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Как модель тройной спирали инноваций меняет борьбу с COVID-19 в Индии?

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Аннотация: Было бы некорректно анализировать масштабы академического капитализма с неуклонным ростом важности предпринимательского университета в соответствии с тенденциями западной образовательной политики. В развивающихся экономиках лишь долгий путь дал надежду на вхождение в число супердержав. В них предпринимательские университеты являются весьма современной концепцией постлиберальной экономики, а изменения правительственных практик и утрата контроля над бюрократическими делами привели к более глубокой инновационной взаимосвязи промышленности, образования и правительства в построении нации. В последние годы произошел серьезный кризис, связанный с пандемией COVID-19, изменивший идеологию, теоретические модели, лежащие в основе экономик благополучных государств, и скорость денежного оборота в обществе. В огромном массиве работ, посвященных исследованиям предпринимательских университетов, очень мало внимания уделяется актуальным вопросам о том, как модель тройной спирали появилась в Индии; как центральное правительство Индии радикально изменило свои убеждения, приняв такую модель в своей инновационной практике, чтобы отстаивать дело создания новых продуктов, экономического благосостояния, разработки продуктов. До настоящего момента не был описан путь, который перевернул ориентацию Индии на импорт медицинских продуктов в сторону создания собственной экспертной и материальной базы для экспорта, тем самым полностью изменив цикл торговли и глобальной логистики в экономической практике здравоохранения. Автором исследована история успеха Индии в использовании модели тройной спирали инноваций в национальной политике и мировой экономике.

Ключевые слова: мировая экономика, предпринимательский университет, подрывные инновации, кризис, национальная политика Индии

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How the Triple-Helix Model of Innovation is changing the Indian COVID-19 Fight?

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Abstract: It is indeed a great misnomer to analyze the dimensions of academic capitalism with the steady rise of entrepreneurial university in line with Western educational policies. It has been a long journey in emerging underdeveloped economies has given the dream of the next superpower where entrepreneurial universities are a very recent concept of post-liberal economy, change in governmental practices and bureaucratic affairs. This has led to a stronger innovation landscape of industry-education-government nexus in building the nation. Recent years have seen the great crisis of COVID-19 pandemic which has changed the ideologies and theoretical models underlying economically well-off states and the velocity of money circulation. Amidst the huge amount of literature in entrepreneurial university studies, very little work has been done which answers the very pertinent question and covers the research gap. Namely, how the Triple Helix model arrived in India and

how the central government in India dramatically changed its beliefs by inheriting such a model in its innovation practices. The model that championed the cause of bringing about new products, economic welfare and product development. These transformed India's idea of being an importer of healthcare facilities to becoming an expert and exporter of medical facilities, thus completely reversing the cycle of trade and global logistics in healthcare economic practices. This paper works on such an exploratory case study concerning India's success story in employing triple helix model of innovation in national policy practices and world economy.

Keywords: world economy, entrepreneurial university, disruptive innovation, crisis, Indian national policy

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Introduction

Knowledge management in its nascent form has been a miracle for quite a long time now. It has been a wonder for both advanced as well as emerging economies to dive into various facets of academic maneuvers and educational management. There have been disputable measures relating to control over educational involvement arising out of regional imbalances and cultural transformation. Whereas the East has seen a more conservative approach to education and academic enlightenment, capitalism saw a faster growth in the Western economies. Trade and commerce has been integral to academic capitalism for quite a long time with the opening of the borders and sea shores with travelers across Asia plunging into multifarious trade and dialectical shifts. It is imperative to point out that the very term of Academic capitalism is quite a new field of study in poorer countries like India as well as African countries [1]. Though there has been a rise of multipolar domination in global economic spheres, such countries were under post-colonial stress and traditions deeply influenced by the colonial rulers. Britain transferred its educational practices to a more industry specific curriculum that looked more liberal than those of universities like London School of Economics and Oxford University. These institutions were the founders of Modern day post-independence university structures in India, which saw rise of colonial state level university structures like Delhi [2], Kolkata and Mumbai. The flavors of British Raj still haunted the very corridors of public policies and governance with missing nationalism in educational flora and fauna. Following independence era [3], the then Prime minister of India, Nehru realized that liberal policies towards national growth were necessary for human development in India. These dialects gave rise to autonomy in educational institutes with the birth of highly ranked institutes like IIM, IIT, ISI which still enjoy comparative advantages and autonomy as compared to industry-academic nexus and policy-making strategic initiatives. With markets opening up, foreign investments inflow and favorable balance of payments showed a change in the national monetary policy. This change was also reflected in the national government's agenda of educational policy and subsequent privatization, giving rise to the impetus of academic capitalism which contributed effectively to national income and economic benefits. In India, such political discourses saw rise of socialist blended political

economy. This new strategy put at question the license of raj and bureaucratic hurdles as compared to Western dominance in liberal education and economics of knowledge management. Such Western dominance was obvious with USA championing the goal of industry-led academic initiatives in funded universities across its borders. The advent of innovation hubs and institutes of higher learning contributed to technological progress across the national hinterland during the World War II years. In the Indian subcontinent early educational discourses also believed higher enlightenment work much faster than even French and Scottish schools. The advent of modern day education platform was laid by the travelers from Far East and China; the substantial rise of university structures like Nalanda saw the necessity for practical knowledge. There were indeed vast exchanges of scholarly dialects and schools of thoughts where trade and commerce got interlinked to educational progress creating sustainability with development of novel science and technology in scholarly pursuits. Thus was born the internationalization of educational purposes. Though substantial jolt was felt during the great depression of 1932 when FDR went forward with the Keynesian policies of governmental intervention, post-Keynesian neoclassical discourses and national planning saw the birth of liberal thoughts and free markets dominating the education industry at large. Examples of such knowledge spillovers were born out of Silicon Valley where MIT-led educational practices saw the rise of nexus between industry and academic pursuits with the growth of innovation pockets on route 218 where BELL labs and the likes cooperated in their actions for individual amalgamation of policies towards innovation. In the sense of emerging practices, India did not lag behind. With the opening up of the market after 1991, the government decided to move towards a public-private partnership in skill development targeting grassroots levels and involving society within its technological gambit. Whereas the MIT university industry championed over many facets in the development of new technology with patenting options, Stanford's Technology Venture Program showcased the involvement of different structures in the rise of scientific pursuits. This helped solve global discrepancies, providing solutions which could be implemented in real life situations through university-led incubation mechanisms [4].

The evolution of national intelligentsia seems quite distant whereas the concept of the "Can Subaltern Speak" highlighted in the writings of J. Derrida and professor G.C. Spivak hit upon the concept of post-colonial political economy which rocked the very foundation of national built-up of India. Countries with high heterogeneity like India saw a steady rise of market economic structure with growth amidst destitution, and national well-being saw the educational rise of elites born out of colonial educational structures. In fact, the term Knowledge Economy rose to prominence with the seminal works of Austrian-born economist Machlup relating to production as well as distribution of knowledge in the USA. By 1958, the economist states, such knowledge economy amounted to 30 % of GNP. He is subsequently credited with knowledge measurements with respect to distribution of research and developmental issues. Machlup propounded some thesis relating to:

- knowledge being part and parcel of national budget and income;
- social welfare relating to knowledge economy;
- knowledge relativity to communication technology;
- rise of modern day brain workers;
- knowledge being a unit of economic growth and sustainability [5]¹.

In knowledge management, according to Gilbert Ryle's philosophy, cognitive aspects in knowledge put humans at a beneficial status over animals with respect to cognition and cultural insights [6]. Thus, there rose two schools of thoughts in knowledge management. Namely, acceleration school which propounds the utility and innovation cycle whereas retardation school limits the scope of innovation cycle. OECD Framework of entrepreneurial university model propounds its definition with seven charters [7]:

- leadership as well as governance;
- organization as well as people;
- entrepreneurial thought process in teaching activity;
- path openings to entrepreneurs;
- university-industry relation as basis for knowledge exchanges;
- internationalization;
- measuring impacts of entrepreneurial university structure.

The concept of educational delivery [8] has changed over the last few years with the rise of economic drivers and education, taken as catalysts for regional as well as social developments across various nations moving towards the concept of entrepreneurial universities [9]. According to H. Etzkowitz (2004) [10], the academic revolution is twofold, with one fold moving to research output as a result of teaching endeavors, whereas the second step means economic pursuits added to academic ones [11].

According to H. Etzkowitz, entrepreneurial university can be defined as an organization which reflects patenting and funding of its project-based activities linked to teaching. Whereas, Clark and Kirby presume "entrepreneurial university" is an innovation hotspot, where taking risks and coming to conclusions matters.

North propounds another bright theory of institutions as being game changers in a society. Such notion is well reflected in the Indian Case study analysis too. In 1995, P. F. Drucker stated that idea, mission, actions and productivity lie at the foundation of institutional innovation mechanism [12]. Middlehurst and later McNay have propounded that bureaucracy and corporate practices evolved, while university functioning changed over time [13]. Further on, H. Etzkowitz in 2004 stated that capitalism means autonomy, proportional to positive functioning of entrepreneurial university structure. Krueger and Brazeal stated in 2001 that with increase in graduate involvements into entrepreneurship education, the entrepreneurial university concept acquires higher chances for success [14]. Subsequently, Shapero's Entrepreneurial Event Model reflects on the environmental impacts on entrepreneurial decision impulses, etc. Another important getaway from the so-called helix formation concept is the Timmons model of entrepreneurship where opportunity plays a critical role in achieving success [15]. The Indian scenario portrays a model opportunity in the pandemic situation creating search for innovation and creativity in the time of national emergency.

This research builds on previous research works and global literature available pertaining to national economic policy and development imbibing Triple Helix model as well as discovering the basic foundations of entrepreneurial university concepts. There has been lately a wide research gap in economic implications of university-industry spillover concerning national crisis situations like COVID-19 which is changing the economic landscape of national boundaries. This research work builds on bridging the gap of research work in emerging countries, fighting the pandemic with the help of profound research on triple helix innovation on nationwide vaccination drive.

Materials and methods. This research paper is the result of exploratory case analysis and a few interviews with local medical colleges and vaccination centers in Eastern Indian facility of Kolkata. Various Indian government agencies conscious of triple helix adaptation, relating to economic restructuring, such as NITI Ayog, All India Medical Sciences, and Health Ministry of the Government of India – the pillars of vaccine creation and administration across the nation – have been reviewed. The case study has been built up to evaluate, understand and create a prediction on future scopes and availability of resources for policy implementations nationwide.

¹ Usher A., Cervenán A. Global Higher Education Rankings 2005. Toronto, ON: Educational Policy Institute, 2005, 73.

Case study analysis

Serum Institute of India: One of the best biotechnological companies specializing in vaccine administration with the record number of vaccine delivered till date. It expanded its global scope by acquiring Netherland based Bilthoven Biologicals thus improving on its vaccine production capacity [14]. Particularly, this institute has been selected amidst a range of research institutes that have successfully worked hand in hand with government agencies in India in its fight against COVID-19. Recently this institute has tied up with Merck to produce advanced monoclonal antibodies which is proving to be a global innovation footprint with wide accessibility in the global vaccination drive. AstraZeneca, in nexus with Serum Institute propounded COVISHIELD vaccine that was granted permission to be implemented on 18+ patients by WHO-led strategic expert group. This is in fact a success of the Government of India initiative to create sustainable resistance to the virus. The vaccine was, actually, prepared for global delivery – the first of its achievements in ‘Made in India’ campaign of the government. Shipments were carried out by the Ministry of Foreign Affairs to Bangladesh as well as Canada under its umbrella program of "VaccineMaitri".

Key takeaways:

1. The proposed case under study reflects Triple Helix cooperation in growth and development with the government playing a distinct role of supervisor.

2. The case reflects Timmons' Model of Entrepreneurship with greater focus on resource allocation and opportunity building measures rather than mere business plan.

3. The institute rightly portrayed its technology transfer mechanism through knowledge spillover through tacit knowledge building apparatus [15].

4. Though there was a chance of another Helix build-up towards vaccine administration and logistics, strategic cooperation indulging in careful observance of international bodies resulted in resilient actions.

5. N-helix build-up was estimated due to the internationalization approach of development but neglected due to nationalistic approaches [16].

Analyzing the case of vaccine drive, the Government of India called on startups as well as SMEs to fasten vaccine deployments, thus creating a Triple Helix foundation to fight COVID-19. The second stage was establishing consultation liaison with regional medical facilities, research centers and state-led governments to conduct feasibility studies and clinical trials for several vaccines to be administered. To chart out vaccination drive regional crisis points, morbidity rates and risk clusters were denoted and studied by NITI Ayog, a national planning organization, aided by leading medical research institutes in New Delhi [10]. This rightly displays how entrepreneurial university structure can effectively and economically create innovation funnels. Thus, India jumped into the World's largest vaccination drive praised even by the World Health Organization.

The above case study distinctly demonstrates the foundations of research put into practice via Triple Helix innovation model [17].

Econometric analysis

In these experiments we took into consideration the various indicators of mutual collaborations ranging from producers' publications to the university researchers' data at one to one basis (Tab. 1). The number of coauthored publications dealing with technology transfer in vaccine-related publications was taken into account. The data was calculated according to extensive field work done in collaboration with national research foundations of the Government of India during vaccination drive.

Tab. 1. University-Firm and SS-Firm pairs and spillover collaborations available dataset

Табл. 1. Данные по парам университет – фирма и выборочное исследование – фирма и о вторичном сотрудничестве

Level of analysis	Spillover collaborations	Pairs
University – Firm	1,980	1,226
SS – Firm	2,360	1,755

Tab. 2, in respective graphs, shows an average of functionaries vs. scientists over 136 SSs under experiment within 2005–2021.

Tab. 2. Total number of scientific and technological spillover between Indian universities and private national enterprises

Табл. 2. Общее количество научных и технологических взаимодействий между индийскими университетами и частными национальными предприятиями

University	Coll	University	Coll
EconoUniversity of Bombay (1582)	123	University of Allahabad (136)	22
University of Calcutta (1454)	159	University of Goa (235)	11
University of Patna (1310)	126	Indian Institute of Technology, Guhawati (310)	17
University of Bombay (2532)	90	Indian Institute of Management, Indore (620)	15
University of Patuli (1123)	86	University of Punjab (610)	13
University of Madras (690)	74	University of Rajasthan (315)	14
University of Jharkhand (1034)	73	Indian Institute of management, Tiruchirrapali (202)	13
Polytechnic of Kashmir (543)	62	Vellore Institute of Technology (36)	12

University	Coll	University	Coll
University of Bangalore (1662)	62	University of Pune (210)	12
University of North Bengal (952)	63	Anna university (149)	13
University of Kalyani (1086)	64	Indian Institute of management, Shillong (123)	3
University of Adamas (1021)	50	Indian Institute of management, Visakhapatnam (26)	4
Jaipuria University (710)	53	University of Kerala (233)	5
Anna University (436)	53	University of Gujarat (192)	5
Alagappa University (446)	46	University of Assam (82)	4
Calicut university (536)	43	University of Guwahati (406)	5
Bombay regional university (710)	44	IIPM (46)	4
Amity University (746)	43	IIRM (171)	4
Central university of Jharkhand (320)	43	IIFT (180)	4
Indian Statistical Institute (446)	42	IIFT, Delhi (138)	5
Maulana Abdul Kalam University (263)	36	UPM (110)	3
Indian Institute of Technology Kharagpur (778)	35	University of Calicut (80)	4
Indian Institute of Technology, Bombay (510)	33	EEDI (155)	4
Indian Institute of Technology, Madras (850)	31	IIT, Delhi (34)	3
Indian Institute of Management, Ranchi (236)	26	ISI (90)	2
Indian Institute of management, Bangalore (386)	23	ISI Dehradun (63)	2
Indian Institute of planning (236)	25	University of Garhwali (126)	2
IICB (900)	23	IIM Raipur (24)	2
Jadavpur University (1010)	22	University of Telengana (43)	2

The calculation shows that the top 55 % are in the southern region of India, which is level for vaccine production with the established indices producing a correlation basis for university spillovers. Between the top 15, top 3 are in the Southern region which actively participates in university-firm collaboration with patenting transfer facilities (Tab. 3).

Tab. 3. Regional spillover frequency

Табл. 3. Частота взаимодействий по регионам

Region	Number of collaborations by universities	Frequency, %
Chennai	363	17,2
Kerala	296	14,0
Bangalore	169	7,6
Kolkata	129	5,8
Delhi	57	2,0
Assam	54	2,9

Dependent variability is defined by the tenacity of the individual university to collaborate and be productive in collaboration. The first model takes into consideration the distance and spillover mechanism of university in the given timeframe. Model two reflects the size and variability and also the qualitative measures of university research.

We implement regression analysis using advanced statistical tools to understand the correlation between innovation, university spillover and technology transfer mechanism effects (Tab. 4, Tab. 5).

The two econometric models can be described as:

$$CPS_{SS} = f(m_{SS}, ds_{SS});$$

$$CPS_{SS} = f(m_{SDS}, ds_{SS}, excels_{SS}, star_scientists_{SS}),$$

where f indicates the possible regression function; CPS_{SS} – the capacity building in collaboration; m_{SDS} – the total number of research material; ds_{SS} – the technology spillover in Indian region; $excels_{SS}$ – the staff quality; $star_scientists_{SS}$ – the size of leading scientists concentration indices; this criteria is chosen to differentiate between the top 2 % quality scientists and a greater portion of related university activity with co-authorship.

SS-Scientific sector as defined by clause 201 of research patent of Government of India.

Results show that spillover is having an influence on university industry collaboration outputs. Also, innovation parameters are guided by variability in top-scientist category based on top authorship in journals meaning retrospective patenting mechanism.

Based on the empirical data followed by extensive case analysis and filed experiments a model was generated. It demonstrates social inclusion and the traditional historical Triple Helix model, correctly encapsulating the notion and spirit of multidisciplinary approaches to innovation funnel (Fig.).

Tab. 4. Descriptive statistical analysis of regression variable, in vaccine pharmacogenomics

Табл. 4. Описательный статистический анализ переменной регрессии в фармакогеномике вакцин

Variable	Definition	Observed Values	Mean	Standard deviation	Min	Max
CS _{SS}	Spillover capability	43	2,376	3,271	0,000	12,000
m _{SS}	Number of scientists	43	14,225	12,628	1,000	68,000
ds _{SS}	Distance (km)	43	368,403	201,464	173,901	857,280
excel _{SS}	Scientific impact per scientist	43	266,345	262,247	0,000	1622,110
star_scientists _{SS}	Concentration of leading scientists	43	0,932	1,605	0,000	9,428

Tab. 5. Negative binomial regression formulating prediction of spillovers in university-Firm mutual collaborations regarding vaccine production

Табл. 5. Отрицательная биномиальная регрессия, отражающая прогноз вторичных эффектов при взаимном сотрудничестве университета и предприятия при производстве вакцин

Variable	Model 1	Model 2
m _{SS}	0,045 (0,010)***	0,049 (0,014)***
ds _{SS}	-0,002 (0,002)	-0,001 (0,001)**
excel _{SS}	-0,001	0,002 (0,001)
const	0,396 (0,452)	-0,080 (0,451)
n	43	43
LR chi square α=0	16,75***	15,05***

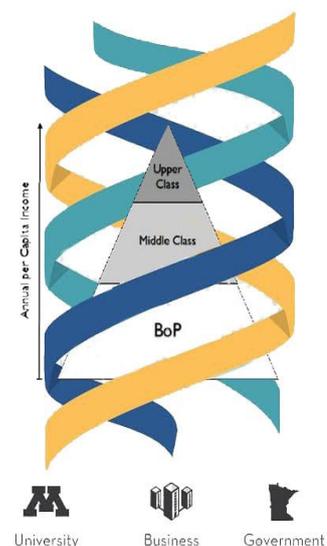
Note: Statistical rationality: the study has a dependent variable pertaining to collaboration; statistical methodology of estimation: negative binomial regression; indicators of statistical significance: * – p<0,10; ** – p<0,05; *** – p<0,01.

The above model not only encapsulates the intrinsic factors of technology spillovers and calculative distances in university industry mechanism. It also has a social essence with a social innovation funnel and inclusion, important for national development goals, pertaining to mass eradication of poverty and maintaining economic stability and resilience during crises like the COVID-19. The model develops on historical nexus models of entrepreneurial university goals in advanced countries and can also be implemented in emerging economies like India. The uniqueness of this model concerns growth formulations in regions with disparity in income distribution indices.

Analysis

While stability of governmental policy is highly linked to national investments and stability in currency fluctuations and devaluations, human knowledge also receives comparative advantages if nurtured via innovation channels. There is substantial literature, where colonial influences in university structures even after declaration of independence in countries like India were proved, but it took the government considerable courage to change its outlook towards knowledge practices [18]. The central government with its

Fig. Amalgamation model of innovation
Рис. Модель объединения инноваций



various policy agencies changed their strategy towards health infrastructure during the COVID emergency. Researchers, both private and public industry players, battled in favor of a triple helix foundation to develop and implement newer technologies along with changing times. Not only were such steps necessary but again proved the changing dimensions of innovator-led development of Schumpeterian thoughts into a Neo-Schumpeterian innovation base. The Indian concept is quite unique and is destined to be transplanted for future application in other emerging economies fighting crises. The concept of entrepreneurial university, developed after 1990, though being quite old and not scientifically justified, has gained prominence in emerging countries within the last years. Recent developments related to vaccine developments saw India's prominence in applying Triple Helix for technological transfer [19], knowledge spillovers, as well as patenting policy advancing with the rise of "entrepreneurial scientist". This case study depicts the emergence of innovation strategy, groundbreaking in its conception as related to established scientific facts and theories. There still exists a belief of Triple Helix model unethical intervention as a new innovation funnel. But ethical practices in academic pursuits with the involvement of industrial players must be disrupted.

The COVID crisis proved the beneficial positive sides of the model for the prosperity of the national economy.

Deduction

It is imperative to point out that in Western countries the behavioral and cognitive aspects of knowledge are wide and quite different with respect to emerging countries like India and Russia. Dialectical aspects of knowledge quite perfectly rotate around Hayek's Austrian Economic school philosophy where human action is *prima facie* to development and growth. It took some time for underdeveloped countries to tread the roads to liberal thoughts, imbibing the notion of Triple Helix in its innovation chain [20]. Thus brought forth concept of "Necessity is the mother of all creations" made India rapidly learn from failures of red tapes and involved entrepreneurial university structure 'researchers and scientists' to create knowledge spillovers for national growth and prosperity.

In the time when the whole country with a billion population was aghast with sufferings and deaths due to the deadly virus [21], India trod the paths to rapid mobilization of its frontline healthcare involving industry and research universities to create a global case study which could be used as reference for future generations and policy-makers while dealing with crisis [22]. At the time when death was tolling high, India changed its strategy from being an importer of health devices to becoming an exporter of facilities, highly praised by global agencies like the WHO.

This research work depicts a global platform where India is projected as a model study. The crisis was handled effectively by national policy makers by involving entrepreneurial university concept and building on innovation channels starting a future prospect for other emerging countries to apply its public policy as and when required. This research work belongs to a series of others, showcasing the necessity of nexus among government-industry-academic bodies which can be effectively applied to emerging countries too. Such research once again puts forth advancement of academic capitalism and knowledge economy that can be

a boon to crisis management and creation of governmental approach globally [23]. The research opens up newer channels of thought regarding how effective the Triple Helix Model is in fighting crises like COVID, generating revenue with knowledge as well as creating a welfare function by means of innovation.

Future Research Implications

This particular research work addresses the long-pending research gap in evolution of Triple Helix model in emerging economies like India where great heterogeneity lies amidst mass poverty and inequality. The World Bank in its SDG charter fights for forging gap in knowledge management through sustainable development, the future looks brighter. Hopefully, academicians and policy-makers making literature are ready to create a blueprint for cooperation and build up to the Helix model of innovation. Moreover, as crisis hits back, poorer countries, deprived of resources, can start off the ladder of innovation and create resilient plans at national economic levels.

Conclusion

Despite the changing colours of the pandemic with various strains and logistics of vaccination indulging in further disruption in innovation the need for interconnected research work with multidisciplinary approach is needed to fight the pandemic. The concept of triple helix model of innovation though is quite evolving post liberalisation phases post 1990 saw remarkable utility during the pandemic in India with substantial resource mobilisation and transfer of technology across borders with support from national governments to fight the crisis at large. There is indeed an ideal scenario created with applications of entrepreneurial university models with cross border spill overs which are quite unique and never earlier researched field which requires considerable thought for future academic exploration on how fertile and fruitful can be the model hybridisation of government, industry and university collaboration for benefit of humankind at large.

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