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TABLE OF CONTENTS

CO-CHANNEL INTERFERENCE MITIGATION TECHNIQUE FOR MOBILE WIMAX DOWNLINK SYSTEM DEPLOYED VIA STRATOSPHERIC PLATFORM	1
<i>Iskar, A. Abubaker</i>	
A BLOCK-BASED IMAGE ENCRYPTION ALGORITHM IN FREQUENCY DOMAIN USING CHAOTIC PERMUTATION	6
<i>Rinaldi Munir</i>	
A METHOD TO IMPLEMENT DAISY ONLINE DELIVERY PROTOCOL	11
<i>Azadeh Nazemi, Iain Murray, David A. McMeekin</i>	
LOW-COMPLEXITY SEQUENTIAL NON-PARAMETRIC SIGNAL CLASSIFICATION FOR WIDEBAND COGNITIVE RADIOS	18
<i>Mario Bkassiny, Sudharman K. Jayaweera</i>	
RESOURCE SHARING BETWEEN M2M AND H2H TRAFFIC UNDER TIME-CONTROLLED SCHEDULING SCHEME IN LTE NETWORKS	24
<i>Kennedy Edemacu, Tonny Bulega</i>	
LEADER-FOLLOWING CONSENSUS IN VEHICLE PLATOONS WITH AN INTER-VEHICLE COMMUNICATION NETWORK	30
<i>Yongxiang Ruan, Sudharman K. Jayaweera</i>	
DEGREE CENTRALITY AND EIGENVECTOR CENTRALITY IN TWITTER	36
<i>Warih Maharani, Alfian Akbar Gozali, Adiwijaya</i>	
HOMOMORPHIC FILTERING FOR EXTRACTING JAVANESE GONG WAVE SIGNALS	41
<i>Matias H. W. Budhiantho, Gunawan Dewantoro</i>	
LOW-COST OUTDOOR ANTENNA RADIATION PATTERN MEASUREMENT	47
<i>Andrian Andaya Lestari, Herlinda Serliningtyas, Deni Yulian, Oktanto Dedi Winarko</i>	
THE MEASUREMENT DESIGN OF INFORMATION SECURITY MANAGEMENT SYSTEM	51
<i>Merry Nancyliya, Eddy K Mudjtabar, Sarwono Sutikno, Yusep Rosmansyah</i>	
USER MOTION IMPACT ON PERFORMANCE OF DOWNLINK MOBILE WIMAX SYSTEM DEPLOYED VIA STRATOSPHERIC PLATFORM (SPF)	56
<i>A. Abubaker, Iskandar</i>	
DESIGN ENERGY HARVESTING DEVICE OF UHF TV STATIONS	61
<i>Noptin Harpawi, Iskandar</i>	
PERFORMANCE EVALUATION OF ENERGY DETECTOR IN COOPERATIVE SPECTRUM SENSING	67
<i>Nasrullah Armi, Mashury Wahab, H. Asep Yudi</i>	
DESIGN AND FABRICATION OF 2-WAY WILKINSON POWER DIVIDER FOR DUAL OPERATING FREQUENCIES	71
<i>Mashury Wahab, Taufiqurrachman</i>	
MUSICAL NOTE RECOGNITION USING MINIMUM SPANNING TREE ALGORITHM	76
<i>Yoppy Sazaki, Rosda Ayuni, S. Kom</i>	
DIGITAL RIGHTS MANAGEMENT WITH ABAC IMPLEMENTATION TO IMPROVE ENTERPRISE DOCUMENT PROTECTION	81
<i>Yusep Rosmansyah, Ir. Budimanbadarsyah, Ubaidillah</i>	
OLSR AND AODV ROUTING PROTOCOL PERFORMANCE ANALYSIS IN AD HOC MOBILE PHONE NETWORK TO MAINTAIN THE CONNECTIVITY OF CELLULAR NETWORK	87
<i>Effi Kurniawati, Rendy Munadi, Ida Wahidah, Doan Perdana</i>	
MODIFYING POWER SOURCE AWARE ROUTING (PSAR) ALGORITHM WITH FUZZY LOGIC ADDITION IN ZIGBEE NETWORK	93
<i>Sri Astuti, Rendy Munadi, Istikmal</i>	
DIGITAL DIVIDEND IMPLEMENTATION ACCELERATION IN INDONESIA	99
<i>Denny Setiawan, Denny Kusuma Hendraningrat</i>	
ANTENNA CO-PLANAR ARRAY OF X-BAND FREQUENCY 9.4 GHZ FOR RADAR	106
<i>Yussi Perdana Saputera, Yuyu Wahyu, Mashury Wahab</i>	
DEVELOPMENT OF SET TOP BOX (STB) FOR DVB-T2 STANDARD TELEVISION BASED ON ANDROID	111
<i>Yuyu Wahyu, Folin Oktafiani, Yussi Perdana Saputera</i>	

CLOSED LOOP POWER CONTROL WITH SPACE DIVERSITY TO IMPROVE PERFORMANCE OF LOW ELEVATION ANGLE USERS IN HAPS-CDMA COMMUNICATION CHANNEL	115
<i>Iskandar, A. Kurniawan, M. E. Ernawan</i>	
PERFORMANCE OF MODULATOR DTA-110 AND DTA-115 IN THE MOBILE TV INTERACTIVE BASED ON DVB AND UNICAST HYBRID NETWORK	120
<i>Iskandar, T. Hendrawan, G. F. Ramadhan</i>	
WIDEBAND CHANNEL MODELING EMPLOYING 60 GHZ FREQUENCY FOR WIRELESS GIGABIT TRANSMISSION	126
<i>Iskandar</i>	
A STUDY OF HAPS-LTE DOWNLINK CHANNEL PERFORMANCE SIMULATION DEPLOYED FOR HIGH SPEED USER VEHICLE	130
<i>M. R. K. Aziz, Iskandar</i>	
STUDY OF UNFAIR COMPETITION BETWEEN REGULATED AND UNREGULATED VOIP PROVIDERS IN THE MIXED OF NON AND ALL-IP NETWORK ERA	135
<i>Sigit Haryadi, Festylalitaniramaya</i>	
ANALYSIS OF CORE-STATELESS FAIR QUEUING FOR FAIR BANDWIDTH ALLOCATION IN AN IP NETWORK	140
<i>Sigit Haryadi, Fine Nur Islami</i>	
TRAFFIC ANALYSIS OF NUMBER OF REQUEST PER USER AND VOLUME PER REQUEST HITS ON IP NETWORKS	144
<i>Sigit Haryadi, Marisa Premitasari</i>	
POLLING SYSTEM AS A MOBILE TV INTERACTIVE APPLICATION BASED ON DVB AND UNICAST HYBRID NETWORK	147
<i>T. Hendrawan, N. Rachmana, G. F. Ramadhan, Iskandar</i>	
ARCHITECTURE DESIGN OF MANADO E-GOVERNMENT ICT NETWORKS: THE ROAD TO MANADO SMART CITY	152
<i>Alicia A. E. Sinsuw, Xaverius Najoan, Yaulie D. Rindengan</i>	
ON THE DEVELOPMENT OF THEMATIC GIS DATABASE APPLICATION PLATFORM FOR REFORMING SPACE AND AREA OF GOVERNMENT CITY/DISTRICT	158
<i>H. Situmorang, L. Adhy, Iskandar</i>	
MOBILE APPLICATION DESIGN OF DISASTER RESCUE TEAM TRACKING	163
<i>Tutun Juhana</i>	
RECOMMENDATION ON DOMESTIC INTERNET INTERCONNECTION TOWARDS ALL-IP NETWORK	166
<i>Sigit Haryadi, Febrianty</i>	
S-BAND SHORTED PATCH ANTENNA FOR INTER PICO SATELLITE COMMUNICATIONS	170
<i>Faisel Em Tubbal, Raad Raad, Kwan-Wu Chin, Brenden Butters</i>	
RECOMMENDATIONS FOR HANDLING PRICE WAR BETWEEN TELECOM OPERATORS IN INDONESIA	174
<i>Sigit Haryadi, Angelia Hermawan</i>	
THE DEVELOPMENT OF REAL TIME APPLICATION MONITORING SYSTEM FOR FISHERY SEA RESOURCES IN INDONESIA	179
<i>Nana Rachmana Syambas, Ian Yosef, Hamonangan Situmorang, Hardi Nusantara</i>	
DESIGN AND IMPLEMENTATION OF CONTENT DISTRIBUTION FROM MOBILE DEVICE THROUGH DVB-T NETWORK	183
<i>Putu Adhika Bayu Bramantya, Hendrawan</i>	
INDOOR POSITIONING SYSTEM BASED ON RECEIVED SIGNAL STRENGTH (RSS) FINGERPRINTING : CASE IN POLITEKNIK CALTEX RIAU	189
<i>Muhammad Diono, Nana Rachmana</i>	
A 2.4 GHZ HIGH DATA RATE RADIO FOR PICO-SATELLITES	194
<i>Brenden Butters, Raad Raad</i>	
A JARQUE-BERA TEST BASED SPECTRUM SENSING FOR COGNITIVE RADIO	200
<i>Agus Subekti, S. Nana Rachmana, Andriyan B. Suksmono, Sugihartono</i>	
A TRANSMIT POWER CONTROL PROTOCOL FOR MULTIPATH WIRELESS SENSOR NETWORKS	204
<i>Uday Abduljaleel Al-Hamdany, Raad Raad</i>	
SECURITY SYSTEM FOR SURVEILLANCE RADAR NETWORK COMMUNICATION USING CHAOS ALGORITHM	209
<i>Nova Hadi Lestriandoko, Tutun Juhana, Rinaldi Munir</i>	

REVERSIBLE IMAGE WATERMARKING BASED ON HISTOGRAM MODIFICATION AND VIRTUAL BORDER	215
<i>Nova Hadi Lestriandoko, Didi Rosiyadi</i>	
DESIGN AND IMPLEMENTATION MULTICAST VIDEO STREAMING ON OPENFLOW NETWORK	219
<i>Abdul Latif, Eueung Mulyana</i>	
DISASTER MITIGATION TECHNIQUES BASED ON LTE RELEASE 8 NETWORK EMPLOYED USING HAPS	225
<i>T. A. M. I. Aziz, Iskandar</i>	
DEVELOPMENT OF DIGITAL EVIDENCE COLLECTION METHODS IN CASE OF DIGITAL FORENSIC USING TWO STEP INJECT METHODS	231
<i>Nana Rachmana Syambas, Naufal El Farisi</i>	
RANDOM EARLY DETECTION UTILIZING GENETICS ALGORITHM	237
<i>Prima Hernandia, Hendrawan</i>	
TRAFFIC ANOMALY DETECTION IN DDOS FLOODING ATTACK	244
<i>Yudha Purwanto, Kuspriyanto, Hendrawan, Budi Rahardjo, Hendrawan</i>	
INTEGRATION OF KLEPTOWARE AS KEYBOARD KEYLOGGER FOR INPUT RECORDER USING TEENSY USB DEVELOPMENT BOARD	250
<i>Surya Michrandi Nasution, Yudha Purwanto, Agus Virgono, Girindra Chandra Alam</i>	
MULTIFACTOR CUSTOMER CLASSIFICATION MODEL FOR IP TRANSIT PRODUCT	255
<i>Ian Yosef, Christophorus Ivan Samuels</i>	
CORRELATION MODEL MAP BETWEEN THE ICT INDUSTRY GROWTHS WITH GDP GROWTH - STUDY CASE: INDONESIA	264
<i>Ian Yosef Matheus Edward, Susmini Indriani Lestaringati, Aldo Agusdian</i>	
E-GOVERNMENT MASTER PLAN DESIGN WITH TOGAF FRAMEWORK - CASE STUDY: PAYAKUMBUH CITY GOVERNMENT, INDONESIA	271
<i>Ian Yosef Matheus Edward, Weryan Shalannanda, Aldo Agusdian, Susmini Indriani Lestaringati</i>	
DEVELOPMENT OF INTEGRATED MOBILE MONEY SYSTEM USING NEAR FIELD COMMUNICATION (NFC) - SMARTPHONE AND ELECTRONIC DATA CAPTURE	277
<i>Emir Husni, Adrian Ariono</i>	
APPLICATION OF MEAN TIME-TO-COMPROMISE AND VEA-BILITY SECURITY METRICS IN AUDITING COMPUTER NETWORK SECURITY	283
<i>Emir Husni, Yustika Kurniati</i>	
DESIGN AND ANALYSIS OF FTTH - GEPON FOR HIGH RISE BUILDING	288
<i>Hardi Nusantara, Freyskania Dairianta</i>	
H.265 VIDEO DELIVERY USING DYNAMIC ADAPTIVE STREAMING OVER HTTP (DASH) ON LAN NETWORK	295
<i>Hamid Azwar, Hendrawan</i>	
ON THE APPLICATION OF SMART HOME TECHNOLOGY TO PROLONG CLASSROOM EQUIPMENT LIFETIME	301
<i>Tutun Juhana, Erdy Suryadarma, Gregorius K. Purwidi, Fadhli Dzil Ikram, Christian Hendy</i>	
SUCCESSIVE MULTIUSER DETECTION TECHNIQUE IN DS-CDMA SYSTEMS	304
<i>Adit Kurniawan</i>	
MOBILE PHONE AUTO REGISTRATION TO OPENBTS-BASED CELLULAR NETWORK IN DISASTER SITUATION	309
<i>Elvanno Hatorangan, Tutun Juhana</i>	
MOBILE PHONE LOCATION LOGGING INTO OPENBTS-BASED CELLULAR NETWORK IN DISASTER SITUATION	312
<i>Elvanno Hatorangan, Tutun Juhana</i>	
DESIGN AND IMPLEMENTATION OF DVB-T DIGITAL TV BROADCAST ANTENNA FOR COMMUNITY TELEVISION IN BANDUNG INSTITUTE OF TECHNOLOGY CAMPUS	315
<i>Aulia Virnanda Suraperwata, Hendrawan, Joko Suryana, Sigit Haryadi</i>	
APPLICATION OF SYSTEM MONITORING AND ANALYSIS OF VEHICLE TRAFFIC ON TOLL ROAD	319
<i>Peter. H. L. Tobing, Hendrawan</i>	
Author Index	

Correlation Model Map Between the ICT Industry Growths with GDP Growth

Study Case: Indonesia

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Abstract— The demand of Information and Communication of today world citizen has triggered ICT as rapidly growing industries in the world. The ICT critical role is significant in improving people's welfare in the sense of providing services for competitiveness and high level of efficiency in all aspects of life, particularly in relation to time and distance. Hence by its nature ICT industry have contributed in very significant in productivity and economic growth.

The original correlation of ICT in economic growth model will be proposed. The statistical data of economic and ICT will be analyzed to show the correlation. Indonesia will be the study case to the proposed original model.

Indonesia ICT stats growth rapidly in these recent years, this is along with the continuing economic growth that put Indonesia into number 15 in G20 country. The scintillating growth of ICT users and services industry in Indonesia is has significant contribution in GDP growth, is not followed by the same respectable growth in ICT software or hardware Industry growth, hence result lesser productivity and higher cost on economic growth.

To conclude, improvement suggestion with the Impact on GDP and other economic parameters will be proposed.

Index Terms—GDP, ICT, Industry, Trading Balance, Government Policy.

I. INTRODUCTION

Various studies indicate a very close relationship between the roles of ICT with a country's economic growth and illustrate the close linkage between the development of ICT and economic growth. In this paper we want to propose a correlation model between ICT and country economic growth, to have better illustration of the correlation. Indonesia is used as a study case, as one of the Economic emerging country and high growth indicators in ICT country.

A. Gross Domestic Product (GDP)

According to [1], GDP measures the market value of final goods and services produced by resources located in a country during a specified period, usually one year. GDP can also be

used to study the economy from time to time or to compare several economies at a time [2].

GDP includes only final goods and services, i.e. goods and services sold to final users. For goods and services that are purchased to be processed again or sold again (intermediate goods and services), are not included in GDP calculation to avoid the problem of double counting, i.e. counting a product more than once.

There are two types of GDP, namely:

1. GDP at current prices or nominal GDP, the value of goods and services produced by a country within a year valued according to prices prevailing in that year.
2. GDP at fixed prices or real GDP, the value of goods and services produced by a country within a year valued according to prices prevailing in a given year are so used to assess the goods and services produced in other years the GDP figures are the result multiplying the amount of production (Q) and price (P), if the prices go up from year to year due to inflation, then the amount of GDP will go up anyway, but the increase is not necessarily indicate the amount of production (real GDP). Possible increase in GDP is only due to price increases alone, while the volume of fixed or declining production.

B. The calculation of GDP

According to [8] there are two kinds of approaches used in the calculation of GDP, namely:

- Expenditure Approach

According to [8] to understand the expenditure approach to GDP, we divide into four components of aggregate expenditure: 1)consumption, 2)investment, 3)government purchases, and 4)net exports.

In the expenditure approach, the state aggregate expenditures equal to the sum of consumption, C, investment I, government purchases, G, and net exports, ie

the value of exports, X , reduced by the value of imports, M , or $(X-M)$.

Summation of these components result in aggregate expenditures, or GDP:

$$C + I + G + (X-M) = \text{aggregate expenditure} = \text{GDP} \quad (1)$$

- Income Approach

According to [8] Income is equal to the sum of aggregate income received by all resources owner in the economy (because their resources are used in the production process). So we can say that:

$$\text{aggregate expenditure} = \text{GDP} = \text{aggregate income} \quad (2)$$

C. Information and Communication Technology (ICT) Indicators and Growth

Information and Communication Technology (ICT) have contributed in driving the economy with a very significant and very meaningful in an effort to increase people's welfare. The basic measurement of ICT existence in one country is covering as follow [3]:

- ICT infrastructure and access as a main indicators
- Household and Business users and access
- ICT Industry productivity and employment
- ICT trading, export and import of ICT goods
- ICT utilization in education

The Partnership on Measuring ICT for Development was launched in June 2004, following the first phase of the World Summit on the Information Society (WSIS). Its current members are Eurostat, the International Telecommunication Union (ITU), the Organisation for Economic Co-operation and Development (OECD), the United Nations Conference on Trade and Development UNCTAD, the United Nations Department of Economic and Social Affairs (UNDESA), the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS), the World Bank, and four United Nations Regional Commissions (the UN Economic Commission for Africa, the UN Economic Commission for Latin America and the Caribbean, the UN Economic and Social Commission for Asia and the Pacific, and the UN Economic and Social Commission for Western Asia) [9].

The work of the Partnership is directed towards achieving internationally comparable and reliable ICT statistics. In order to achieve this, its members are involved in developing and maintaining a core list of ICT indicators. Other activities include the compilation and dissemination of ICT data, and the provision of technical assistance enabling statistical agencies to collect data that underlie the core list of ICT indicators.

TABLE I. ICT CORE INDICATOR FOR INFRASTRUCTURE AND ACCESS [3]

A1	Fixed telephone lines per 100 inhabitants
A2	Mobile cellular telephone subscriptions per 100 inhabitants
A3	Fixed Internet subscribers per 100 inhabitants
A4	Fixed broadband Internet subscribers per 100 inhabitants
A5	Mobile broadband subscriptions per 100 inhabitants
A6	International Internet bandwidth per inhabitant (bit/second/inhabitant)
A7	Percentage of the population covered by a mobile cellular telephone network
A8	Fixed broadband Internet access tariffs per month:
A9	Mobile cellular telephone prepaid tariffs per month

A10	Percentage of localities with public Internet access centers (PIACs)
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The ICT indicators for how the household, business, and education, access and use ICT is narrowly consider in this paper due to correlation model developed for macro economic, the indicators are exposed in Table II, Table III, and Table VI in [7].

TABLE II. ICT CORE INDICATOR FOR INDUSTRY AND TRADING [3]

ICT1	Proportion of total business sector workforce involved in the ICT sector
ICT2	ICT sector share of gross value added
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total imports

The ICT Development Index (IDI) [4] performed by ITU ranks 155 countries' performance with regard to information and communication technology (ICT) infrastructure and uptake. The ICT Price Basket (IPB) is a unique metric that tracks and compares the cost and affordability of ICT services in more than 160 countries globally. Both the IDI [4] and the IPB [3] combined are powerful measures for benchmarking and explaining differences among countries and within regions when it comes to ICT developments [3].

II. PROPOSED ECONOMIC AND ICT CORRELATION MODELS

The research is based on the statistical data collected from various trusted secondary resources, which will be put into tables and analyzed after. The simple original model is proposed to have better illustration of the data and analysis.

The ICT Industry is growing from simply telephone and computer into multimedia and various computer based end user terminals. The proposed ICT industry mapping is summarized in Figure 1.

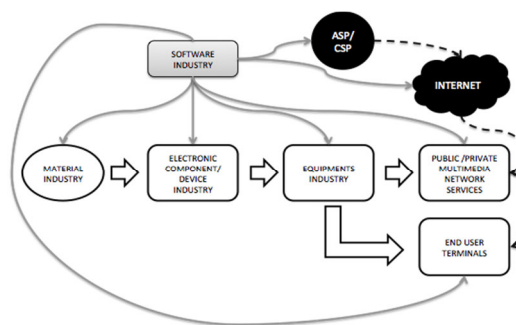


Fig. 1 Industry Mapping

The material industries overspread from semiconductor material, vacuum tube, optical material, until metal, Polycarbon, even composite, for electronic equipment components from main components such IC (Integrated Circuit), LCD/LED monitors, until supporting component such keypads. The breakthrough on the material technology

impacts on better performance and lower power consumption on electronic equipment.

The electronic equipment industry also spread from network equipment, such exchange, core networks router, cellular BTS, into variation of end user terminal such computers, laptop, netbook, tabled, gadget, smartphone, STB, smart TV, game console. Additional special purposes equipment such cash register, POS, vending machine, vehicle control, military, and other similar devices is also put into considerations. The network technology is also has evolve from 1990's simply telephone/mobile phone network and internet into NGN (next generation network) that covers multimedia services include voice, video and data, this evolution include the private/business network, and by all means can be mobile. The evolution even going further when everything going network to be come what we called cloud, and such application service providers or content providers is growing fast trigger mostly by android and apple's IOS.

This whole development indubitably support by incredible development of software industry that even support from design, manufacturing of materials, electronic components, planning and operation of the network, as core engine of the equipment itself, operating system of computers and online application/content, and any special purpose application that support other activities such financial, medicals, manufacturing, etc. The software together with the equipment has become the most important thing in modern entity activities.

As more and more electric transducers and access technology introduce in current world, then more ICT become more important in today economic activities. The ICT itself has developed from services, which support entities to compete in global world, into significant Industry that creates productivity and economic income for society and countries.

The correlation of the original ICT and Economic general model in one country is proposed as depict Figure 2 shows how the ICT services increase productivity of community. Like the other technology ICT grow by means of human instinct in their urges to always ease their life along with civilization development. The access to ICT means access to information to make entity more effective and competitive, hence ICT roles in economic is very basic involve in act of manage resource to survive and win the competition or in simply will improve the productivity of entity that uses it. Hence the better and better quality of services or products of ICT is supporting higher productivity. In the government economic point of view the more productivity must be able to transform into GDP higher growth, hence higher economic growth and higher tax income for the government.

On the other hand, as services industry, in order to deliver better services and products the ICT industry itself must grow in order to have sustainability of development. Fortunately in fact today worldwide ICT industry grow even more than expected before as an electronic industry, ICT has play more role in one country to another, and can be consider as one of the main sector in one country such as India, that is calculated

to drive economic growth like others like agriculture, mining, etc.

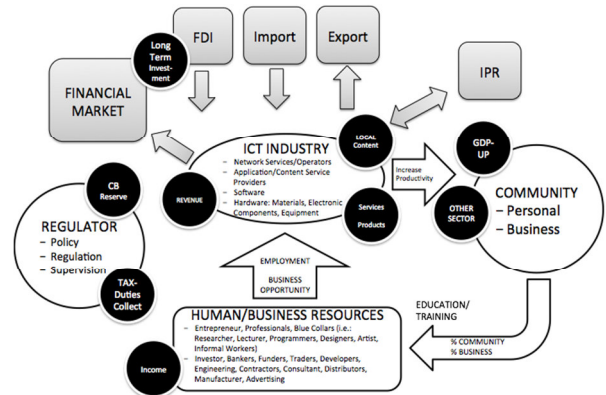


Fig. 2 Industry Economic General Model Map

The ICT industry like other sector, is also consider being able to absorb work force, hence lower the unemployment rate of country. ICT Industry might shutdown several ancient services like long distribution channels of goods, but it also give new products to be distributed to the market, instead also create another jobs or business opportunity for SME (small medium enterprise) which non exist before such job like network engineer, web designer, programmers, IC designers, etc., and no such business like software house, internet cafe, application, or content providers, etc.

As an uprising high growth Industry, definitely ICT Industry also attracts Financial Industry to take the opportunities for benefits. Not only the conventional Bankers, or Funders, but buy its natural symbioses with Financial Industry as modern industry of ICT industry usually go public to have more sophisticated financial resource from the financial market. Besides enormous numbers of ICT Industry go to financial market, the ICT services and products on the other hand are supporting the incredible growth of Financial Industry. It ease the access of the person that involve in the Financial Industry, and also become the operating engine of the Financial Industry, hence even further the ICT growth give more impacts to economic benefits.

Portion of community itself is also can be a workforce that is absorbed the ICT industry, by preliminary education and training. The more ICT growth in term of revenue then the more income to the workforce/professionals or SME involve in the activities, and by all means the more also financial sector get benefits from its involvement. The quality of services or products should grow together with the growth of the Industry along with the competitions, but usually one country will define the standard of services or products in order to assure better productivity of the nations. The competition itself sometimes control in one country sometimes let to be free, it is depend on how one country want to retain incumbent and attract more investment in order to keep good growth of ICT industry. All benefits of productivity growth, ICT Industry growth, employment growth, GDP growth summarized in growth of government

income, mainly tax collection and other income such as duties, frequency charges, etc.

The government also can push the combination of productivity of nation and ICT Industry growth to create more local content of ICT Industry. This will reduce portion of imported goods furthermore can increase exported goods of country. Together with foreign investment inflow will bring more Foreign Currency Reserve of the country, eventually stabilize and strengthen one country economy. The mechanism is illustrated in Figure 3.

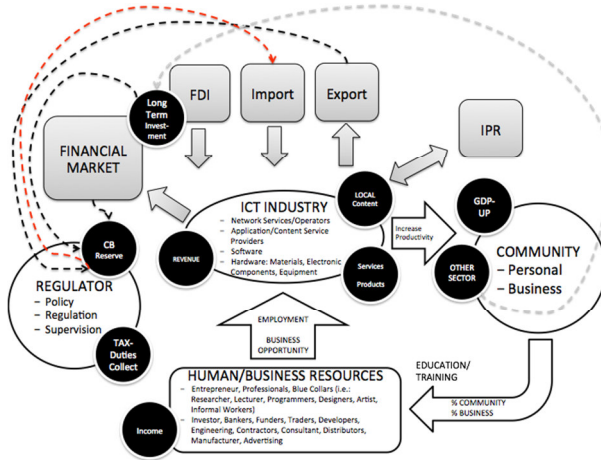


Fig. 3 Ideal Condition of Growth Indicator on The Proposed Model Map

The foreign capital inflow mainly comes from the Foreign Direct Investment (FDI) and financial market, but FDI is preferable to its long term placement hence supports stability of Foreign Currency Reserve. A very well prospect of ICT Industry in the country will attract the FDI, but FDI not only comes from ICT, but government policy is very important for attracting the FDI.

The local content in ICT Industry also can yield IPR (Intellectual Property Right)/patent, which is able to secure ICT Industry development in one country in the long term while also the country has benefits from person or business patent being used by foreign party.

To conclude the proposed model the ideal condition of one country is that while the ICT industry is growing up there is also must be a mechanism to make sure high improvement on quality of services or products, and high growth in local content, hence impacts on maximum possible productivity, GDP Growth, Government Income, Support Employment growth, Financial Market growth and strong Foreign Currency Reserve. The proposed ideal condition of the model is illustrated below in Figure 4.

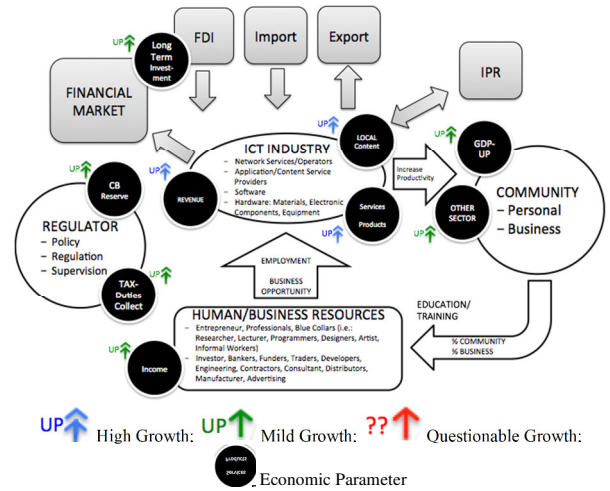


Fig. 4 Foreign Reverse Mechanism on The Proposed Model Map

III. INDONESIA ECONOMIC, ICT STATS, AND ANALYSIS

GDP (Gross Domestic Product) Nationwide demonstrates macro-economic performance Output. Development of GDP in Indonesia from 2005 until 2012 is summarized in the Table III.

Over the last two decades Indonesia has experienced rapid sustained growth, significantly increasing the share of GDP, despite agriculture had suffered a significant setback during the 1997 financial crisis. The achievement is indeed impressive. Nominal GDP increased 3 times from 285.9 billion USD in 2005 to 878.2 billion USD in 2012, and predict will be in the top rank 5 or 7 country in term of nominal GDP in 2050. GDP per capita in real terms the count is also increased 260 percent or almost 4 times from 1,076 USD in 2005 to 3,910 USD in 2012. Indonesia's GDP nominal by sectors 2005-2012 are shown in Table IV.

From the Table V it is obvious that the ICT sub-sector growth is much higher than other sectors. In the 2008 the ICT sub-sector booked highest growth almost 30% while national GDP grew only 6.01%, and also is the highest growth and much higher than any other sector or subsector. The highest growth achievement of ICT sub-sector continues each year until today 2012.

The rapid developments in the ICT Industry, especially since 2006 is characterized by the implementation of 3G network services, which role in encouraging increased communication sub-sector in national GDP in 2006-2009, while the downfall of the growth in 2010-2012 is discouraging in the means of saturated growth of mobile penetration. The Indonesia ICT Statistic is shown in Table V.

TABLE III. RECENT ECONOMIC INDICATORS [5][6][7][8][9] [9]

ECONOMIC INDICATORS	2005	2006	2007	2008	2009	2010	2011	2012
GDP US\$ bn	285.9	364.4	432.2	511.2	538.5	706.8	834.3	878.20
GDP PPP US\$ bn	663.3	768	840.4	910.7	962.4	1,033.0	1,122.6	1,216.7
GDP per capita US\$	1,076	1,636	1,916	2,237	2,327	2,974	3,469	3,910
GDP per capita PPP US\$	2,497	3,448	3,725	3,985	4,160	4,347	4,668	4,977
GDP Growth % yoy	5.7	5.5	6.3	6	4.6	6.1	6.4	6.2
Exports %GDP	30.0	31.6	30.2	30.3	24.7	24.7	27.7	21.6
Inflation % change yoy	17.1	13.1	6	9.8	4.8	5.1	5.7	4.3

TABLE IV. INDONESIA GDP 2005-2012 BY SECTORS

No	Sectors	Years (bn Rp)							
		2005	2006	2007	2008	2009	2010	2011*	2012**
1	Agriculture	364,169.30	433,223.40	547,235.60	713,291.40	857,241.40	985,448.80	1,093,466.00	1,190,412.40
2	Mining	309,014.10	366,505.40	440,826.20	543,363.80	591,912.70	718,136.80	886,243.30	970,599.60
3	Processing Industry	760,361.30	919,532.70	1,068,806.40	1,380,731.50	1,477,674.30	1,595,779.40	1,803,486.30	1,972,846.60
4	Electricity, Gas and Running Water	26,693.80	30,354.80	34,726.20	40,846.70	47,165.90	49,119.00	55,700.60	65,124.90
5	Construction	195,110.60	251,132.30	305,215.70	419,321.60	555,201.40	660,890.50	756,537.30	860,964.80
6	Trading, Hotel and Restaurant	431,620.20	501,542.10	590,822.30	692,118.80	744,122.20	882,487.20	1,022,106.70	1,145,600.90
7	Transportation and ICT	180,584.90	231,808.60	265,256.90	312,454.10	352,423.40	423,165.30	491,240.90	549,115.50
	a. Transportation	110,157.30	142,799.00	149,926.60	171,203.00	181,896.00	217,311.20	254,427.00	287,356.20
	b. ICT	70,427.60	89,009.60	115,330.30	141,251.10	170,527.40	205,854.10	236,813.90	261,759.30
8	Financial, Rentals, and Corporate Services	230,522.70	269,121.40	305,216.00	368,129.70	404,013.40	466,563.80	534,975.00	598,523.20
9	Services	276,204.20	336,258.90	399,298.60	483,771.30	574,116.50	654,680.00	783,330.00	888,676.40
	GDP	2,774,281.10	3,339,479.60	3,957,403.90	4,954,028.90	5,603,871.20	6,436,270.80	7,427,086.10	8,241,864.30
	GDP without Oil&Gas	2,458,234.30	2,967,303.10	3,540,950.10	4,426,384.70	5,138,955.20	5,936,237.80	6,794,373.40	7,604,759.10

TABLE V. INDONESIA ICT STATISTICS [10]

ICT STATS	2004	2005	2006	2007	2008	2009	2010	2011	2012
Population	224,606,531	227,303,175	229,918,547	232,461,746	234,951,154	237,414,495	239,870,937	243,740,000	244,769,110
Fixed Wired Line	8,058,139	8,299,883	8,735,843	8,715,479	8,671,928	8,421,766	8,426,973	8,426,973	8,426,973
Mobile/ Cellular	30,336,607	46,909,972	63,803,015	93,386,881	140,578,243	163,676,961	211,290,235	249,805,619	281,963,665
Internet Users	5,839,770	8,182,914	10,944,123	13,459,535	18,608,131	16,429,083	26,193,906	43,873,200	54,828,281
Broadband Subscription	84,900	108,200	194,367	778,770	981,562	1,863,821	2,280,316	2,736,379	2,983,000
Fixed Wired Line%	3.59	3.65	3.80	3.75	3.69	3.55	3.51	3.46	3.44
Mobile/ Cellular %	13.51	20.64	27.75	40.17	59.83	68.94	88.08	102.49	115.20
Internet Users %	2.6	3.6	4.76	5.79	7.92	6.92	10.92	18	22.4
Broadband Subscription %	0.04	0.05	0.08	0.34	0.42	0.79	0.95	1.12	1.22

As shown in Table VI the mobile cellular penetration in Indonesia has grown very fast in 12 years from only 3% in 2001 into 115% in 2012, while the fixed wired line remains the same or no development since 2001. Indonesia mobile and cellular subscription has put Indonesia in the rank 6 in the world, and has driven ICT Industry development and growth in Indonesia during 2001 to 2012.

As in the world trends of Internet user penetration, which reach 2.7 billion Internet users in 2012, Indonesia also shows rapid development in Internet user penetration, which grows from 2% user penetration or about 2 million Internet

users in 2001 into 22% user penetration or about 55 million Internet users in 2012. The Internet users in Indonesia have reach rank 13 in the world, while the penetration still bellow the world average 37%. Indonesia as a communal society reach 51 million Facebook users at end of 2012, and has reach rank 2 in Facebook users in 2010 before it is surpassed by India in 2012, hence the internet play important role for Indonesian people especially the youngster or people bellow 40 years old. The growth in ICT industry of Mobile services also drives the services goods trading as shown in Table VI.

TABLE VI. GROWTH IN ICT GOODS TRADING [10]

ICT GOODS	2005	2006	2007	2008	2009	2010	2011
Export in USD	916,903,299	912,615,463	791,072,473	1,044,207,325	1,886,732,217	2,310,105,995	2,681,090,192
Import in USD	203,358,918	209,462,317	664,248,080	1,130,915,894	2,503,657,803	3,619,695,162	4,246,802,605
Trading Balance	713,544,381	703,153,146	126,824,393	(86,708,569)	(616,925,586)	(1,309,589,167)	(1,565,712,413)

After the crisis, the gap or distance between the service industry and the telecommunications equipment industry in the country has widened. Services industry has begun to grow rapidly (mainly mobile communication service) while industrial devices still survive / survival. The growth of ICT has not been accompanied by growth of the domestic ICT industry, as seen from the figures of imports rose from year to year, as it is shown in Table VI that the trading balance

plumbed from surplus 713 million USD to minus 1.5 billion USD in 2012.

ICT industry has not get the incentives, both of banking and government, reflected in the government charges in ICT Industry as it is shown in Table VII, and income derived from all these industries have not returned to the interests of the development of the Indonesia local ICT industry itself. The growth of mobile services is merely pure demand opportunity of communication and broadband services due lack of broadband fixed line availability in Indonesia.

TABLE VII. GOVERNMENT REVENUE 2005-2012

Indonesia Government Income	2005	2006	2007	2008	2009	2010	2011	2012
Tax	331,791.90	395,971.50	470,051.90	622,358.70	601,251.80	720,764.50	816,422.30	976,898.80
Trading Tax and Import Duties	15,239.20	13,231.50	20,936.80	36,342.10	18,670.40	22,561.40	23,118.10	42,433.60
Natural Resource Sharing	110,467.20	167,473.80	132,892.60	224,463.00	138,959.20	164,726.70	158,173.70	172,870.80
BUMN Profits	12,835.20	21,450.60	23,222.50	29,088.40	26,049.50	29,500.00	26,590.00	27,590.00
Other Government Income	23,585.90	38,025.70	56,873.40	63,319.00	53,796.00	43,462.00	43,429.00	54,398.30
Public Services Institution Income			2,131.20	3,734.30	8,369.50	9,486.00	14,895.00	17,861.10
TOTAL	493,919.40	636,153.10	706,108.40	979,305.50	847,096.40	990,500.60	1,082,628.10	1,292,052.60

Other Government Income from ICT	2005	2006	2007	2008	2009	2010	2011	2012
Nominal	1,776.58	3,314.70	3,385.94	7,707.71	12,862.92	10,748.73	11,232.34	11,583.73
% to Total Other Government Income	7.53%	8.72%	5.95%	12.17%	23.91%	24.73%	25.86%	21.29%

As it shown in Table VII that the government charges of ICT services industry in Indonesia quite high, which is not included the tax derived from ICT Industry itself.

The Indonesia Economic and ICT correlation model and analysis is illustrated in Figure 5.

In the 2012 ITU reports on IDI (ICT Development Index), puts Indonesia in rank 99 from 155 countries, because of unbalance growth of ICT indicators in Indonesia. The lack of growth of fixed wired line yields lack of fixed line broadband subscription in Indonesia yields very low teledensity indicators and low fixed line broadband subscription compare to other country. The higher import than export of ICT goods and services also yields low ICT indicators on added value.

Indeed Indonesia ICT Industry growth drives the nation GDP but there is huge gap of better quality of services such broadband fixed line services. The lack of local content Industry also did not contribute on higher export then imports, then yields negative trading balance that will give a burden to the country Foreign Currency Reserve. The models of Indonesia ICT Industry Economic will far from ideal as shown in figure 5.

In the future ICT industry growth, the mobile services cannot become the major driver anymore due to its saturation, the Fixed Line and Broadband subscription can be the main driver in the near future. The policy of local content must be strengthen even though there has been strong political urge to do so, imply by several regulation impose on Industry, but if still not strong enough to trigger the local Industry. More government procurement is recommended while several financial incentives can be applied.

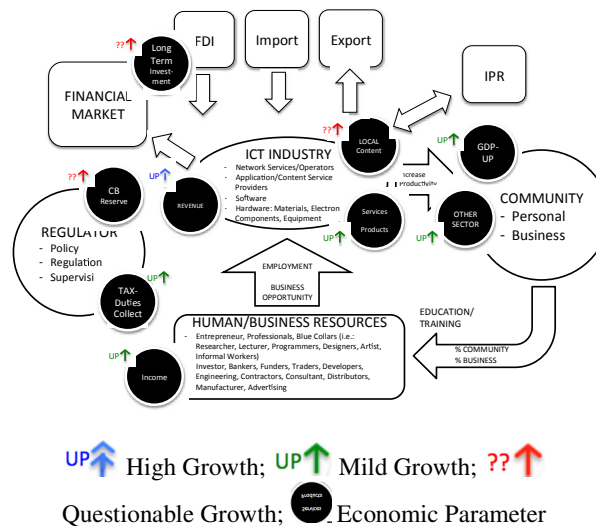


Figure 5. Indonesia ICT Economic Indicators on The Proposed Model Map

IV. CONCLUSION

The proposed original economic and ICT correlation model can be used to show:

- a. The correlation on ICT services industry growth has main impact on GDP growth hence government tax income growth, and will trigger long-term investment growth, which has other impact on employment, and financial market growth.
- b. The correlation of the local contribution/content in ICT industry growth in one country will lower import and trigger more long term investment and will have main impact on the bank or country reserve growth.

The Indonesia Economic and ICT correlation has shown by the model that GDP in ICT experienced a significant increase in line with the increase in GDP and even grows more than the nation GDP. However the growth has become more easy last 3 years due to saturation of mobile services industry, which is the major driver of the growth from 2001-2010. For the sake of future development of ICT Industry, the fixed line network services is recommended, and the strong development local content of ICT industry is also recommended to have surplus trading balance of ICT Industry.

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