INNOVATION READINESS OF AFRICAN COUNTRIES IN A KNOWLEDGE-BASED ECONOMY: CHALLENGES AND OPPORTUNITIES

Presentation at the WIPO/ARIPO Conference on Intellectual Property (IP), Innovation and Value Addition for Business Competitiveness and Sustainable Development in Africa: 6-8 November 2019, Harare, Zimbabwe

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Presentation Outline

1. What is Innovation, Creativity and Development?
2. Innovation + Creativity + Development = R & D Success
3. Selected Challenges, Opportunities
4. The Innovation Diamond
5. Utilization of Research Products – utilisation of the Stage Gate ® Concept
6. What Can We Do In Specific Areas?
7. Conclusion

Introduction

- African countries aspire to produce high-value knowledge-based goods and services, emulating Japan, South Korea, China – just to name a few
- There is great desire to reverse the current trend where the continent imports most of what it consumes
- The continent is seriously embarking on value-addition to exports (industrialization)
- Innovation and intellectual property (IP)are key to these aspirations

The Innovation Diamond

What is Innovation, Creativity and Development?

INNOVATION

- *The Introduction of something NEW*

CREATIVITY

- *The ability to make or otherwise bring into existence something new, whether a new solution to a problem, a new method or device, or a new artistic object or form*

DEVELOPMENT

- *The act, process or result of developing*

Challenge: Very low funding levels, Innovations not prioritized for strategic attention

Opportunity: making R&D, Innovations attractive to funders

Share of R&D expenditure to Country GDP

(Source: World Bank Devt. Indicators 2010)

Africa		Rest of the World	
Country	*% R&D Exp. to GDP*	*Country*	*% R&D Exp. to GDP*
Burundi	0.14	Australia	2.39
Cape Verde	0.07	Austria	2.84
Egypt	0.43	Belgium	2.24
Ethiopia	0.25	Brazil	1.21
Gambia	0.13	China	1.98
Ghana	0.38	Canada	1.86
Kenya	0.98	Denmark	3
Lesotho	0.01	Finland	3.9
Mali	0.66	France	2.26
Morocco	0.76	Germany	2.92
Mozambique	0.46	Israel	3.97
Namibia	0.14	Japan	3.39
Senegal	0.54	South Korea	4.04
South Africa	0.93	Singapore	2.47
Tanzania	0.52	Sweden	3.41
Uganda	0.56	UK	1.78
Zimbabwe	0.30*	USA	2.79

Challenge: Very few experts, always on the move away from their countries of origin

Opportunity: Development and retention of experts, crafting innovations that suit Africa

Table 1.3: **World shares of researchers, 2007, 2009, 2011 and 2013**

	Researchers ('000s)				Share of global researchers (%)			
	2007	2009	2011	2013	2007	2009	2011	2013
World	**6 400.9**	**6 901.9**	**7 350.4**	**7 758.9**	**100.0**	**100.0**	**100.0**	**100.0**
High-income economies	4 445.9	4 653.9	4 823.1	4 993.6	69.5	67.4	65.6	64.4
Upper middle-income economies	1 441.8	1 709.4	1 952.3	2 168.8	22.5	24.8	26.6	28.0
Lower middle-income economies	439.6	453.2	478.0	493.8	6.9	6.6	6.5	6.4
Low-income economies	73.6	85.4	96.9	102.6	1.2	1.2	1.3	1.3
Americas	**1 516.6**	**1 656.7**	**1 696.1**	**1 721.9**	**23.7**	**24.0**	**23.1**	**22.2**
North America	1 284.9	1 401.2	1 416.1	1 433.3	20.1	20.3	19.3	18.5
Latin America	222.6	245.7	270.8	280.0	3.5	3.6	3.7	3.6
Caribbean	9.1	9.7	9.2	8.5	0.1	0.1	0.1	0.1
Europe	**2 125.6**	**2 205.0**	**2 296.8**	**2 408.1**	**33.2**	**31.9**	**31.2**	**31.0**
European Union	1 458.1	1 554.0	1 623.9	1 726.3	22.8	22.5	22.1	22.2
Southeast Europe	11.3	12.8	14.2	14.9	0.2	0.2	0.2	0.2
European Free Trade Association	51.9	56.8	62.9	67.2	0.8	0.8	0.9	0.9
Other Europe	604.3	581.4	595.8	599.9	9.4	8.4	8.1	7.7
Africa	**150.1**	**152.7**	**173.4**	**187.5**	**2.3**	**2.2**	**2.4**	**2.4**
Sub-Saharan Africa	58.8	69.4	77.1	82.0	0.9	1.0	1.0	1.1
Arab States in Africa	91.3	83.3	96.3	105.5	1.4	1.2	1.3	1.4
Asia	**2 498.1**	**2 770.8**	**3 063.9**	**3 318.0**	**39.0**	**40.1**	**41.7**	**42.8**
Central Asia	21.7	25.1	26.1	33.6	0.3	0.4	0.4	0.4
Arab States in Asia	31.6	35.6	40.7	44.0	0.5	0.5	0.6	0.6
West Asia	116.2	119.2	124.3	136.9	1.8	1.7	1.7	1.8
South Asia	206.2	223.6	233.0	242.4	3.2	3.2	3.2	3.1
Southeast Asia	2 122.4	2 367.4	2 639.8	2 861.1	33.2	34.3	35.9	36.9
Oceania	**110.5**	**116.7**	**120.1**	**123.3**	**1.7**	**1.7**	**1.6**	**1.6**
Other groupings								
Least developed countries	45.2	51.0	55.8	58.8	0.7	0.7	0.8	0.8
Arab States all	122.9	118.9	137.0	149.5	1.9	1.7	1.9	1.9

Source: *UNESCO Science Report, Towards 2030* of 2019

Table 1.4: **World shares of scientific publications, 2008 and 2014**

	Total publications		Change (%) 2008–2014	World share of publications (%)		Publications per million inhabitants		Publications with international co-authors (%)	
	2008	2014		2008	2014	2008	2014	2008	2014
World	**1 029 471**	**1 270 425**	**23.4**	**100.0**	**100.0**	**153**	**176**	**20.9**	**24.9**
High-income economies	812 863	908 960	11.8	79.0	71.5	653	707	26.0	33.8
Upper middle-income economies	212 814	413 779	94.4	20.7	32.6	91	168	28.0	28.4
Lower middle-income economies	58 843	86 139	46.4	5.7	6.8	25	33	29.2	37.6
Low-income economies	4 574	7 660	67.5	0.4	0.6	6	9	80.1	85.8
Americas	**369 414**	**417 372**	**13.0**	**35.9**	**32.9**	**403**	**428**	**29.7**	**38.2**
North America	325 942	362 806	11.3	31.7	28.6	959	1 013	30.5	39.6
Latin America	50 182	65 239	30.0	4.9	5.1	93	112	34.5	41.1
Caribbean	1 289	1 375	6.7	0.1	0.1	36	36	64.6	82.4
Europe	**438 450**	**498 817**	**13.8**	**42.6**	**39.3**	**542**	**609**	**34.8**	**42.1**
European Union	379 154	432 195	14.0	36.8	34.0	754	847	37.7	45.5
Southeast Europe	3 314	5 505	66.1	0.3	0.4	170	287	37.7	43.3
European Free Trade Association	26 958	35 559	31.9	2.6	2.8	2 110	2 611	62.5	70.1
Other Europe	51 485	57 208	11.1	5.0	4.5	188	207	27.2	30.3
Africa	**20 786**	**33 282**	**60.1**	**2.0**	**2.6**	**21**	**29**	**52.3**	**64.6**
Sub-Saharan Africa	11 933	18 014	51.0	1.2	1.4	15	20	57.4	68.7
Arab States in Africa	8 956	15 579	74.0	0.9	1.2	46	72	46.0	60.5
Asia	**292 230**	**501 798**	**71.7**	**28.4**	**39.5**	**73**	**118**	**23.7**	**26.1**
Central Asia	744	1 249	67.9	0.1	0.1	12	18	64.0	71.3
Arab States in Asia	5 842	17 461	198.9	0.6	1.4	46	118	50.3	76.8
West Asia	22 981	37 946	65.1	2.2	3.0	239	368	33.0	33.3
South Asia	41 646	62 468	50.0	4.0	4.9	27	37	21.2	27.8
Southeast Asia	224 875	395 897	76.1	21.8	31.2	105	178	23.7	25.2
Oceania	**35 882**	**52 782**	**47.1**	**3.5**	**4.2**	**1 036**	**1 389**	**46.8**	**55.7**
Other groupings									
Least developed countries	4 191	7 447	77.7	0.4	0.6	5	8	79.7	86.8

Challenge: Limited capacity to conduct R&D, to innovate

Opportunity: Capacity to conduct R&D, to innovate in strategic areas; sustained commercialisation of R&D output

Source: *UNESCO Science Report, Towards 2030* of 2019

Table 1.5: Patents submitted to USPTO, 2008 and 2013

By region or country of inventor

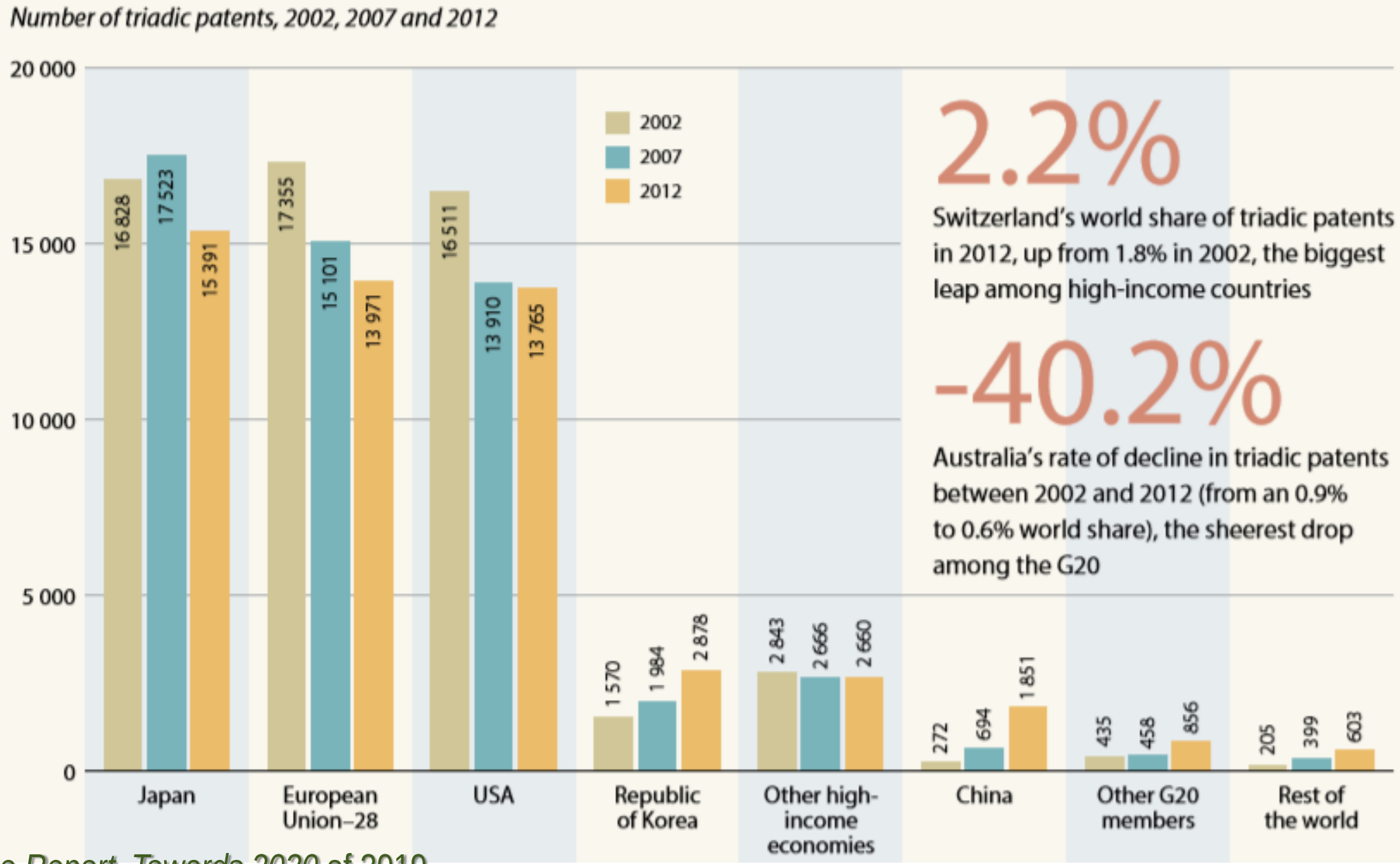
	USPTO patents			
	Total		World share (%)	
	2008	2013	2008	2013
World	**157 768**	**277 832**	**100.0**	**100.0**
High-income economies	149 290	258 411	94.6	93.0
Upper middle-income economies	2 640	9 529	1.7	3.4
Lower middle-income economies	973	3 586	0.6	1.3
Low-income economies	15	59	0.0	0.0
Americas	83 339	145 741	52.8	52.5
North America	83 097	145 114	52.7	52.2
Latin America	342	829	0.2	0.3
Caribbean	21	61	0.0	0.0
Europe	**25 780**	**48 737**	**16.3**	**17.5**
European Union	24 121	45 401	15.3	16.3
Southeast Europe	4	21	0.0	0.0
European Free Trade Association	1 831	3 772	1.2	1.4
Other Europe	362	773	0.2	0.3
Africa	**137**	**303**	**0.1**	**0.1**
Sub-Saharan Africa	119	233	0.1	0.1
Arab States in Africa	18	70	0.0	0.0
Asia	**46 773**	**83 904**	**29.6**	**30.2**
Central Asia	3	8	0.0	0.0
Arab States in Asia	81	426	0.1	0.2
West Asia	1 350	3 464	0.9	1.2
South Asia	855	3 350	0.5	1.2
Southeast Asia	44 515	76 796	28.2	27.6
Oceania	**1 565**	**2 245**	**1.0**	**0.8**
Other groupings				
Least developed countries	7	23	0.0	0.0

Challenge: Limited mentorship, output quite low

Opportunity: Innovation mentorship for greater impact

Source: *UNESCO Science Report, Towards 2030* of 2019

Figure 1.6: **Trends in triadic patents worldwide, 2002, 2007 and 2012**



Source: *UNESCO Science Report, Towards 2030* of 2019

Life sciences and geosciences dominate

Source: *UNESCO Science Report, Towards 2030* of 2019

Cumulative totals by field, 2008–2014

Ranking Lowest in Manufacturing Value Added (MVA) per capita

Challenge: Ranking lowest in MVA per capita among the 7 categories, prospects of job creation and industrial competitiveness remain very low

Opportunity: Waking up, vigorously pursuing VA to abundant raw materials

Key raw/crude exports by selected African countries

Country	Dominant raw/crude export	% of Total Exports per country
Angola	Crude petroleum	95.8
Botswana	Diamonds	88.2
Burkina Faso	Cotton	84.5
Chad	Crude petroleum	94.9
Congo Republic	Crude petroleum	88.7
Equatorial Guinea	Crude petroleum	92.6
Malawi	Tobacco	59.2
Mali	Cotton	81.8
Mozambique	Aluminum	73.4
Nigeria	Crude petroleum	92.2
Sierra Leone	Diamonds	62.7
Sudan	Crude petroleum	89.2
Zambia	Copper	55.8
Source: ADB/UNCTAD/WTO Statistics		

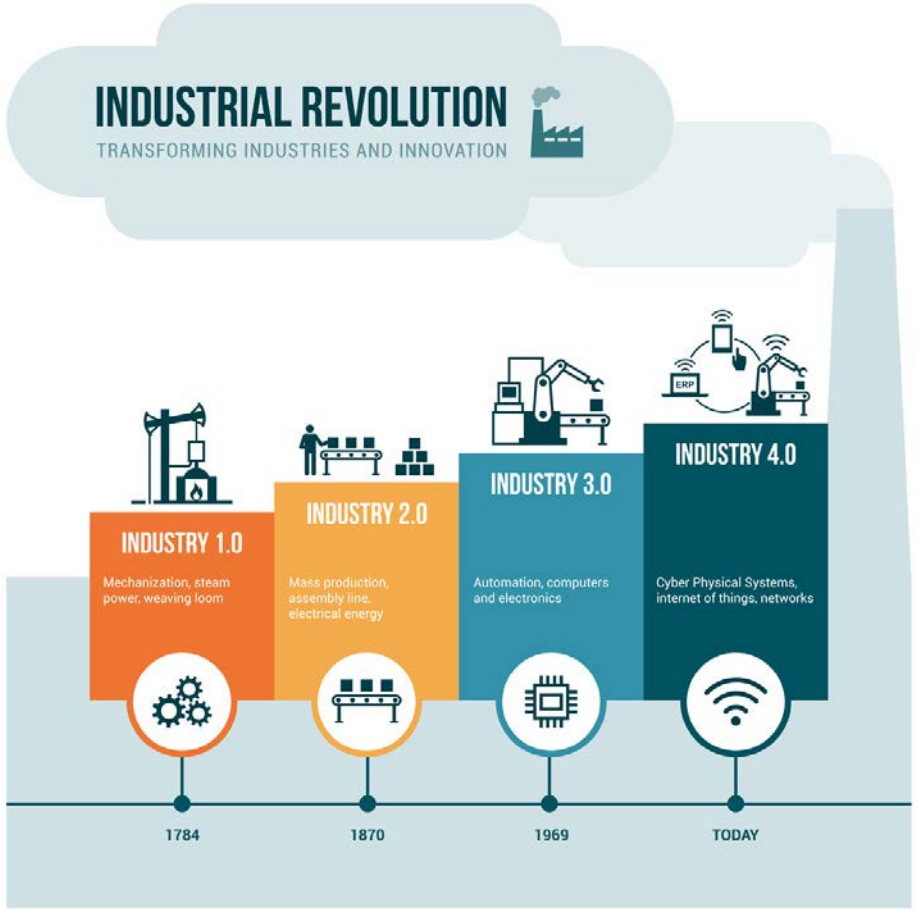
Challenge: Dominance of raw commodity exports; exporting jobs; competitiveness etc

Opportunity: Value-addition through commercialisation of innovations; jobs; competitiveness etc

SUSTAINABLE DEVELOPMENT GOALS

- SDG 9 covers **Industry, Innovation and Infrastructure (issues extensively covered by the 4th IR)**
- SDGs 1, 2,…, 6, 7,…, 11,…, 13 clover topical issues for Africa as the continent walks its development path
- SDG 17 (**partnerships for the goals**) will be effective if Africa carefully maneuvers itself under **4th IR**

Context of 4th Industrial Revolution (IR)

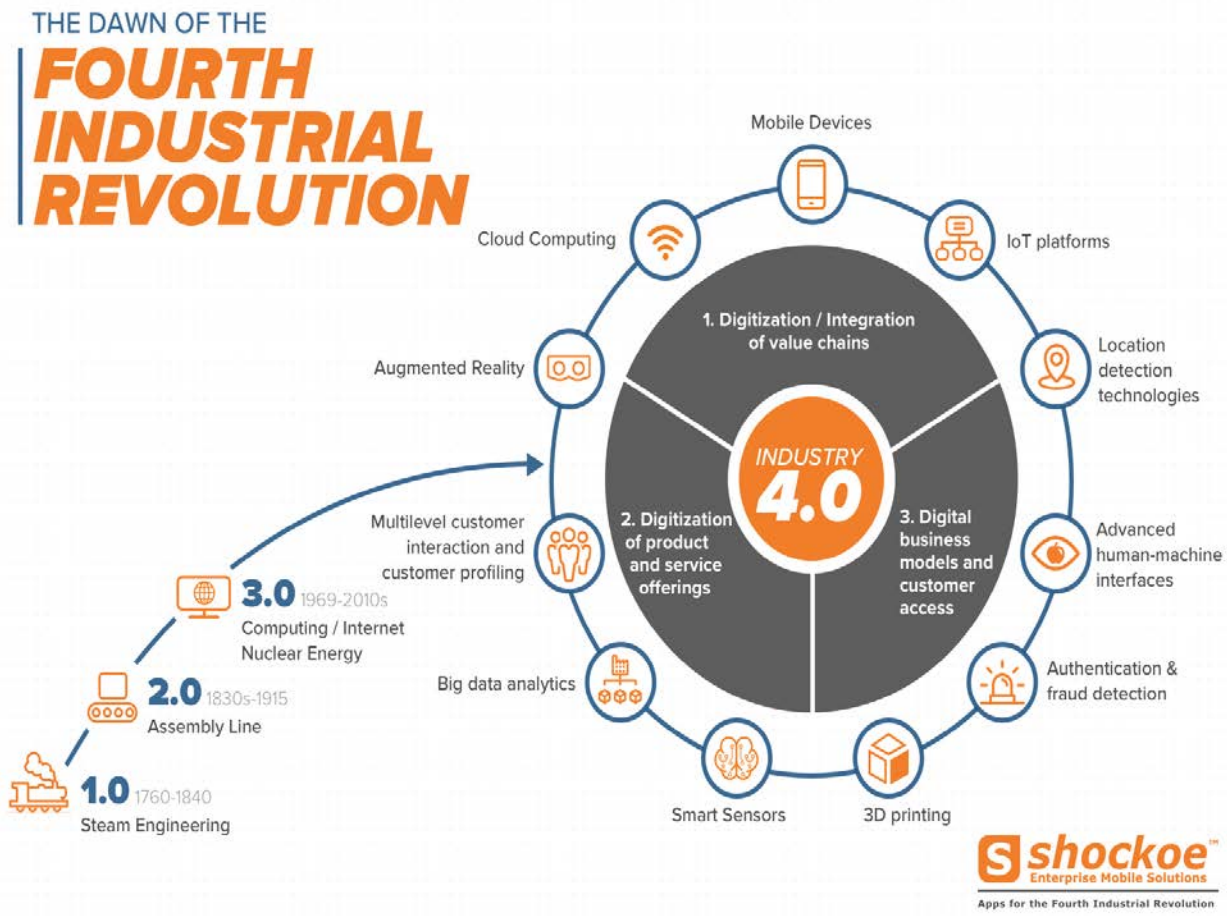


- Africa has no choice, must be tooled to compete with other economies under 4IR
- Issues of Innovation and IP Management will be key
- Are member countries ready?

4TH IR

Key elements:

- Digitisation/integration of value chains
- Digitisation of product and service offerings
- Digital business models and customer access

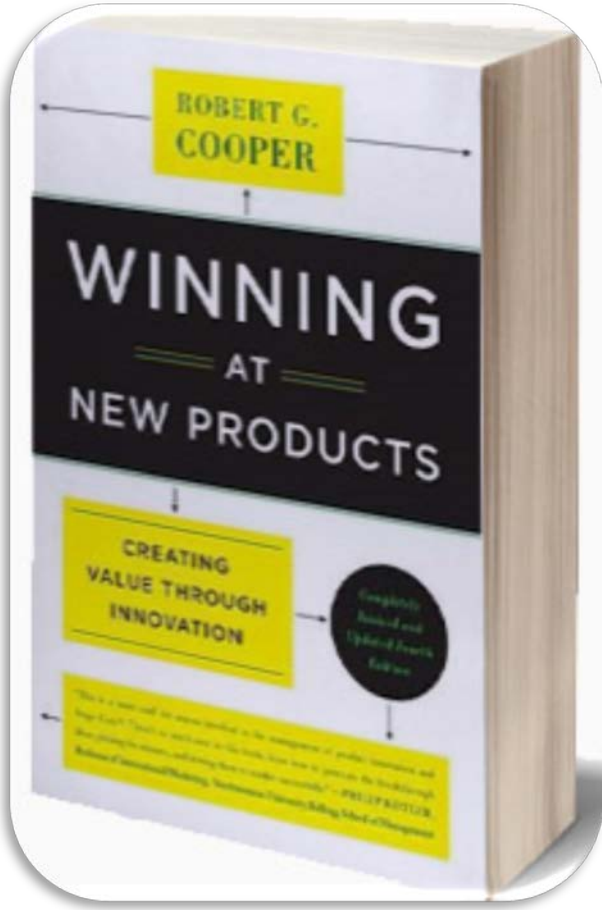


EMULATING GLOBAL BEST PRACTICES

Pillar Number One

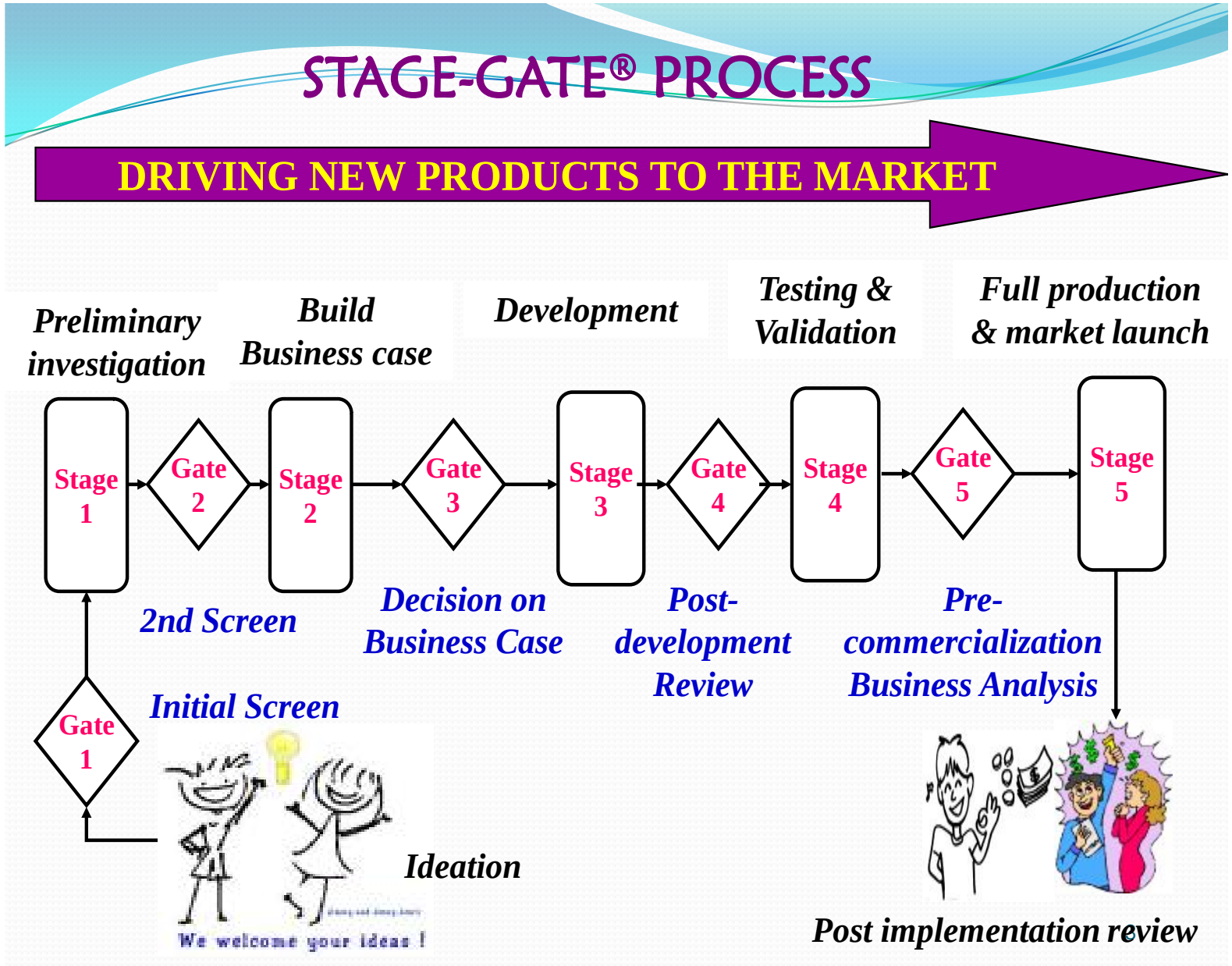
- An Effective, Flexible and Streamlined Idea-to-Launch System

- The Stage Gate Process (R. Cooper)



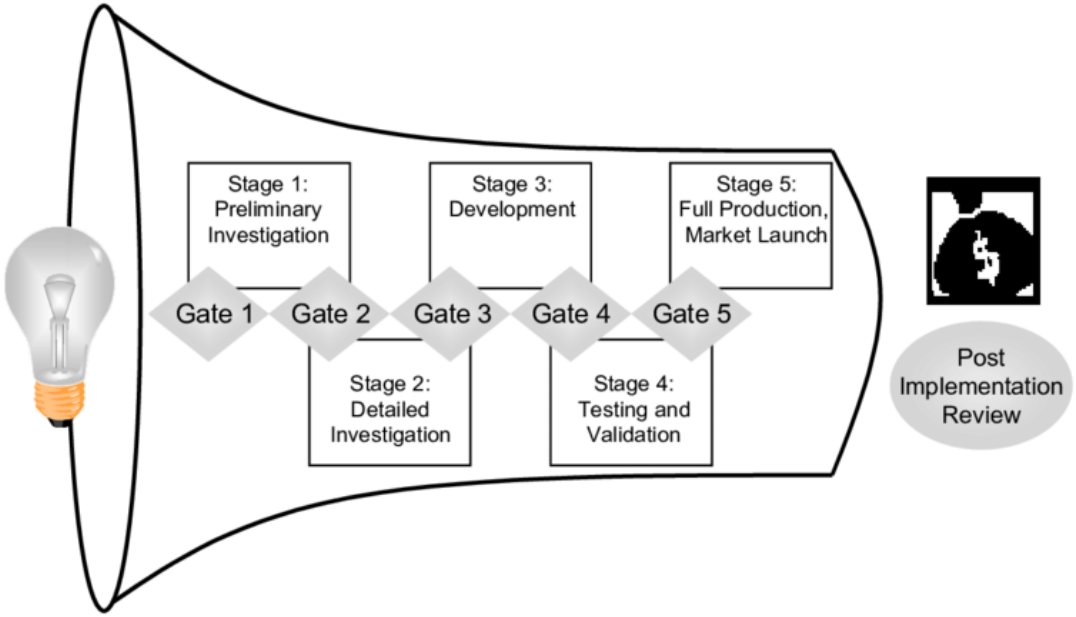
Guiding Principle: Teamwork through the Stage Gate ® Process

- More than **75%** of product developers in the USA companies use the Stage Gate Process
- Majority of the Fortune 500 companies use it (in short or in full)
- Almost 70% of USA- GDP
- 12.8 trillion $ combined sales, 1 trillion $ profits, 28.1 million jobs and 21.6 trillion $ in market value
- We urge African countries to utilize the concept for effective participation under the 4th IR!



BENEFITS OF USING THE STAGE-GATE® PROCESS

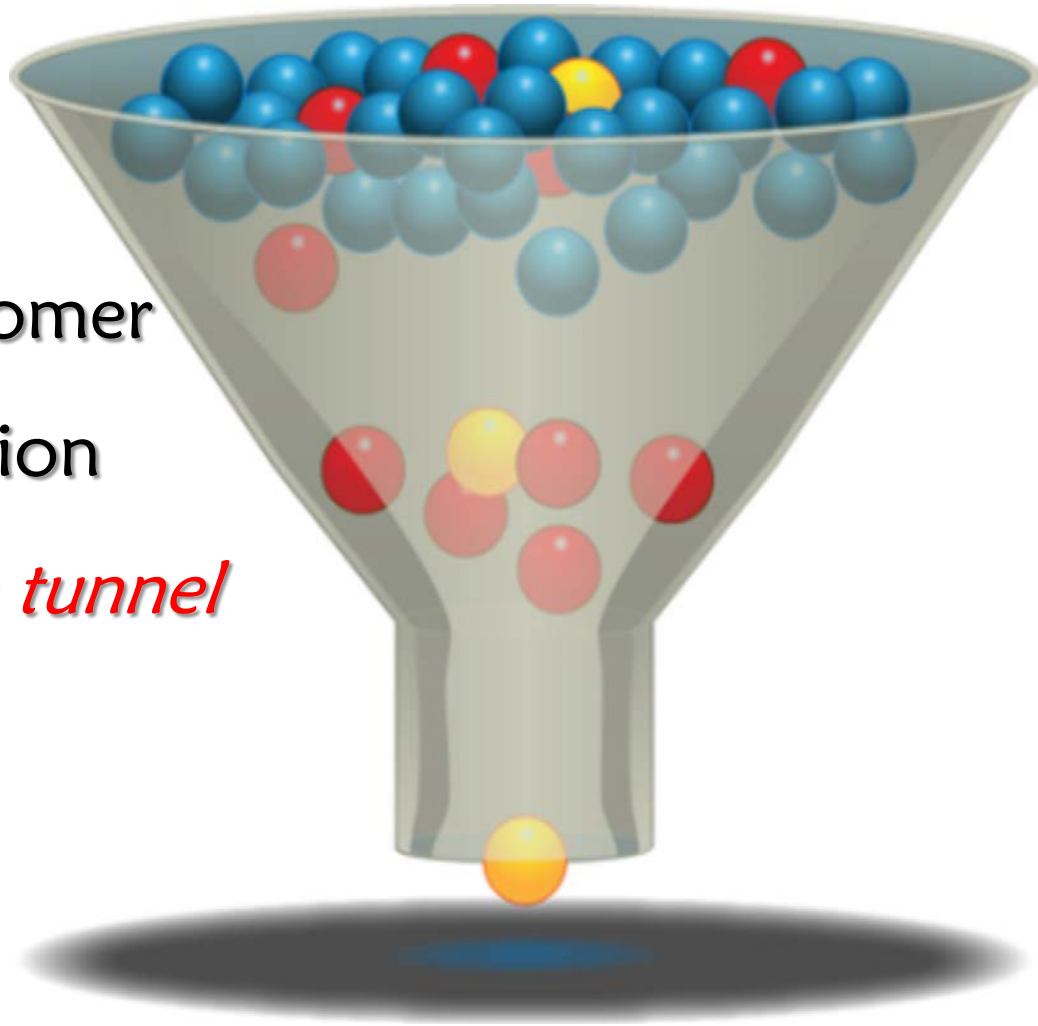
1. Accelerates speed-to-market
2. Effective and efficient allocation of company's limited resources
3. Puts discipline in an ad-hoc and chaotic process
4. Doing things right the first time!
5. Focuses attention on quality of execution
6. Facilitates a focus on new product performance
7. A visible process known by all
8. Ensures a complete process – no critical steps are omitted



Results in a faster, more effective and efficient process that produces winning new products

CRITICAL SUCCESS FACTORS

1. A differentiated, superior product
2. Up-front homework pays off
3. Market orientation – voice of the customer
4. Sharp, stable and early product definition
5. Tough Go/Kill decisions – *funnel not a tunnel*
6. True cross-functional project teams
7. International orientation
8. Role of top management critical



PILLAR 2: A PRODUCT INNOVATION AND TECHNOLOGY STRATEGY FOR THE BUSINESS

- Have clearly defined new product development (NPD) goals
- Understand the role of innovations in your organization and/or business
- Define areas of strategic focus
- Have long term commitment
- Have a product road map in place

PILLAR 3: RESOURCE COMMITMENT AND PORTFOLIO MANAGEMENT

- Align development projects with business strategy, and resource breakdowns in the R&D Institute mirror the business strategy
- Ensure the right balance of projects (for example, between long term and short term projects; between high risk and low risk; and between major new products and minor modifications)
- Do an excellent job of ranking and prioritizing projects. Have high value projects only
- Strike the right balance between resources available and numbers of projects underway, so that a resource crunch is avoided

PILLAR 4: A POSITIVE CLIMATE AND ENVIRONMENT FOR INNOVATION

- Policy Makers and Senior Organisation management must be strongly committed to R&D
- Business climate must support entrepreneurship and innovation
- Senior management provides support and empowerment to teams
- Ensure a reward system for new products/innovations produced

Fitting into Vision 2030 for Zimbabwe

January 2019:

- US$1,718 per capita
- US$25.8 billion
- 1% of GDP equates to US$258 million

Application of R&D / Technology will be Key to realization of the Vision

December 2030:

- Over US$3,500 per capita *(US$5,837)*
- US$117.3 billion
- 1% of GDP equates to US$1,173 million

Innovations in Productive Sector: Agriculture

Promoting agricultural production and food security

- Drought-tolerant maize varieties
- Enhanced Small grains (sorghum, millets, cowpeas) productivity and up-scaled value-addition
- Irrigation development, especially harnessing solar energy
- Agro-business development
- Control and monitoring systems for agricultural inputs supply and distribution chain
- Improving farmer access markets

Challenges & Opportunities under the 4th IR

SIRDC

Innovations in the Productive Sector: Mining

Mining Exploration and Development: Promoting beneficiation and value addition, through domestic smelting and refining, to increase earnings from mineral resources

- Capitalization of artisanal miners
- Value addition & beneficiation (gold, lithium, platinum, diamond, coal-bed methane)
- Utilisation of Advanced Techniques in exploration for minerals, oil and gas
- Optimisation of extractive metallurgy

Challenges & Opportunities under the 4th IR

Innovations in the Productive Sector: Manufacturing systems

Resuscitating Industry and Industry Development: emphasis on value addition and beneficiation of agriculture produce and minerals

- Value addition and beneficiation focusing on our natural resources – agriculture, mineral resources, etc..
- Mechanization -Reverse Engineering of imported technologies and embark on serious local production of tractors, implements, spares
- Innovation and commercialization on new, better designs
- Strengthening R&D linkages with industry

Challenges & Opportunities under the 4th IR

SIRDC

Taking care of the Environment

Protecting the Environment: protection, restoration and promotion of sustainable use of terrestrial ecosystems, sustainable management of forests, fighting the veld fire scourge, combating desertification, halting and reversing land degradation and loss of biodiversity

- Environmental Impact Assessments (EIAs)/ Environmental Management Plans (EMPs) in support of Policy enforcement
- Gaseous Emissions tests for safety
- Water quality checks
- Imported Foods Quality Checks – for safety
- Policy advice on dumping
- Climate related hazards and natural disasters

Challenges & Opportunities under the 4th IR

Supporting devolution of powers

Supporting Decentralised Provincial Councils through:

- Resource Audits using GIS technologies
- Technical Interventions among Value-Addition Projects
- Environmental Impact Assessments (EIAs) / Environmental Management Plans (EMPs) to unlock projects
- Business Plans and Capitalisation for Strategic Projects
- Modelling Provincial Gross Domestic Product (GDP) Values

Challenges & Opportunities under the 4th IR

Innovations in the Services

Supporting Digital Economy through:

- Capacity building in ICT
- Customised ICT Products (e-Government; Insurance Broking System-IBS; Geo-databases

Supporting Education and Heath services through:

- Science and Laboratory Teaching Equipment (SLATE)
- Calibration of medical equipment
- Laboratory Analyses

Challenges & Opportunities under the 4th IR

Utilization of Research Products

- R & D products should lead to:
  - Sustained economic development
  - Industrialization
  - Job creation
  - Poverty reduction in an African context

- Knowledge generated by an R &D Institution should be transferred or utilized by industry.
- An R & D Institution with transferred knowledge is relevant to society

What can we do in specific areas

- Raise the share of public expenditure on R&D at least to 1% of GDP as recommended by the AU
- Focus at least 60% of university education on developing skills in science and technology
- Invest more resources in R&D infrastructure
- Accelerate commercialization of research results/innovations
- Provision of requisite financial resources to promote R&D
- Development of human capacity to conduct R&D
- Foster the right regulatory environment for the transfer of new technologies to the business sector
- Promote a national innovation system
- Foster international collaboration in R&D

Conclusion

- It is important to support R&D for effective national development (skills retention, equipping, tech expo visits, at times espionage..)
- Lets fully utilize R&D Centres, support R&D Commercialization and break silos so that we compete effectively under 4IR
- With R&D we can shorten time-frame and achieve set targets early

Thank you