A STUDY ON SMARTPHONE MANUFACTURING ECOSYSTEM IN INDIA

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A STUDY ON SMARTPHONE MANUFACTURING ECOSYSTEM IN INDIA

by

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*Dedicated to my wife **Renuka** who has been a constant Source of Encouragement for my PhD work*

CERTIFICATE

The thesis entitled **"A Study on Smartphone Manufacturing Ecosystem in India"**; being submitted by **Jadumani Jena** to the Indian Institute of Technology Delhi, for award of the Degree of **"Doctor of Philosophy"** is a record *bona fide* Research Work carried out by him. He has worked under our supervision in conformity with rules and regulations of the Indian Institute of Technology Delhi. The research reports and results presented in the thesis have not been submitted in part or full for the award of any degree or diploma in any other University or Institute.

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ABSTRACT

Telecom Sector in India has traversed through major changes in recent years. More than just a voice communication medium, it is now contributing a lot towards economic growth and financial inclusion of poorest of the poor. There is also significant change towards using telecommunication to play a major role in value added services, such as on-line banking, m-health, m-commerce, m-governance, m-education etc. Many business decisions are now facilitated through telecom infrastructure and therefore it is contributing towards the overall GDP of a nation. However the penetration of mobile tele-density is still far from satisfactory especially in rural and semi urban areas, thus having a high growth potential both in quantitative and qualitative terms.

An important feature of this sector is strong interdependence of different sub systems like handset manufacturing, service delivery, tower technology, application development etc. on one another. With rapid technological convergence, the mobile devices are becoming smarter day by day and smartphone is becoming the ubiquitous platform both for personal and business activities. This device demand in India is growing in geometric progression and many economic/ governance activities are being offered on this platform. However, the weakest link in the entire telecom ecosystem of India is handset manufacturing which is mostly import dependant but has many customer-facing challenges. Therefore there is a need to carefully understand the way we can strengthen smart phone manufacturing in India.

The objective of this research is to analyse smartphone manufacturing ecosystem (SME) and identify key Enabling variables and Inhibitors and establish their hierarchical importance so that these can be appropriately managed to develop the manufacturing ecosystem.

To achieve this main objective, attempt was made to study a few countries like China, USA, Taiwan, Korea and Finland which helped us to understand their respective strength, weakness, opportunity and threat. This knowledge was helpful in synthesis of the results and in drawing conclusions.

Subsequently, a few representative case studies of smartphone manufacturers were undertaken to study their performance parameters under Indian conditions to get an idea

about the manufacturing ecosystem and analysed using SAP-LAP (Situation Actor Process - Learning Action Performance) framework. This helped us in understanding enabler and inhibitor variables of smartphone manufacturing ecosystem. This was further augmented with literature survey and expert opinion to arrive at a set of Enabling and Inhibiting variables. Around these variables, a questionnaire based Survey was conducted and responses were collected from different segment of the telecom sector. Using appropriate statistical tools like factor analysis and regression testing, a few hypotheses were formulated and these hypotheses were tested to get the final set of significant enabling/ inhibiting variables.

Thereafter, Total Interpretive Structural Models (TISM) were developed both for the enabling variables and inhibitors separately, which provided useful information about the driving power and dependence relationships amongst the variables. Thus the strategic enablers and inhibitors (barriers) were identified along with their hierarchical importance level with respect to each other. These enablers and barriers of TISM model were then synthesized with the strength, opportunity obtained from SWOT analysis for India to get the SOEB (Strength-Opportunity-Enabler-Barrier) matrix for decision making in development of smartphone manufacturing ecosystem.

The research ends with documentation of implication of the study for practitioners and academician. Limitations of research and scope of future work were also listed. The thesis has thrown up some revealing facts as to how the policy makers have been focussing on some of the non-strategic areas that have low driving power but give lesser attention to strategic areas. Supportive Govt. policy, entrepreneur development and global competitiveness have been the strategic enablers for developing smartphone manufacturing ecosystem and political corruption coupled with low R&D spending have been the biggest inhibitors to the growth of the ecosystem. This study lays the foundation to the least studied area of ecosystem development for manufacturing mobile handsets, a mass consumed product in India today. Hopefully this work will trigger more studies and research to take place in this area in years to come.

Keywords: Smartphone Manufacturing Ecosystem (SME), Total Interpretive Structural Modelling (TISM), India Case study, Inhibitor, Enabler, Barriers, SOEB.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
3GPP	3rd Generation Partnership Project
A	Action
AR	Actor
ARPU	Average Revenue Per User
ATMP	Assembly Testing And Packaging
BOM	Bill Of Materials
CAGR	Compound Annual Growth Rate
CCC	Cheap Chinese Chipset
CDMA	Code Division Multiple Access
CENVAT	Central Value Added Tax
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIF	Cost, Insurance and Freight
CKD	Completely Knocked Down
COAI	Cellular Operators Association Of India
CSF	Critical Success Factor
CTO	Chief Technology Officer
DOT	Department of Telecommunications
E4GI	Early 4G Introduction
ECM	Environmentally Conscious Manufacturing
EMS	Electronic Manufacturing Services
EOU	Export Oriented Unit
EU	European Union
FDI	Foreign Direct Investment
FI'S	Financial Institutions
GDP	Gross Domestic Product
GMCI	Global Manufacturing Competitiveness Index
GOI	Government of India
GOVT.	Government

GPS	Global Positioning System
GPU	Graphics Processing Unit
GSM	Global System For Mobile Communication
GSMA	Global System For Mobile Communication Association
GST	Goods And Services Tax
IC	Integrated Circuit
ICT	Information And Communication Technology
IDC	International Data Corporation
IEEE	Institute of Electrical and Electronics Engineers
IIM	Indian Institute Of Management
IISC	Indian Institute Of Science
IIT	Indian Institute Of Technology
IMD	Institute For Management Development
IMF	International Monetary Fund
IPR	Intellectual Property Rights
ISM	Interpretative Structure Modelling
ISP	Internet Service Provider
IT	Information Technology
ITRI	Industrial Technology Research Institute
ITU	International Telecommunications Union
JV	Joint Ventures
KMO	Kaiser Meyer Olkin
L	Learning
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LTE	Long Term Evolution
M2M	Machine to Machine
MAP	Mutual Agreement Process
MFN	Most Favored Nation
MICMAC	Cross Impact Matrix Multiplication Applied to Classification
MIE	Mature Innovation Ecosystem

MIIT	Ministry Of Industry And Information Technology
MNC	Multi National Company
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
NA	Not Applicable / Not Available
NFC	Near Field Communication
NGN	Next Generation Network
NSDC	National Skill Development Corporation
ODM	Original Design Manufacturer
OECD	Organization For Economic Cooperation And Development
OEM	Original Equipment Manufacturer
OS	Operating System
PC	Personal Computer
PCB	Printed Circuit Board
PCO	Public Call Office
PDA	Personal Digital Assistant
POITC	Presence of IT Companies
PPP	Public Private Partnership
PR	Process
PWC	Price Waterhouse Coopers
Q1	Quarter-1
R&D	Research And Development
RIM	Research In Motion
S	Situation
SAP-LAP	Situation Actor Process - Learning Action performance
SEZ	Special Economic Zone
SIM	Subscriber Identity Module
SKD	Semi Knocked Down
SME	Smartphone Manufacturing Ecosystem
SMED	Smartphone Manufacturing Ecosystem Development
SMS	Short Message Service
SOEB	Strength Opportunity, Enablers, Barriers
SPSS	Statistical Package for the Social Sciences

SWOT	Strengths, Weakness, Opportunities, Threats
TCOE	Telecom Centre Of Excellence
TFT	Thin Film Transistor
TISM	Total Interpretive Structural Modelling
TSDSI	Telecommunications Standards Development Society, India
TPM	Total Productive Maintenance
TQM	Total Quality Management
TSP	Telecom Service Provider
TSSC	Telecom Sector Skill Council
TV	Television
UHF	Ultra-High Frequency
UI	User Interface
US	United States of America
USA	United States of America
USD	United States Dollar
VAS	Value Added Services
VAT	Value Added Taxes
VLSI	Very Large Scale Integration
VOIP	Voice Over Internet Protocol
WAP	Wireless Access Protocol
WEF	World Economic Forum
WP7	Windows Phone 7