessment). In my opinion, such change is fundamental for what Kerala is aiming to achieve. International comparisons push researchers to work on problems that are of interest for international journals; this orients research agendas away from problems of local importance but with little visibility in the northern countries. The stress to achieve quantity of papers leads also to address short-term, little risky problems, and even to pursue inadequate conducts, like "salami papers". I would love to work with Kerala reserachers to help building a new global academic reward systems, convergent with open science, where no important problem is left aside and all research is carefully assessed in terms of quality.

2.- The document put the overcoming of the digital divide in a correct perspective, away of a sort of magical thinking by which digitalization by itself will solve all problems. Digitalization may bring more dignity to people if people already have it: housing, sanitation, good nutrition, health, general education need to be there to allow digitalization to deploy all its potentialities. The recognition of social problems in Kerala, including inequality, and the impressive list of measures to

address them pave the way to a digitalization process that adds to development instead of transforming it in a new sort of mirage.

3.- To help the revamped knowledge system of Kerala to address the whole gamut of problems that require new knowledge to be solved, some problems and demands need to be unearthed. This is so for various reasons, including that people may not know that knowledge can be of help for solving some problems, or that they do not know how to phrase a problem in knowledge terms. Unearthing knowledge demand beyond "strong knowledge actors" is not an easy task. But when knowledge demand is clearly stated, research and particularly local research, answers. An Uruguayan anecdote illustrates the point: a team of young researchers at the University of the Republic started developing a new clinical test for COVID-19, combining different pieces of evidence in an innovative manner. They did that for two reasons: rich countries would overbuy tests kits; they also wanted to provide a cheaper solution that is available in the market. Their success was impressive. They provided a key piece in the strategy pursued by Uruguay in the six firsts months of the Pandemic. When Nature, in the issue of December 24, 2020, included Gonzalo Moratorio, the young scientific team leader, as one of the 10 scientific personalities of the year, the whole country was thrilled. This reaffirms the conviction that when demand is clearly stated, it may deliver innovative solutions. My group at the University Research Council has developed a methodology for unearthing knowledge demand related to social inclusion problems: we would love to put our modest advances at your service.

4.- Innovation and development scholars have learned from India the concept of frugal innovation. This leads to pay attention to the heuristics followed to solve problems, to the need for creativity, to the acknowledgement that never ever there is a single solution to a problem, even if this is what we are told. The mantra of "do not reinvent the wheel; if someone have already solved a problem just buy the solution", etc., is misleading. Re-inventing by following different heuristics is simple good common sense. Developing frugal heuristics to problem-solving, that is, to innovation, is something in which we can be of service to humankind. I am sure that Kerala could excel on that.

5.- Governments have always urgencies of all kinds; they need to show results in the short term of politics. However, these urgencies need not to take all their efforts. A small protected space, a sort of niche, where pursuing demand unearthing, where heterodox heuristics to solve problems are followed and tested, may always be allowed. Perhaps, among the wide array of Centers of Excellence that are envisaged, a Center for Heterodoxy in Innovation (or something like that) may be included, centered around problems defined differently and solved differently. You have been so audacious in your document that a proposal like that can perfectly fit in.

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Jayati Ghosh
Professor, Jawaharlal Nehru University, New Delhi

It is always inspiring to be involved with the government of Kerala and Dr. Thomas Isaac, in particular, because of that combination of vision, ambition, energy and commitment. I hope Kerala continues to be an example for the world. In the spirit of your excellent budget speech, which has outlined so many different things that I think at some point, you mentioned this list is not exhaustive. One that I really want to emphasize is the translation services. You know this is something that has always amazed me that in India we do not do more. If you look in Europe, they have translation even for 300,000 people.They will have complete translations of everything.

There is so much scope for translation from Malayalam to English and from Malayalam to Hindi and back, which is very important for inclusion, because it allows every citizen of Kerala every resident to have access; It allows your migrants to have access to your work; It allows people outside Kerala to know of what is happening in Kerala. It allows people in Kerala access to all kinds of knowledge. It is very undeveloped and one of those things that happens only when you provide it because people don't know what they're missing otherwise. Once you generate it people realize what they're missing and that becomes a demand which is the answer and you get a market for it. But there is a real need to establish a translation mission which would translate everything, not just literature but scientific work, economic and political weekly. I mean, all kinds of things and work done in Malayalam to be made available to a wider audience. So, my first plea would be to put translation. It's also very employment generating, particularly of skilled labour.

My second point is about the recognition, dissemination and promotion of traditional knowledge. You already have a very excellent IPR policies, I think in 2008 you did that for traditional knowledge. But I don't think there's been enough follow up in terms of actively looking for codifying writing up and disseminating the traditional knowledge. So I would again put the emphasis on recognizing and disseminating traditional knowledge as a very major area of activity. Related to that, in a way, agricultural extension has really lost out in India. There was some attempt to

revive it in the late 2000s. But since then, whether it is agriculture or other primary activities, fisheries such attempts have been sadly missing. We don't have enough relevant research. Relevant for the problems that producers are facing today and relevant extension, especially when people have to face climate challenges, newpests, new kinds of things etc you really need much more emphasis on knowledge pertaining to agriculture, fisheries. forests and dissemination and extension services related to that.

Then there is Kerala's huge advantage in care services. You already have tremendous skill and experience in a whole range of services. I think, you're ideally placed to develop new kinds of things in care; geriatric care, alzheimer's or dementia or palliative care. Kerala is now in a position to go beyond the basic health care to new kinds of care. These are globally much more significant because of demographic change and greater incidence of various kinds of trauma and various kinds of disorder that need active intervention. Once again, I don't have to emphasize this is very employment generating.

Finally, I just want to mention, you talked about how each of these things are going to be decentralized and the local governments will have an important role to play. I really think you should be looking not only at the mission mode that Mariana Mazucato has been talking about, but also look at the doughnut approach that was popularized by Kate Raworth, which is being used today by the city of Amsterdam, by Barcelona and others. And that is looking at creating sustainable cities in which you can actually bring together various forces of knowledge to make sustainable cities that are also human creative cooperative democratic. I think there's a huge potential in Kerala, because you're beginning on a much better place. You're beginning on a base in which you have a highly educated population, relatively speaking, not higher education, but in general, everyone is educated and you have a much greater civic awareness. So, the potential for doing that kind of doughnut economics to create sustainable cities that are also fun to be with and good to live in.

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Arun M Kumar
Chairman and CEO, KPMG

It is no surprise that recent budget by Dr. Isaac has placed the creation of a knowledge economy as its centrepiece. I'm very glad to see a focus on higher education, that is foundational to a competitive knowledge economy. The proposed creation of a knowledge economy fund, ensuring ubiquitous access to the internet and advancing the use of AI and Internet of Things are all transformational initiatives that you have laid out. Many talks today reflected the fact that the quality of thinking and innovation in Kerala is already many steps ahead of other parts of the country and in fact many parts of the world. My remarks will be highlighting a few thoughts on Kerala's efforts to establish and to successfully execute its ambition to be a knowledge economy.

First, I want to highlight the importance of and applaud the state's efforts to promote an ecosystem that fosters the digital industry. The ecosystem should help the state ride the wave of the fourth industrial revolution that is well upon us. The ubiquitous availability of connectivity is leading to democratization of technology; Dr. Isaac asserted his commitment that there shall be no digital divide in Kerala. The state, with its high human development indicators, is uniquely poised to take advantage of the paradigm shift of the fourth industrial revolution.

The state is a pioneer in terms of creating a proactive policy environment, being the first in the country to formulate a policy for the development of technological startups and incubation centres. It is important to continue to evolve this enabling ecosystem.

Many successful Kerala entrepreneurs, who have made their mark globally, nationally, and regionally, can help lead this endeavour. Mention was made today of the important need for mentors. Successful entrepreneurs and experienced industry executives should be tapped in this regard, possibly with incentives for their participation.

My second point has to do with data. Along with ubiquitous connectivity we are amid the Big Data revolution. The ability that we now process to collect, curate, and utilize what has been called a tsunami of data. To unleash the power that this presents, Kerala could consider

embracing open data concepts which would allow citizens to review, compare, visualize, and analyse government data online and share their findings in real time. In my tenure in the US government, I saw how President Obama's policies for open data led to a host of new businesses that grew up to use such data.

Let me now come to revamping of the skilling ecosystem to take advantage of the disruptions brought about by technology and by Big Data. Talent is becoming increasingly critical in proportion to capital as a factor of production, while robotics and AI are displacing human endeavour and repetitive work across sectors. Studies have predicted that up to 50% of the current tasks and skills would be replaced by AI. In this regard, it is important to understand the near-term and long-term changes that are likely to happen and shape the skilling ecosystem accordingly.

A critical requirement today is to collapse the barriers between the specialized skilling institutions like the ITIs, and universities and industry. The legacy paradigm is that of training institutions that deliver programs anticipating the needs of industry and then supplying graduates annually. But in this new era, skilling can no longer be the episodic or modular and we must embrace a new paradigm of flexible, customized, and contextual lifelong learning. This means all the actors, skilling institutions, communities, and firms must work together as a coalition. And skilling delivery models can be asset-light, transmitting learning and skills even remotely, through media like the mobile phone.

The COVID-19 crisis has exposed two other disruptive trends that we need to be prepared for. Increasing talent and price arbitration arising from the ease with which skills and work can be delivered remotely to clients worldwide, and rising popularity of what is called gig working - where services are increasingly being delivered to firms exogenously, and not by staff on the payroll. Kerala should tap into these opportunities and serve global clients working from Kerala, at a scale that surpasses what is already happening.

And last but not least, leveraging the educated women population of Kerala. Kerala has a significant number of qualified women. Dr Isaac mentioned the number as 5 million, who are not in formal jobs. In the wake of COVID-19, a number of remote execution jobs, from data analytics and predictive modelling, to design services for various industries that are suitable for women, are emerging. A focused attempt to make such opportunities available, along with a well-targeted upskilling initiative, can potentially double the formal working population of women in Kerala.

So, I will conclude with my belief that a new moment for Kerala is well within sight and the state can build on its favourable socio-economic base to transform itself into a knowledge economy based on soft skills, technology, and innovation - and commitment to inclusivity.

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José Eduardo Cassiolato
Professor, Federal University of Brazil, RedeSist Coordinator &
Former Secretary General, GLOBELICS

There have been a lots of attempts to develop the strategy to deal with the problems and perspectives of the world economy. In this context knowledge economy has been discussed and implemented in several countries. In my country, during the bright years of the President Lula and from 2004 and 2015 several national and state level initiatives have been developed precisely with the same type of objectives. There is some important progress, particularly relating to the two key points of discussion here: 1) in terms of skills; 2) in terms of infrastructure. We have improved a lot in several parts of Brazil in these two areas. But in terms of innovation systems, there was a mismatch.

The second point is a general point, of course, has to do with some points already mentioned by some of the speakers that preceded me. I would point out particularly Professor Ghosh's remarks about the importance of looking into the capabilities, the productive and social capabilities at local level. In all my trips to Kerala, I have benefited a lot from your care systems, particularly Ayurvedic medicine. I think that the issue of linking the local specificities to the program of transformation to the knowledge society should be seen in a very detailed way. I think that a focus in local innovation systems is an important part in my point of view, that could constitute one of the key stones of the program.

I think there are a couple of consensuses that are already emerging. The first one could be an outcome of pandemic, which is the development and use of the disruptive technology or the so called Fourth Industrial revolution having its impact on work and how we relate each other.

Secondly, although the globalization is here to stay, perhaps in a different way, the issues of sustainability, food, and health security are becoming important and much changes are happening at the local level.

Christopher Freeman pointed out in the early 90s that in an economy driven by short term market forces changes the technological trajectory incrementally given the existence of various lock-in mechanisms inhibiting radical paradigm shifts. That is the point that I think it's important to take into account because

we keep trying to follow the same technological trajectory in industry 4.0 that is happening in most countries of the world.

In most countries we are witnessing the use of this new artificial intelligence and all the technologies of the industry 4.0,try to make the old paradigm believe for some more time. This is a huge problem. Based on our recent research in the area of health, we certainly know what is happening. We have several examples that could be shared with you regarding how the use artificial intelligence is being done in the most part of the country. A recent research paper carried out to know about the main use of artificial intelligence in the area of health. These users are, of course, the major US health organization, especially big private hospitals, which are mostly controlled by investment funds by Wall Street in which they follow the logic of short-term profit maximization for shareholders. The study is fantastic because it shows that in all 99 per cent of use of Artificial intelligence in US hospitals,they are precisely trying to increase the economic efficiency of ongoing activities to make process more efficient, improving existing product and service and reduce costs nothing radical on that. I remember recent paper by Daron Acemoglu from MIT, where he pointed out that in this area of health, artificial intelligence could be used in so many novel ways. Not trying to substitute machine for labour and increase short run cost efficiency, but creating new products and empowering nurses, technical people in hospital, even MDs to use this technology in other ways.

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Gabriela Dutrénit
Coordinator, Management and Innovation Policies,
Metropolitan University, Mexico City, Mexico

I would like to focus on one specific aspect that I consider is important to ensure the success in the dynamics of this transformation: the evolution of different subsystems of society that influence the decisions and actions that are taken. As the Minister described, this process presents the arenas of economy, technology and innovation. But, our countries are complex and are at the stage of development where the problem of social inclusion is a key issue in any strategy, as was mentioned by many colleagues before. Hence, other subsystems of society may be included into de considerations.

I would like to go back to Chris Freeman, who in 1995 told us that a set of subsystems of society are important in the process of change, namely science, technology, economy, politics, and general culture. Freeman provided a different lens on how to analyse the development process and which components should be included in a strategy. Some subsystems like science (which includes ideas, individuals, and institutions) could be more important than knowledge on engineering and math as Patrick Heller said. Technology includes artefacts and techniques, but also the activities of the individual, groups and institutions involved in the design, development, improvement and diffusion. The economic subsystem includes institution concerned with the production, distribution and consumption of goods and services, and those individuals and institution concerned with the organization of these activities. But other two subsystems mentioned by Freeman include politics and the general culture. Politics include ideas, non-values of individuals and institutions concerned with the government and the governance, and the legal and political regulation by the central, local, and international authorities of society, including military affairs. And also, Freeman mentioned the general culture. I mean ideas, values, artistic creations, traditions including tradition and knowledge that was mentioned before. This includes education, which is an important aspiration of Kerala. Coming from developing countries, but also from what we are leaving today in the world, we have to add two-order subsystems. One is

social aspect that is much a problem of the developing countries concerning the income distribution, inclusion, and the generation of social welfare, but we also have to add the environment, which Freeman didn't include at that time in 1995 but for us now is a must.

Each of these subsystems of society has some independent performance, but they interact and influence on the process of economic growth. Hence, it can emerge either a lack of synchronicity and harmony between the subsystems when you are analysing a process of change or in contrast, they can converge and generate a virtuous cycle effect on economic growth and development. Hence, which is key with the subsystems of society is not only that they evolve, which is important is that they interact and co-evolve. But the success of a process of economic growth and development is associated with the extent to which the changes in these different autonomous subsystems of society are congruent instead of counteracting each other.

What we have seen in our countries is the lack of congruence between the political institutions that come from the past and the advances in the economy related to Internet of Things or manufacturing 4.0, or the contradictions between high rate of growth and the persistence of high level of exclusions, hence the distribution of benefits of the economic growth is unequal. And now during the COVID-19, we have seen in several countries an interesting response from the business sector, particularly the small and medium enterprises and even the informal sectors, with the emergence of new practices, services and products, which denote greater entrepreneurship and innovation than before. In most of the countries, this behaviour has overcome the government measures and incentives showing a different evolution of the subsystems.

So as a final reflection, I would like to say that the transit of Kerala to knowledge economy might require elaborating strategies that consider the different subsystems of society. It is needed to better define which are the relevant subsystems in the case of Kerala, and analyse how the policy can contribute to the evolution of these autonomous subsystems. It is important to identify clearly which institutions are relevant, how institutions favour positive bidirectional links, where to make an investment to strengthen these links between different subsystems. It is relevant to reflect on how to analyse the relationship between subsystems, and also to identify the existence of thresholds in any of these subsystems that affect the evolution of the country as a whole. Hence, we need to design policies that include instruments to promote a synchronous and harmonious development of all the subsystems.

We are excited to know and follow up on these interesting processes that happens in Kerala and can be an example for many other developing countries. Thanks for the opportunity to give an opinion about what is going on in Kerala.

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Patrick Heller
Brown University, Director, Development Research Programme at the Watson Institute of International Studies and Public Affairs

I have been learning from Kerala and, in particular, learning from Professor and now Minister, Thomas Isaac, for almost three decades. So, it's an absolute honour and privilege to be here. I will take the opportunity to comment on the budget and maybe locate it in a larger context.

So, let me begin with a brief comment about the literature on accelerated economic transformation. That literature focused on developmental state. But today we're talking about a very different kind of a developmental state, that is, the 21st century developmental state which is geared not so much to promoting industry, but rather services and a knowledge economy. In thinking about the 21st century developmental state, I think there are four features of success that we have to underscore, all of which are present in the Minister's budget speech.

The first is having and articulating a specific vision and associated projects grounded in local history and politics. The budget does just that by specifically framing the idea of developing a knowledge economy as an extension of Kerala's overarching democratic project. Second is having the actual state capacity to get the job done. By state capacity I don't just mean the conventional focus on bureaucratic and technical capacity, but also the ability to coordinate across governmental agencies and in particular coordinate across levels of government especially local governments. Third is a focus on expanding human capabilities - both for their intrinsic value of sustaining human freedom and their instrumental value for supporting development. Fourthly, we need states that are not just democratic, but that are deeply embedded in civil society. And by civil society, I do not just mean movements and associations, but also autonomous institutions of knowledge production, most importantly universities. So, let me just make three substantive points along these lines, and then finish with a comment about universities in particular.

In many respects, Kerala is the prototype of the 21st century developmental state. It is building on its extraordinary achievements in welfare and capability enhancement, but also in deepening governance and specifically by deepening democracy and empowering local governments. There is now an abundance

of comparative and historical evidence to suggest that the key to promoting more inclusive forms of economic dynamism is local government.

The second point, again, building on the successes of Kerala's long-term investment in welfare and capability-enhancement is precisely finding new ways to leverage those investments. The two fastest growing sectors in the world are education and health. They are labour intensive, especially as the nature of care itself intensifies and education specializes. There are extraordinary opportunities here to build on those welfare state investments. But I think the key here - given the tendencies towards precarity and fragmentation of the labour force and the growth of the gig economy - is ensuring that there is security for workers in these new highly flexible work arrangements.

Let me then quickly turn to higher education, which is of course the new thrust of the Minister's budget speech, and here I just want to make two points. First the budget speech, of course, is about broad-based commitments. Next comes the actual detailed programs and the devil is always in the details. And I think one of the details that really need to be thought through carefully is the question to the autonomy of institutions of higher education and there's reference to this in the budget speech. But for those of us who've experienced working in universities in the United States and Europe, we all know that one of our institutional advantages is the extraordinary autonomy that we have as faculty and as researchers. And I think that's not always been the case in India. Preserving autonomy from market forces, but also from the state itself is essential to attracting the best and creating environments of innovation.

And then let me make my final point that goes to the information economy, but also the particular role that higher education will play in supporting that economy. In an environment of scare resources, there's a tendency in the debate on the new economy to emphasize technology and innovation and in doing so to prioritize STEM (science, technology, engineering and mathematics) disciplines at the expense of other disciplines. But the knowledge economy is not just about technology and innovation. It's also about creativity and in particular understanding how the digital interfaces with the social. Creativity today is rooted - more than ever - in culture. And I think it's absolutely essential to invest in cultural capital, to invest in pedagogical models that are interdisciplinary and that ground hard knowledge or technical knowledge in the social and cultural fields.

Let me finish by observing that given Kerala's long-standing history and success as a people-centric model of development, it is uniquely positioned to build a knowledge economy, but not just any knowledge economy, but rather a knowledge economy that would be more cosmopolitan, more pluralistic, more inclusive, and more deeply rooted in a very creative culture. Thank you. And again, it's a true honour and privilege to be part of this conversation.

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Susan E. Cozzens
Professor Emerita, Georgia Institute of Technology, Atlanta, GA, USA
Vice President, Globelics

The budget for Kerala for 2021-22 is a bold document, laying out a distinctive pathway towards shared prosperity in a changing global economy. Kerala has long been a model for human-centered development; this document continues that commitment. The foundation of Kerala's social cohesion has been its investment in the health and education of its people. This new stage of development is possible because of that investment.

Nonetheless, the comments on the budget offered in this symposium have raised key questions. Kerala for what? Kerala for whom? Whose knowledge will count? Can Kerala continue to sustain "proactive equality" and build a Knowledge Economy?

These questions are critical because of what we know about the dynamics of inequality in high-technology development. High-technology development produces high-skill, high-wage jobs; this is inherent in its design. Typically, the number of such jobs is small in relation to overall employment. In countries with low general levels of education, most people do not have access to those jobs because they are not prepared for them. Fortunately, that would not be the case in Kerala. The people who hold the high-wage jobs are able to support the service economy around them - laundry, retail, food, transportation services, etc. These are typically low-wage jobs. Thus the high-technology economy adds fewer jobs towards the top of the income scale and more at the bottom; this increases inequality.

Inequality is already rising very fast in Kerala. While its human-centric commitments give it among the lowest levels of poverty among Indian states, it has the highest level of inequality. Inequality increased by ten Gini points over the period 1994 to 2005, quite a remarkable increase seldom seen in the world statistics. These Gini numbers are consumption-based; increases in income and wealth inequality are probably even more dramatic.

There are some key elements in the knowledge economy strategy for Kerala that will help to protect social cohesion in the face of these income and wealth dynamics. The commitment to preventing a digital divide is one. Additionally, and perhaps surprisingly, the expectation that

knowledge economy work will often be done from home is another, in ways that might not be immediately apparent. When people can do their high-wage jobs on a distributed basis, they will also support local businesses with their spending. Neighborhoods can maintain a mixed-income, mixed-use character. Mixed-income neighborhoods make it easier to maintain high-quality public schools for everyone; high-income families are less likely to flee into private schools and low-income families have access to the education that underpins social mobility. Children from different kinds of households go to school together, know each other, and are more likely to participate as equals in "the democratic project of Kerala." I am sure from everything I have heard today is that Kerala does not want to bifurcate.

In building a distinctively Kerala knowledge economy, some other lessons from the state's history are important to keep in mind. Local, craft knowledge has long been a font of innovation in Kerala, like the knowledge of farming and fishing. This will not only be important in bottom-up innovation in the informal economy of the state, but also needs to be combined with more formal knowledge. Innovation that is suited to a broad range of economic circumstances is generated best when people solve problems using expert and local knowledge together. Kerala's egalitarian social environment should be rich soil for this type of growth.

The massive investment in infrastructure that appears in the budget can also be the site of distinctive innovations. For example, Kerala's water supply is under stress, in ways that other regions are also experiencing. Inventing and implementing ways to address such challenges could be marketed elsewhere by Kerala-based enterprises. Likewise with innovations in energy, health, and transportation that is suited to Kerala's conditions. These can result in products that can be exported to markets that European and American firms do not understand, along with the approach of adapting them locally through local knowledge and experience.

Through all these steps forward in shared innovation and shared prosperity, wealth will accumulate. It is essential to "the democratic project" of Kerala to keep the wealthy in. On the one hand, Kerala's leaders should keep a close watch on tax structures, to make sure that the new wealth that accumulates is shared back into the kinds of investments in people that have made Kerala fertile ground for a knowledge society. On the other, leaders need to exhibit the attitudes and mutual respect that will hold the community together.

My best wishes to you in forging this unique way forward.

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A.V Jose
Former Director, GIFT

To me sitting right through the webinar was an immensely rewarding exercise. It was the kind of an immersion course in a whirlpool of ideas, floated by people from far corners of the world, all directed towards making Kerala a knowledge economy, not just for its inhabitants, I believe for the whole of India. The knowledge setup that develops in Kerala ought to be meant for the rest of India. I am confident that we have the visionaries prepared to underwrite the cost of embarking on such a venture. We have the skilled craftsmen or the knowledgeable persons who can make it happen, chart out every step involved in turning an idea into a product, and reach it to the market. It is a very ambitious venture that has been planned in the context of Kerala. I do believe Kerala is ideally suited for that because it is just a continuation of the transformation process, we have had in the past involving the democratization of the public space in the education and health spheres.

What happens next is the sequential stage of generating a knowledge economy, where knowledge is made accessible to people at the lower end of income distribution. It is a natural consequence of our past development and I am happy to note that the state has embarked on that in full force. The budget document is a clear indication that the state and its political leadership are prepared to go any length to realize that vision. The fact that the Finance Minister has said in the morning session: "forget about the cost or the mobilizing resources, I am going to make it happen, I am going to ensure that the resources are there" is a profoundly significant statement and indeed one of the most rewarding experiences while listening to the whole discourse here.

What I wish to say is that in Kerala, the focus is now shifting to the service economy. The service economy, by the way, is significantly different from the one we have envisaged as one cantered around manufacturing activities. We might have difference of opinion about the relative importance of different industrial divisions. Maybe 10 years down the road, we will still be focusing on manufacturing, but the shift is entirely towards the services sector based on the use of skilled labour. This is the culmination of a new industrial transformation where work is moving to

where the people are, unlike in the previous industrial revolutions where people always moved to where the work was located. Therefore, making the instruments of skill-acquisition accessible to people at the lower end of income distribution is extremely important. That is being pursued in Kerala.

More importantly, they are trying to make it possible for women workers to come into the labour force, which Professor Sushil Khanna made a reference to earlier. What needs to be done is to make sure that the reserve prices of women in the skilled labor households are met through what the state has to offer, which means it has to create an ambience to make work far more attractive. This means that more than raising the wages, which is part of an all-India process, we should focus on establishing appropriate institutions for social security. This is not just for the distribution of state's largesse, but for the creation of annuity-based contributory pension funds, which is what has been emphasized in the budget document. As the Finance Minister mentioned earlier in the day that he is going to meet the cost of social security payments for all the new jobs being created outside the public sector, it is indeed one of the most commendable initiatives.

Another point which Professor Khanna raised again in this session is about raising the quality of higher education. This has got to be done with the involvement of the existing crew of teachers and professors. I have heard the point often raised by very responsible people, familiar with the higher education setup, that nothing is possible with the existing crew. No, that is not the case. The point is that they have to be empowered to enhance their skill-sets and move up the ladder by making it possible to interact with the best and the brightest in the academic community in the rest of the world. This again is eminently doable. We are moving into the service economy and there is an abundance of opportunities awaiting us on account of the income effect generated through the factor price equalization theorem becoming fully operational. And that is something which Kerala can certainly look forward to. All those people passionately involved in planning for the future and charting every step in the transformation, I wish them the very best and look forward to working with all of you. Thank you very much.

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Alexandre Oliveira Vera-Cruz
Professor, Metropolitan Autonomous University, Mexico

I am grateful for the opportunity to learn from the experience of Kerala and be able to express some words related to this strategy of development based on knowledge. I'd like to make a point only on the topic of public policy, specifically on public participation in this process, and the public policy challenge of transforming Kerala into a knowledge economy.

In the decision regarding the design of STI policy in our countries, it has dominated a top-down approach, an approach to government policy as opposed to public policy. Therefore, there have been difficulties in recognizing the voice of stakeholders. Government policy faces the challenge to becoming public policy and for these the participation of interested parties is required. The public nature of the policy refers to increasing stakeholders' participation in the policy formulation process. Public participation is a political principle or practice. It can be recognized as a human right, the human right to public participation. It can be seen as a form of empowerment of citizens and there is part of the democratic governance. In order to design a public policy, it is required to think in participation, negotiation, and consensus generation of proposals of the different actors of the STI sector. To deepen public participation requires fostering the dialogue between officials and stakeholders for the decision-making process.

Public participation in STI opens space for a dialogue between STI communities (stakeholders) and the officials. Each community intervene with different intensity in each stage of the policy cycle. The evidence at the international level shows a more intense participation in the stage of definition of the agenda and design, which is the stage in which Kerala is.

Today, the generation and management of the dialogue is part of the governance capability of the national innovation system. I believe that public participation is very important for this strategy of the development based on knowledge with the vision of transforming Kerala into a knowledge economy. We are very interested in this process that you are starting now and I am confident that it will be an example for many developing countries. Thank you very much.

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Jeffrey Orozco
National University of Costa Rica &
Secretary General, GLOBELICS

Okay, first a thank you for the invitation. It is an honour for me, and for Globelics to be part of this activity. I think it is very important for you and also for us in Globelics to stress their relevance of our global network. It gives some feedback in these development challenges. There are also many lessons from Costa Rica, but I don't have the time now to say something, especially from our agricultural sector, on how to manage their R&D sector, their diffusion of knowledge, and also, the attraction of investment. Since you are about to be at your midnight in India I am not inclined to elaborate on any of these aspects. But I am sure later on, we will have a number of opportunities for more intense, elaborate and relaxed discussion.

For now, just to think about this activity and to remember that we are having a Globelics Conference this year in Costa Rica. We have already sent the call for papers. We hope to have a hybrid conference with some people here in Costa Rica and others online. It will still be difficult to predict how the situation with Covid would be by the end of the year (November). But I think this activity is a good example that we can share and the technologies help us to share in different ways. I thank everybody, we had a lot of feedback from experts from everywhere. It's really an honour for Globelics to be part of this and I hope that this dialogue will continue. I look forward to welcoming all of you in person in Costa Rica for the conferance, if not, at least online. Thank you.

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New studies on Kerala

Young Scholars' Forum, GIFT
Led by Lekshmi Prasad and Shagishna K

Economics

Scopus Indexed Journal Articles

1. Chathukulam, J., & Tharamangalam, J. (2021). The Kerala model in the time of COVID19: Rethinking state, society and democracy. *World Development*, *137*. https://doi.org/10.1016/j.worlddev.2020.105207

The objective of this paper is to examine Kerala's trajectory in achieving success in containing the pandemic and then confronting the unanticipated reversal, the legacy of the Kerala model such as robust and decentralized institutions and provisions for healthcare, welfare and safety nets, and especially the capacity of a democratic state working in synergy with civil society and enjoying a high degree of consensus and public trust. It then examines the new surge of the virus and attempts to establish if this was due to any mistakes made by the state or some deficits in its model of "public action" that includes adversarial politics having a disruptive tenor about it. The study concludes by arguing that the Kerala model is still relevant and that it is still a model in motion.

Other Journal Articles

1. Krishnankutty, J., Blakeney, M., Raju, R. K., & Siddique, K. H. (2021). Sustainability of Traditional Rice Cultivation in Kerala, India—A Socio-Economic Analysis. *Sustainability*, *13*(2), 980. https://doi.org/10.3390/su13020980

This study explored the dynamic, economic, institutional and socio-demographic factors involved in the production and marketing of traditional rice in Kerala, India. It employed a multinomial logit model and discriminant function analysis to extract the key factors governing farmers' marketing behaviour, various cost measures to study the economics of rice enterprises, and the socio-demographic factors were analysed using descriptive statistical tools. The study found that traditional farmers are ageing, have lower education, use limited marketing channels and the majority of them were satisfied with their farm enterprise.

2. Pillai, T, M. (2021). Gendered Desire in Kerala Affect and Assemblages as Development Indicators. *Economic and Political Weekly, 56(7)*, 48-54.
https://www.epw.in/journal/2021/7/special-articles/gendered-desire-kerala.html

An effort is made towards writing the immaterial and intangible coordinates of gendered sociality and connectivity into narratives of gender and development that conventionally operate on the premises of quantitativeness and measurability within discourses of developmental economics. The question of whether gendered desire can be used as an index to interrogate development paradigms has been raised. Further, the shifts in sociocultural landscapes amidst a digital media revolution that has made possible new

kinds of affordances around gendered, affective and networked publics has been addressed and a tentative theoretical investigation into possibilities of bringing an effective modality into developmental matrices is presented.

3. Sreejith, P. M., & Sreejith, S. (2021). Report on Socio-Economic Impact of COVID 19 on Migrant Workers with Reference to Kerala State. *Journal of Contemporary Issues in Business and Government*, *27*(1).
https://cibg.org.au/index.php/cibg/issue/article_7487_050ca8470c0950882ebe3701a4e4b7a9.pdf

Centered on the data collected via the survey method in Kerala's districts, this research aims to explore the social effect of lockdown. The sampling evidence indicates that the whole population, except the government employees, has suffered the brunt within terms of declining well-being. Self-employed people, too, have been able to boost their family stability significantly. The article also aimed to investigate and analyze the response of state policy to the crisis.

Books and Chapters in Edited Volumes

1. Mathew, J. & Varkey, J.(Eds.). (2020). *COVID 19: Unmasking the post pandemic realities.* Kottayam: DC Books.
https://dcbookstore.com/books/-covid-19-unmasking-the-post-pandemic-realities-405308641646

Following papers in the book are on Kerala:

Covid-19, public health system and local governance in Kerala by T M Thomas Isaac and Rajeev Sadanandan

Covid-19 lockdown: Protecting the poor means keeping the Indian economy afloat by K P Kannan

Covid-19 and development path – A Kerala experience by T P Kunhikannan and P K Sujathan

Social Sciences in Kerala in the context of Covid-19 by Shelly Johny

How to combat Covid-19: Lessons from Kerala experience by P K Sujathan, Prasad M G and Azad P

History and Culture

Scopus Indexed Journal Articles

1. Gallo, E. (2021). Kinship as a 'Public Fiction'. Substance and emptiness in South Indian inter-caste and inter-religious families. *Contemporary South Asia*, *29*(1), 81-96. https://doi.org/10.1080/09584935.2021.1884658

Abstract: This article explores inter-caste/religious (ICR) marriages in Kerala and focuses on the meanings and experiences of kinship when the latter is devoid of its expected emotional and relational substance, to become a 'public fiction'. The article maps how the reality of ICR marriages is turned into a fiction by persisting unspoken norms. It suggests the importance of linked discussions on fiction/reality in the domestic sphere to the public/political role that kinship and families hold in modern postcolonial Kerala.

2. Mini, D. S. (2020). Cinema and the mask of capital: Labour debates in the Malayalam film industry. *Studies in South Asian Film & Media*, *11*(2), 173-189. https://doi.org/10.1386/safm_00027_1

Abstract: Focusing on the Malayalam language film industry based in Kerala, this article examines how the film industry's apprenticeship and unpaid labour arrangements affect below-the-line labour and less influential job profiles on a film set. In corollary, it also explores how labour and bargaining rights are conceptualised differently by film organisations based on their ideological positions. Using a mixed-methods approach, including media ethnography and interviews with members of different trade guilds who form part of Malayalam cinema's professional, technical, and service sectors, the study demonstrates how structural inequalities in

the film industry are overlooked while the cine worker's agency is co-opted by a neoliberal system that masquerades as welfare.

3. Mannil, B. M. (2020). The gendered film worker: Women in cinema collective, intimate publics and the politics of labour. *Studies in South Asian Film & Media*, *11*(2), 191-207. https://doi.org/10.1386/safm_00028_1

Abstract: This study attempts to develop a framework centred around the politics of labour to provide a useful case to highlight how thoughtful engagement with these categories provides immense value for both contemporary film scholarship and feminist histories of media. Through examining the Women in Cinema Collective's (the first collective of women film workers to be formed in India) social media campaigns, advocacy work, petitioning and legal counselling, the study argues that Women in Cinema Collective emerges as a tenuous collective whose work moves across the porous boundaries of a new social movement, workers collective and an autonomous women's group.

Other Journal Articles

1. John, S. (2020). The Rise of 'New Generation' Churches in Kerala Christianity. Martha, Frederiks. Dorottya, Nagy. *World Christianity: Methodological Considerations*, 19, 271-291. Brill. https://doi.org/10.1163/9789004444867_014

This study explores the appropriate terminologies and conceptual frameworks to understand the complexity and uniqueness of new churches and movements of 'pentecostal' or 'charismatic' nature in the light of global Pentecostalism and local histories. It focuses on the case of 'New Generation' churches from Kerala and its diaspora and tries to understand contemporary movements within local contexts shaped by the movements and denominations to which they are responding and reacting.

2. Punathil, S. (2020). Archival ethnography and ethnography of archiving: Towards an anthropology of riot inquiry commission reports in postcolonial India. *History and Anthropology*, 1-19. https://doi.org/10.1080/02757206.2020.1854750

This paper examines the challenges and possibilities of combining archival and ethnographic methods in the field of 'communal' violence studies in India. It critiques how colonial and postcolonial Indian archival reports problematically inscribe violence between any religious communities (such as Muslims and Christians) in the same narrative as the predominant case of Hindu–Muslim conflict, and also illuminates how archival ethnography can be an effective way of studying violence between religious communities. The approach called 'ethnography of archiving', is introduced to detail the judicial and nonjudicial discourses and bureaucratic manoeuvring involved in the creation of an archival report.

3. Thadathil, H. (2020). Constructing Authenticity in Discourse (s): Debates among the Mappila Muslims of Malabar, South India. *Asian Journal of Social Science*, *48*(5-6), 449-467. https://doi.org/10.1163/15685314-04805007

This paper seeks to bring out the dynamics of Muslim public sphere where prominent Muslim groups debate constantly over the representation and following of what is called 'True Islam'. It highlights these debates in the context of the academic debates over 'True' and 'Authenticated' Islam.

4. Visakh, M., Santhosh, R., & Mohammed Roshan, C. (2021). Islamic Traditionalism in a Globalizing World: Sunni Muslim identity in Kerala, South India. *Modern Asian Studies,* 1-42. https://doi.org/10.1017/S0026749X20000347

This paper examines the challenges and possibilities of combining archival and ethnographic methods in the field of

'communal' violence studies in India. The ethnographic study among the traditionalist Sunni Muslims of Kerala, observed the emergence of new intellectual critiques of Islamic reformism and a revival of 'traditional' Islamic articulations through a new class of traditionalist Sunni ulama, claiming to be 'turbaned professionals' who believed in providing epistemic sanctioning to 'traditional' Islamic piety while simultaneously grounding it within the discourses and processes of neoliberal developmentalism. Socio-economic change within the community facilitated by structural as well as cultural forces of globalisation has led to the discursive shift of the Sunni Islamic traditionalism in Kerala since the 1980s, from defensive to more assertive forms.

5. Yasser Arafath, P.K. (2021). Southern Hindutva: Rhetoric, Parivar Kinship and Performative Politics in Kerala, 1925–2015. *Economic and Political Weekly*, 56(2), 51–60. https://www.epw.in/journal/2021/2/special-articles/southern-hindutva.html

This study aims to understand the rise and growth of Hindutva in Kerala and the characteristics of the strategies it has evolved in the state. The study examines the core elements of its political and ideological characteristics and the intrinsic connections between the growth of Hindutva and the elements of violence, sexual politics, and the notion of purity.

6. Paul, V. B. (2021). 'Onesimus to Philemon': Runaway Slaves and Religious Conversion in Colonial 'Kerala', India, 1816–1855. *International Journal of Asian Christianity*, *4*(1), 50-71. https://doi.org/10.1163/25424246-04010004

Abstract (edited): This paper explores the history of slave caste conversion before the abolition period. Most of the existing literature only explored the lower caste conversion after the legal abolition of slavery in Kerala (1855). These studies ignored the slave lifeworld and conversion history before the abolition period, and they argued that through religious conversion, the former slave castes began breaking social and caste hierarchy with the help of Protestant Christianity. From the colonial period, missionary writings bear out that the slaves were hostile to and suspicious of new religions. They accepted Christianity only cautiously.

7. Goren-Arzony, S. (2021). Sweet, sweet language: Prakrit and MaGipravâ7am in premodern Kerala. *The Indian Economic & Social History Review*, *58*(1), 7-27. https://doi.org/10.1177/0019464620980905

Abstract: This paper studies the connections between Prakrit and early MaGipravâ7am literature from pre modern Kerala and highlights a rarely discussed aspect: the role of Prakrit in shaping both MaGipravâ7am literature and theory. The relation between Prakrit and MaGipravâ7am is discussed in two connected ways: first, by considering the similarities between the practices themselves, especially in terms of their themes and aesthetics; and second, by examining the implicit ways in which MaGipravâ7am theory, as it is presented in the Lîlâtilakam, Kerala's first grammar and work on poetics, is structured on Prakrit materials or on Sanskrit materials dealing with Prakrit.

8. Haneefa, M. (2021). Muslim Barbers of South Malabar and Covid 19: Homogamy, caste occupation and economic hardship. *Anthropology Today*, *37*(1), 9-12. https://doi.org/10.1111/1467-8322.12628

Abstract: This article explores how having a particular caste occupation is devastating for a community who live in the South Malabar region of Kerala. During this pandemic, the system of traditional caste occupation based on homogamous marriage and validated by religious scriptures has compounded severe economic hardship for the Muslim Barbers. A

specific caste occupation and engagement of household members in a similar profession strengthen the 'strong kinship ties' within the community, and they miss out on the benefits of 'weak ties'. Everyone is suffering, but the Barbers are among the hardest hit.

Health

Scopus Indexed Journal Articles

1. Indu, P. V., Beegum, M. S., Kumar, K. A., Sarma, P. S., & Vidhukumar, K. (2020). Validation of Malayalam Version of Everyday Abilities Scale for India. *Indian Journal of Psychological Medicine*. https://doi.org/10.1177%2F0253717620973419

This study's objective was to validate the Malayalam version of Everyday Abilities Scale for India (M-EASI) in those aged e"60 years. Everyday Abilities Scale for India (EASI) is a scale to assess activities of daily living that is employed as screening tools for dementia or major neurocognitive disorder (MNCD). A total of 304 participants were recruited from a tertiary care center attending psychiatry, neurology, or geriatric clinic of general medicine departments.

2. Satheesh, G., Sharma, A., Puthean, S., Ansil T, P, M., Jerena, E., Raj Mishra, S., & Unnikrishnan, M. K. (2020). Availability, price and affordability of essential medicines for managing cardiovascular diseases and diabetes: a statewide survey in Kerala, India. *Tropical Medicine & International Health*, *25*(12), 1467-1479. https://doi.org/10.1111/tmi.13494

This study uses the WHO/HAI survey methodology to evaluate the availability and prices of 23 Essential Medicines (EMs) for cardiovascular disease (CVD) in 30 public sector facilities and 60 private retail pharmacies across 6 districts in Kerala (Nov 2018- May 2019). Data on six anti-hypertensive fixed-dose-combinations (FDCs) designated as 'essential' by the WHO in 2019 was analysed and Median Price Ratios (MPRs) were also calculated. The study finds that on average, the most-sold and highest-priced generics, respectively, were 6.6% and 8.9% costlier than the lowest-priced generics (LPG) and that the availability of CVD and diabetes EMs fall short of WHO's 80% target in both the sectors. It also reports on the unaffordable prices in comparison to GSDPs despite near-optimal availability in private retail pharmacies.

3. Mathew, D. (2021). Yoga as a potential psychosocial tool: Results from a quasi experimental study on victims of flood affected state of Kerala. *Advances in Integrative Medicine*. https://doi.org/10.1016/j.aimed.2021.01.004

Abstract (edited): Natural disasters of any form leave individuals in agony. Mental and social health are among the notable domains affected by such disasters. Thirty-two participants (Mean age 37.8 years) victims from a flood-affected state of India were enrolled for 15 days of yoga interventions after obtaining written consent. Breathing exercises and guided relaxation techniques were provided as intervention after obtaining a self-rated visual analog scale (VAS) for fear, sadness, anxiety, and lack of sleep. All the participants completed the study. Statistically significant changes were observed in all the VAS-dependent scale variables, such as fear, sadness, anxiety, and lack of sleep. No adverse events were reported.

4. Kiran, P. S., Mohan, B., Abhijith, V., Abraham, A., Anoop, G., Dinesh, R. S., Krishnan, S., Mahadevan, K., Peethambaran, M., Kunheen, M., Sidharthan, M., Prathibha, S., Sukesh, G., Thomas, K. P., Jayaprakashan, K. P., & Jaisoorya, T. S. (2021). Framework for strengthening primary health care and community networks to mitigate the long-term psychosocial impact of floods in Kerala.

International Journal of Disaster Risk Reduction, *52*. https://doi.org/10.1016/j.ijdrr.2020.101947
Abstract (edited): Individuals who encounter disasters experience negative consequences across physical, mental, and psychosocial domains. Impacts on mental health and psychosocial domains are more common, and last longer than physical health problems. In August 2018, Kerala witnessed unprecedented floods that resulted in 483 deaths and significant loss of property and livelihood. Project 'Pariraksha' was implemented by the Government of Kerala, to mitigate the long-term psychosocial impact of the disaster. This paper describes the detailed methodology of this project.

Other Journal Articles

1. Sarkar, S. (2021). Breaking the chain: Governmental frugal innovation in Kerala to combat the COVID-19 pandemic. *Government Information Quarterly*, *38*(1). https://doi.org/10.1016/j.giq.2020.101549
This research uncovers the mechanisms at play as Kerala State Government implemented and used frugal technologies as platforms that helped decision making and strategy to fight COVID-19, in partnership with research institutes and private sector actors, which are cheap and efficacious. The study defines and promotes the concept of Government Frugal Innovation (GFI) and provides valuable insights and tools to help governments navigate and effectively respond to this crisis, encouraging the rest of the world to learn from Kerala's experience.

2. Sukesh, G., & Nair, V. I. (2020). Pathways to care and duration of untreated illness in patients attending a state psychiatric hospital. *Kerala Journal of Psychiatry*, *33*(2), 137-146. https://doi.org/10.30834/KJP.33.2.2020.218
Abstract: In India, due to various factors, mentally ill often turn to a variety of carers for treatment. It results in a longer duration of untreated illness (DUI) with poor long term prognosis. Studies on pathways to care, seek to find out predictors of mentally ill person's help-seeking behaviour. This study seeks to examine this matter in Kerala setting. Four gateways to care were identified: Psychiatrist-71.2%, faith healers – 14.8%, non-psychiatrist modern medicine doctors- 9.2%, alternate systems of medicine- 4.8%. Median DUI was seven months. Faith healers as first carers were more in below-poverty-line (BPL) compared to APL families.

3. Krishnan, S., Lekshmy, K., Anil, P., Sandhya, B., & Jayageetha, K. (2020). Self-reported Emotional Experience Among Police Personnel Before and After Attending a Mindfulness Based Intervention (Mindful Life Management-MLM)-an Observational Study. *Kerala Journal of Psychiatry*, *33*(2), 125-130. https://doi.org/10.30834/KJP.33.2.2020.210
Abstract: The objective was to study the effectiveness of Mindfulness-Based Interventions (MBIs)in reducing the negative emotions among police officers. The observational study attempts to assess and compare the subjectively reported emotion and Mindfulness level among police personnel before and six weeks after attending the Mindful Life Management (MLM) workshop.Results of the present study suggest a statistically significant association between subjective emotional experience and the MBIs.

4. Santhosh, K., Vinaychandran, S., Narayan, K. D., & Mini, C. H. (2020). Postpartum depression and its association with social support: a cross sectional study at a maternity hospital in Kerala. *Kerala Journal of Psychiatry*, *33*(2), 114–120. https://doi.org/10.30834/KJP.33.2.2020.198
Abstract: Cross-sectional assessment of mothers (n=250) during postnatal visits to the family planning clinics between four weeks and one year of delivery, using Edinburg Postpartum Depression Scale (EPDS), Social Support Questionnaire and a structured questionnaire for the assessment of

psychosocial risk factors was carried out in a tertiary care postgraduate teaching hospital of north Kerala. Multivariate Regression Analysis was used to identify the risk factors for postpartum depression (PPD). 27.6% had postpartum depression, and 18.4% had suicidal ideation. Factors associated with the presence of PPD included alcohol use of husband, marital discord, lack of family support and lack of physical help during the postnatal period.

5. Parvathy, R. S., & Smitha, C. A. (2020). Emotional intelligence, perceived stress, and internet use behaviour among undergraduate medical students-a cross sectional study. *Kerala Journal of Psychiatry*, *33*(2), 105–113. https://doi.org/10.30834/KJP.33.2.2020.202

Abstract: In this cross-sectional study, using convenience sampling, 368 study participants were selected from the undergraduate medical students of a medical college in North Kerala. After getting written informed consent, socio-demographic data sheet, Internet Addiction Test (IAT), Schutte Self Report Emotional Intelligence Test (SSEIT) and Perceived Stress Scale (PSS) were filled up by the participants. Completed responses were scored and analyzed using SPSS 18.0. In the sample, 42.9% had mild internet addiction, and 22.8% had moderate internet addiction. There was a positive correlation between scores of IAT and PSS and a negative correlation between scores of IAT and SSEIT. A pattern of increased levels of perceived stress and decreased levels of emotional intelligence was noticed with increasing levels of internet addiction scores.

6. Valsan, N., Thomas, R., Kuttichira, P., Valsan, C., & James, A. (2020). Willingness and psychological preparedness to attend to COVID-19 patients among healthcare workers in a tertiary care private hospital in Kerala-A mixed method study. *Kerala Journal of Psychiatry*, *33*(2), 96–104. https://doi.org/10.30834/KJP.33.2.2020.204

Abstract: The study highlights the altruistic attitude of frontline health workers to be the most important contributing factor for psychological preparedness. The willingness to respond to the pandemic was found to be significantly higher among doctors and nurses compared to medical interns. While anxiety was the most common emotional response, the fear of infecting family members was found to be the most common risk perceived in qualitative analysis. Considering the risks, workload, and socioeconomic stressors, proactive psychosocial support should be given to frontline healthcare workers by the institutions, governments, and society.

7. Radhakrishnan, P., Arathil, P., & Narayanan, D. (2020). Association of tobacco smoking with bipolar affective disorder-a comparative cross-sectional study at a tertiary care centre in south India. *Kerala Journal of Psychiatry*, 33(2), 131-136. https://doi.org/10.30834/KJP.33.2.2020.215

Abstract: Smokers with psychiatric disorders, most notably those with serious mental illness and substance use disorders tend to present with more severe nicotine dependence and nicotine withdrawal than smokers without these illnesses. The comparative cross-sectional study was done in Amrita Institute of Medical Sciences & Research Centre, Kochi, a 1,450-bed hospital for a period of 2 years. There appears to be a relationship between smoking tobacco and certain clinical features of bipolar affective disorder. It is possibly a bidirectional relation between these two disorders.

8. Cherian, V., Philip, J., & John, A. (2020). Prevalence and factors associated with post-traumatic stress disorder among flood-affected adults in a panchayat in Ernakulam district in Kerala. *Kerala Journal of Psychiatry*, *33*(2), 147-152. https://doi.org/10.30834/KJP.33.2.2020.222

Abstract: This study aimed to determine the prevalence and the factors associated with Post-Traumatic Stress Disorder (PTSD) among flood-affected adults in a panchayat in Kerala.

This was a cross-sectional study undertaken in 100 households in a flood-affected community in Kerala. The PTSD Checklist for DSM-5 (PCL-5) was administered to diagnose PTSD. The intensity of flood exposure was measured using a checklist of ten factors. Our study demonstrates the high prevalence of PTSD following floods in Kerala and the need to conduct post-disaster mental health screening. It highlights those factors that may predict the occurrence of PTSD in the affected population.

9. Vinuprasad, V. G., Sharadha, N. R., & Eskin, M. (2020). Change in attitude towards suicide with current undergraduate training in psychiatry: a cross-sectional study. *Kerala Journal of Psychiatry*, *33*(2), 153-157. https://doi.org/10.30834/KJP.33.2.2020.221

Abstract: In this cross-sectional study, we looked into the change in the attitude of an undergraduate student towards suicide with his/her training in psychiatry with the present undergraduate curriculum. The current undergraduate medical curriculum by Medical Council of India is successful in bringing attitude change in some important domains of the subject of suicide. Domains remain under-covered by the curriculum should be looked into in the future curriculum revisions.

10. Sam, S. P., Geo, J., Lekshmi, G. I., & Kallivayalil, R. A. (2020). Post Stroke Depression and Lesion Location: A Hospital based cross sectional study. *Kerala Journal of Psychiatry*, *33*(2), 158–161. https://doi.org/10.30834/KJP.33.2.2020.223

Abstract: Thus the study aims to assess the prevalence of PSD in stroke patients and the relation between site and side of stroke with PSD. A cross-sectional study was done among 40 stroke patients. This study showed a high prevalence of PSD and its correlation with left-sided cortical and subcortical lesions. Eliciting the relationship between the lesion and depressive symptoms may help shed light on the neurobiology of depressive disorders.

Sociology

Scopus Indexed Journal Articles

1. Vijay, D., & Gekker, A. (2021). Playing Politics: How Sabarimala Played Out on TikTok. *American Behavioral Scientist*. https://doi.org/10.1177/0002764221989769

Abstract (edited): This article analyses the emergence of TikTok as a political actor in the Indian context and how politics is performed on TikTok and how the platform's design shapes such expressions and their circulation. It reviews existing academic work on play, media, and political participation and examines the role of TikTok in the contentious issue of women's entry into Sabarimala [in Kerala], a temple that women of menstruating age are barred from entering on religious grounds. It goes on to examine the case of Sabarimala through the double lens of ludic engagement and platform-specific features.

2. Shaji, J. (2021). Evaluating social vulnerability of people inhabiting a tropical coast in Kerala, south west coast of India. *International Journal of Disaster Risk Reduction*, *56*. https://doi.org/10.1016/j.ijdrr.2021.102130

Abstract (edited): This study is an attempt to compute the Coastal Social Vulnerability Index (CSoVI)for the coast of Thiruvananthapuram, which is densely populated and beset with several problems. CSoVI has been defined in this study in terms of eleven quantifiable variables, comprising four demographic, three economic, and four infrastructural variables and the Social Vulnerability Index (CSoVI) of each coastal panchayat was computed. The study reveals that about 25% (19 km) of the coastline in Thiruvananthapuram is highly socially vulnerable.

Other Journal Articles

1. Deepak, S. A., & Ramdoss, S. (2020). The life-course theory of serial killing: a motivation model. *International journal of offender therapy*

and comparative criminology. https://doi.org/10.1177%2F0306624X20981030

The study using life-course theory approach is a pioneering one conducted on eight serial killers in India who were inmates in central prisons of Kerala and Tamil Nadu. Biographies of the offenders were created chronologically using information collected through in-depth interviews with serial killers in the prisons, interviews of relatives of the killers, surviving victims, etc that supported the construction of a less rigid inclusive motivation model, explaining the process of individuals evolving into serial killers. The model shows the presence of a short incident named 'trigger' in the lives of the six serial killers which played a significant role in bringing out the dormant killer instinct. Interactions in the lives of serial killers proved to be more important than standalone factors and there exists no predetermined recipes for the making of a killer.

2. Krishna, R. M., & Balasubramanian, P. (2021). Understanding the decisional factors affecting consumers' buying behaviour towards organic food products in Kerala. *E3S Web of Conferences* EDP Sciences. 234. https://doi.org/10.1051/e3sconf/202123400030

This research intends to explore the factors influencing Kerala consumers' organic purchase behaviour based on data collected from 200 respondents (100 regular and 100 irregular organic users) using a structured questionnaire. Analysis techniques consisting of correlation and multiple linear regression have been applied for data evaluation. The research findings support the formulated hypothesis and aim at providing necessary guidelines for various stakeholders who are involved in the organic industry.

3. Prasad, V., & Thampi, B. V. (2021). Gender ideology and gendered political dynamics shaping electoral fortunes of women politicians in Kerala, India. *Women's Studies International Forum,* 84. https://doi.org/10.1016/j.wsif.2021.102437

This paper analyses the 2019 general elections and the by-elections that followed in Kerala to discern the changing gender dynamics that produced certain kinds of 'desirability' and 'approval' around the candidature of women politicians. The identification of three specific frameworks—'honorary masculinity, 'relaxed honorary masculinity', and 'welfarist feminine altruism' —in and through which three generations of women politicians entered into public politics and carved out their niches, also raises the question of intersectionality in women's political leadership.

4. Mani, V., & Krishnamurthy, M. (2021). The Work of Sporting Bodies: Football and Masculinity in North Kerala. *Verge: Studies in Global Asias*, *7*(1), 147-169. https://doi.org/10.5749/vergstudglobasia.7.1.0147

Abstract: This paper investigates how sevens, a particular, local and dynamic form of football in North Kerala, also functions as an important avenue for work and sustenance. The paper argues that this largely uncontrolled, irregular network of what we see as sports labour reveals how economic factors, such as high unemployment and recessive job markets, often congeal with social dispositions such as expectations of masculinity to produce unique gendered relationships between sport and its actors in localised South Asian contexts.

Working Paper

1. Chathukulam, J., Joseph, M., Rekha, V., Balamurali, C. V., & George, S. (2021). *An Evaluation Report on Ayyankali Urban Employment Guarantee Scheme (AUEGS) in Kerala*. (Working Paper No. 21). Central for Rural Management in India https://crmindia.org/wp-content/uploads/2021/02/Woring-Paper-21.pdf

The state of Kerala has been a frontrunner in launching an urban wage employment

guarantee scheme by launching the Ayyankali Urban Employment Guarantee Scheme (AUEGS). However, despite being modelled on MGNREGS, the implementation of the AUEGS has been a flawed one. So, at a time when the demands to introduce an urban wage employment programme for solving the unemployment crisis, the study suggests that it is better to take into consideration the performance of similar wage unemployment programmes and then introduce a national urban wage employment programme that can address the present pitfalls and drawbacks.

Book

Suresh, L., & Suchitra, M. (2021). Suicidal Resistance: Understanding the Opposition Against the Western Ghats Conservation in Karunapuram, Idukki, Kerala. [Monograph] *Ecological Challenges & Local Self-Government Responses, 2*. Thiruvananthapuram: Centre for Development Studies. https://cds.edu/wp-content/uploads/Western-Ghats_MonographSeries2.pdf

About the book: This is the second in the series resulting from the small research projects supported by the Research Unit on Local Self-Government at the Centre for Development Studies on Kerala's emergent ecological challenges and the preparedness of our local democracy to tackle them. The study area is situated in Idukki District and seeks to understand how far ecology is included in local governance, in the context of the discourse around the protests against the recommendations of the Gadgil and the Kasturirangan committees. In this work, a journalist and a researcher collaborate to present the underlying social, political and economic factors that drive local resistance to ecological conservation.

Tourism

Scopus Indexed Journal Articles

1. Paulose, D., & Shakeel, A. (2021). Perceived Experience, Perceived Value and Customer Satisfaction as Antecedents to Loyalty among Hotel Guests. *Journal of Quality Assurance in Hospitality & Tourism*, 1-35. https://doi.org/10.1080/1528008X.2021.1884930

Abstract: Despite the hospitality industry reeling under the impact of Covid-19, few studies provide practitioner-oriented perspectives capturing dimensions of guest loyalty within emerging markets. The researchers examine the influence of perception of value and experience on guest loyalty within the context of the Indian hotel industry.Analysis using structural equation modelling confirms that both guest loyalty and satisfaction continue to be positively inûuenced by perception of value and the service experience. Both guest satisfaction and loyalty are strongest among guests who perceive high service value.

2. Joseph, A. I., Peter, S., & Anandkumar, V. (2020). Development of a Typology of Tourists Based on Pre-trip Use of Social Media. *International Journal of Hospitality & Tourism Administration*, 1-29. https://doi.org/10.1080/15256480.2020.1842837

This study seeks to expand the understanding of typologies in tourism and to suggest directions for destination marketing organisations and tourism service providers. The study was carried out by typology 400 domestic and international tourists visiting Kerala using cluster and discriminant analysis. The findings indicate that domestic and international tourists differ in their usage of social media in which the former use social media for gathering information while the latter use it for trip planning, online travel booking, and for gathering information. Also, the study shows that gender does not influence the usage of social media in the pre-trip phase.

Other Journal Articles

1. Azzali, S., Kamble, Z., Thirumaran, K., Wong, C., & Wood, J. (2021). Mitigating impact from natural disasters, building resilience in tourism: the case of Kerala. In C. Taha (Ed.), *Economic Effects of Natural Disasters* (pp. 119-129). Academic Press. https://doi.org/10.1016/B978-0-12-817465-4.00008-X

Abstract: This study examines the 2018 Kerala flood and its impact on tourism through a critical assessment of the responses of government agencies and organisations. The strong inverse relationship between tourism and natural disasters underscores the vulnerability of tourism determined by the extent of direct and indirect impact from natural disasters which makes it necessary for us to evaluate post–disaster management. Understanding the extent of policy adaptations during and after the 2018 Kerala flood in India allows us to develop a framework for policymakers and other stakeholders to consider impact-limiting measures and construct built-in resilience in the tourism industry.

Environment

Scopus Indexed Journal Articles

1. Sreelekshmi, S., Veettil, B. K., Nandan, S. B., & Harikrishnan, M. (2020). Mangrove forests along the coastline of Kerala, southern India: Current status and future prospects. *Regional Studies in Marine Science*. https://doi.org/10.1016/j.rsma.2020.101573

Abstract (edited): This review examines the current status of mangrove vegetation along the Kerala coast, factors responsible for the decline of mangroves, various conservation measures adopted, and future prospects. It was found that scientific information on the mangrove area of many districts in this state is still lacking. In this context, GIS and remote sensing would be effective tools for the identification and mapping of various mangrove patches in Kerala.

What is new(s) from GIFT

1.GIFT webinar series

Webinar on Post-Budget International Consultation on Transforming Kerala to a Knowledge Economy, January 23, 2021

GIFT and GLOBELICS jointly organized a Webinar on Post Budget International Consultation on Transforming Kerala to a Knowledge Economy. The opening session was chaired by Prof. TM Thomas Isaac, Hon'ble Finance Minister of Kerala. Prof K J Joseph, Director GIFT and President Globelics delivered the welcome address. Shri Pinarayi Vijayan, Hon'ble Chief Minister of Kerala, delivered the inaugural address. In his address, Prof. Isaac presented a blue print of the innovative strategy of transforming Kerala to a knowledge economy. The chief guest of the session was Prof. Bengt Ake Lundvall, Emeritus Professor, Alborg School of Business in Denmark and the founder of Globelics. Prof. V K. Ramachandran, Vice Chairman, Kerala State Planning Board delivered the keynote address while special addresses were delivered by Dr KM Abraham, Chairman K-DISC and Shri Deepu Zakaria, Joint Secretary, Group of Technology Companies. Shri Mohammad Y Safirulla IAS, Additional Secretary, Department of Electronics and Information proposed the vote of thanks. Scholars of eminence across the world participated in the deliberations and shared their experience in all the sessions.

A Special session on Federalism and Development Financing, held as part of the international webinar on Kerala Looks Ahead, organized jointly with Kerala State Planning Board, February2, 2021

Prof K J Joseph, Director GIFT welcomed the participants. The session was Chaired by Prof. M Govinda Rao, former Director NIPFP. Prof. TM Thomas Isaac, Minister for Finance and Coir delivered the inaugural address. Other panelists included Shri Rajesh Kumar Singh, IAS, Additional Chief Secretary, Finance, Kerala, Professor D Narayana, former Director, GIFT, Prof C P Chandrasekhar, former Professor, JNU, Prof Sushil Khanna, former Professor, IIM, Kolkata, Prof Pinaki Chakravorty, Director, NIPFP, New Delhi. Sri P Shaji, Head, Plan Coordination Wing, Kerala State Planning Board proposed the vote of thanks.

Webinar on Economic Survey 2020-21 & Union Budget 2021-22 jointly organized with Department of Economics, University College, Thiruvananthapuram, Government College for Women, Thiruvananthapuram on February 5, 2021

Prof. T M Thomas Isaac, Minister for Finance delivered the inaugural address in a webinar on Economic Survey 2020-21 and Union Budget 2021-22, jointly organized by Gulati Institute of Finance and Taxation and Departments of

Economics, Government Women's College and University College. Prof. Achin Chakraborty, Director, Institute of Development Studies, Kolkata, delivered a special address at the webinar. Prof. K. J. Joseph, Director GIFT welcomed the participants. Prof. Alwin Prakash, Prof. Mary George, Prof. D. Narayana, former director, GIFT, Prof. K.P. Kannan, former director, Centre for Development Studies led the sessions based on the various aspects of the Union budget and economic survey report. Dr Ravi Raman, member, State Planning Board, R Mohan, senior consultant, GIFT, Shri C.P John, former member, State Planning Board, Prof. Lakhwinder Singh Gill, University of Patiala, Prof. Thankom Arun, University of Essex, UK, and various experts, scholars and academicians shared their views in various sessions. Smt. V Uma Jyothi, Head, Department of Economics, Women's College, Thiruvananthapuram proposed vote of thanks.

Inaugural programme of Makerspace at GIFT on February 18, 2021

GIFT initiated a makerspace with a view to facilitate interaction among people with interesting business ideas. Prof. Thomas Isaac, Minister of Finance inaugurated the programme. Prof K J Joseph, Director, GIFT welcomed the gathering. Shri C Balagopal, (Penpol) gave the special address. Dr Ramalingam, Associate Professor, GIFT, the Coordinator of the programme proposed the vote of thanks.

Indialics Public Lecture Series 6: Draft Science and Technology policy: A Critical Assessment by Prof. Dinesh Abrol March 18, 2021; Chair: Dr. Nagesh Kumar

Webinar on Fifteenth Finance Commission and Tax Devolution: Impact on State Finances by Dr Parma Chakravartti, Assistant Professor, GIFT on March 10, 2021.

Abstract: The fifteenth finance commission report is released during the most difficult time when the economy was bordering on a recession along with the economic challenges of pandemic. In fact, the Fifteenth Finance Commission (XV-FC) named its report as "Finance Commission in COVID Times". There was much fear among the states based on the terms of reference of XV-FC and the preliminary report submitted by the Commission that the Commission could reduce the states' share in tax devolution. However, the commission retained the vertical share of 41 per cent of the divisible pool of taxes for the 28 States with 1 per cent adjustment for the reorganization of Jammu and Kashmir. This study tries to analyse the impact of tax devolution of the XV-FC on the state Finances by looking at two issues. Firstly, the implication of retaining the same share of tax devolution as recommended by the preliminary report of XV-FC (2020-21). Secondly, comparing the criteria for horizontal devolution adopted by various finance commissions and its implications on state finances.

Webinar on Prices, Indirect taxes and Poverty by Professor Nanak Kakwani, University of New South Wales, Australia on March 19, 2021.

Abstract: Every economy produces thousands of goods and services every day or even every hour. The outputs so created are ultimately consumed by people. They make their purchasing decisions based on market prices. Thus, prices play a crucial role in people's lives. People have different economic circumstances and consumption patterns, so the impact of prices on people's lives will differ from one person to another. People who are unable to meet their basic needs are particularly vulnerable to price changes. Hence, the prices can have a signifi8cant impact on poverty. In this lecture, Prof Kakwani discusses a systematic

measurement of the impact of prices on poverty. He measures the effect of prices on poverty measured by the entire class of additive poverty measures. He captures the price impact on poverty by employing the price elasticity of poverty He demonstrates that this elasticity can be decomposed into the sum of two components. The first component is the income effect, and the second component is the distribution effect. It is the distribution effect, which determines whether price changes are pro-poor or anti-poor. Thus, he proposes a pro-poor price index to analyze the impact of various goods and services prices have on poverty.

Indialics Public Lecture Series 7: Understanding the Structure and Dynamics of Fourth Industrial Revolution: Implications for India by Prof. Sujit Bhattacharya on March 20, 202; Chair: Prof. Aradhna Aggarwal

Webinar on International Macroeconomics and Finance jointly organized with HSS, IIT Patna as a tribute to Prof Bandi Kamaiah, on March 27, 2021.

GIFT organized a one-day virtual conference on International Macroeconomics and Finance along with the department of HSS, IIT Patna on 27/03/2021.

The conference was a tribute to Professor Bandi Kamaiah (Former Dean, School of Economics, and University of Hyderabad) and his remarkable journey in academia. Authors from reputed institutes presented their work on aforementioned themes. The session was chaired by noted economist and former CEO of Asian Development Bank Institute-Japan, Yoshino Naoyuki. The presented papers will be published as an Edited volume by springer. This conference provided an excellent opportunity to scholars as well as faculties to have an understanding about the cutting-edge research in international macroeconomics and finance.

Webinar on Deindustrialization in India under globalisation: Does Innovation matter? by Professor K J Joseph, Director, GIFT and Dr Kiran Kumar Kakarlapudi, Assistant Professor, GIFT on March 31, 2021

Chair: Prof A V Jose Discussant: Prof D Narayana

Abstract: There is a growing empirical evidence of premature deindustrialization in developing countries wherein the share of manufacturing in GDP and employment declined at a much lower level of per capita income as compared to the trend observed in developed countries. This study examined the manufacturing performance of India, which has been persistent with industrialization as its catch-up strategy. While the study finds no evidence of deindustrialization in the conventional sense, it presents compelling evidence in terms of the quality of employment generated and share of GDP in value added. Therefore, the study argues that a realistic analysis of deindustrialization should consider the quality of employment, wage share and wage rate along with employment share and GDP share. The study attributes deindustrialization in India as an outcome of its strategy to build international competitiveness based on price/ wage cost advantage and the failure to build a vibrant learning, innovation and competence building system.

The webinars were coordinated by Smt. Anitha Kumary L, Associate Professor, GIFT and Anoop S Kumar, Assistant Professor, GIFT

2. Teaching and training programmes

1. PGDGST program Third Batch

Admission for the third batch of the Post Graduate Diploma in Goods and Service Tax (PGDGST) is closed. The training program

comprising 120 hours of teaching started through onlinemode for the 325 students initially with 17 more students joined later. Total strength of students is 342. Third set of training for the third batch for 56 hours started on 24 December on online mode. Forty hours of classes have already been completed.

Course Co ordinators: Dr N Ramalingam and Smt. L Anitha Kumary

For more details: https://www.gift.res.in/index.php/course/detail/14/PGD-GST

2. PhD programme

For the current academic year, seven new PhD Scholars were admitted in the month of February 2021. A total of 14 scholars are currently working towards their doctoral thesis at the institute distributed across three batches. From this year onwards, a rigorous year-long course work focused particularly on Public Economics and Public Finance with a special focus on Indian Fiscal Federalism is being implemented. The course work also has a non-credited foundational course on Applied Mathematics for Economics, Statistics and Economic theory which started from mid-February 2021. The second batch of PhD students have presented their term papers on February 18, 2021 as part of their coursework.

3. Training on Multi-Level Marketing

Training on Multi-Level Marketing was conducted on 31 March 2021 by Dr Thomas Joseph Thoomkuzhy. Around 1000 participants took part in the session.

3.New Reports and Publications

1.Kerala Tax Reporter (KTR)

December and January issues of KTR published Online and offline.

https://www.gift.res.in/ktr

2.Innovation and Development

A Routledge journal from GIFT, Volume 11, No. 1 published, Editor in Chief, K J Joseph.

For details, please visit https://www.tandfonline.com/toc/riad20/current

3. Weekly update on the Indian Economy

This is an attempt by the Young Scholar' Forum in GIFT, led by Smt. Shency Mathew to update on important developments in the national economy. Latest issue: 20-26, March 2021.

For details, please visit https://www.gift.res.in/index.php/publish/publish_list/14/Weekly-Updates-on-Indian-Economy

Gulati Institute of Finance and Taxation (GIFT), Thiruvananthapuram, Kerala, formerly Centre for Taxation Studies, has been conceived as a premier national institute to promote theoretically grounded and empirically based research within an interdisciplinary perspective to aid policy making at the national and sub-national level. Affiliated to Cochin University of Science and Technology, GIFT is also mandated to facilitate research leading to PhD and undertake training programs for capacity building of different stakeholders, including government officials. It also offers a Post Graduate Diploma in Goods and Service Tax. Recently, GIFT joined hands with Kerala Financial Corporation (KFC) in training the new entrepreneurs being promoted under the Chief Minister's Entrepreneurship Development Programme (CMEDP).

The governance of the Institute is entrusted with a Governing Body and an Executive Committee, consisting of scholars of eminence and senior administrators representing both the Central and the State Governments. Dr T M Thomas Isaac, Minister of Finance and Coir, Government of Kerala, is the Chairperson of the Institute.

Gulati Institute of Finance and Taxation,
GIFT Campus, Chavadimukku,
Sreekariyam, Thiruvananthapuram, Kerala - 695017.
Phone : 0471 2596970, 2596980, 2590880, 2593960.
Email : program@gift.res.in www.gift.res.in