



INTERNATIONAL OPERATIONS

Initial investigation into the suitability of potential
expansion locations for Griffiths&Hughes

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Management

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Introduction

Griffiths & Hughes (G&H) Ltd based in mid Wales specialise in security systems, for domestic, commercial, and industrial applications. Products range from home security cameras that can be viewed on a mobile device's app, to commercial CCTV equipment. Due to the impact of COVID-19, a very popular product they produce is a body temperature scanner which can be placed at factory entrances to scan individuals for body temperature, the machine will grant or deny access depending on the body temperature.

The device also has a face mask recognition capability - and can be programmed via a friendly interface to confirm if a person is wearing a mask or not. Considering for a future beyond a COVID-19 environment, the company is also developing a retinal scanner for the same machines, so that an employee for example may be identified prior to being granted access to specific areas.

One of the main changes to come about with G&H's possible expansion will be that it will become a Multi-National Corporation (MNC). Running such an enterprise requires a business strategy which has been tailored to MNCs rather than a company based in a single nation. There will be different institutions to interact with, different levels of education, infrastructure and business sophistication will also be at different levels. The culture of the prospective location also plays an important role (Dubina, Carayannis 2016) in the selection and its geopolitical status as well. Beyond this initial investigation, the company must consider what the best business strategy will be going forward. One of the studies into hybrid business models in high-technology markets (to which G&H belongs) concludes that choosing hybrid over single competitive strategy cannot be definitively selected as the correct approach every time (Gabrielsson, Seppälä et al. 2016). The findings are inconclusive and additional considerations must be made in a case-by-case basis. A new tool at the disposal of innovation managers is the ISO 56000 suite, which provides a framework in undertaking such projects.

Selection Criteria

The G&H board has and has shortlisted the following possible locations for further consideration.

South America	Asia	Africa
Porto Alegre (Brazil)	Shenzhen (China)	Durban (South Africa)
Montevideo (Uruguay)	Mumbai (India)	Bulawayo (Zimbabwe)
Buenos Aires (Argentina)	Taipei (Taiwan)	Tunis (Tunisia)

The task at hand is to evaluate and select the best fit 3 locations (one per continent) for the planned business expansion. The World Intellectual Property Organisation (WIPO) offers resources that can assist in the evaluation of the above. Tools like technology trends, World IP report and World IP Facts and Figures can give insight and analysis to help the interested parties in their process. The other comprehensive tool they provide is called the Global Innovation Index (GII) which has a yearly updated with global expert contributions.

GII tracks worldwide innovation trends and creates a hierarchy of 132 countries and economies, ranking their performance in innovation by using circa 80 indicators grouped in 7 categories as follows:

- Institutions with 7 indicators
- Human Capital and Research with 12 indicators
- Infrastructure with 10 indicators
- Market Sophistication with 10 indicators
- Business Sophistication with 15 indicators
- Knowledge and Technology Outputs with 14 indicators
- Creative Outputs with 13 indicators

A detailed description of the indicators in each innovation pillar can be found in Appendix A.

The abounding data is gathered from different sources covering both long-established indicators such as Trade, Investment, Education, Political environment and indicators that cannot be easily quantified like knowledge: absorption, creation, impact and diffusion.

South America



Figure 1 - South America Locations Map

Porto Alegre (Brazil)

Brazil scores 54th of the 132 economies in the GII in 2022, and it continues an ascending trend from 57th in 2021 and 62nd in 2020. Figure 2 shows Brazil's ranking in each of the 7 pillars.

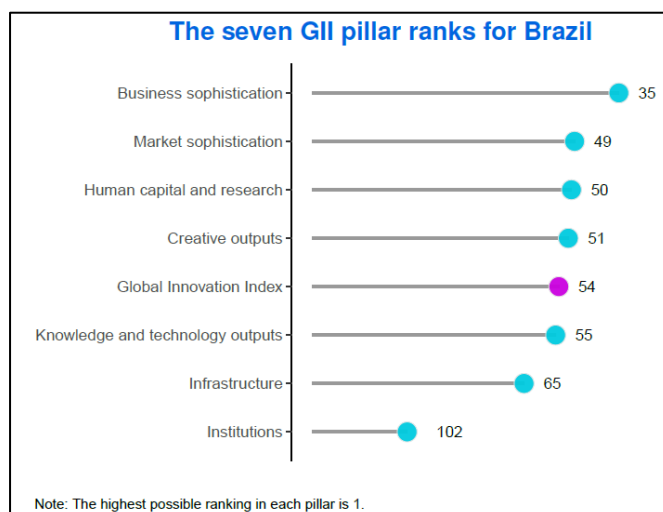


Figure 2 - Brazil GII pillar ranks 2022

Among the Latin America and Caribbean economies, Brazil is evaluated in 2nd place and is performing above expectations for its level of development (Brazil 2022). The country's strong indicators include expenditure on education, high-tech and ICT imports and Domestic market scale, bn PPP\$. It's

weaknesses rest in Policies for doing business, Gross capital formation, % GDP and Tertiary inbound mobility, % (Brazil 2022).

A cultural trait of Brazilian businesses is that knowledge sharing is encouraged, and it exhibits a natural openness to new ideas (Dávila, Andreeva et al. 2019). This is a desirable behaviour that any company would consider when looking to enter a new market.

Montevideo (Uruguay)

The country of Uruguay ranks 64th globally on the GII index, and 5th in the Latin America and Caribbean group of countries.

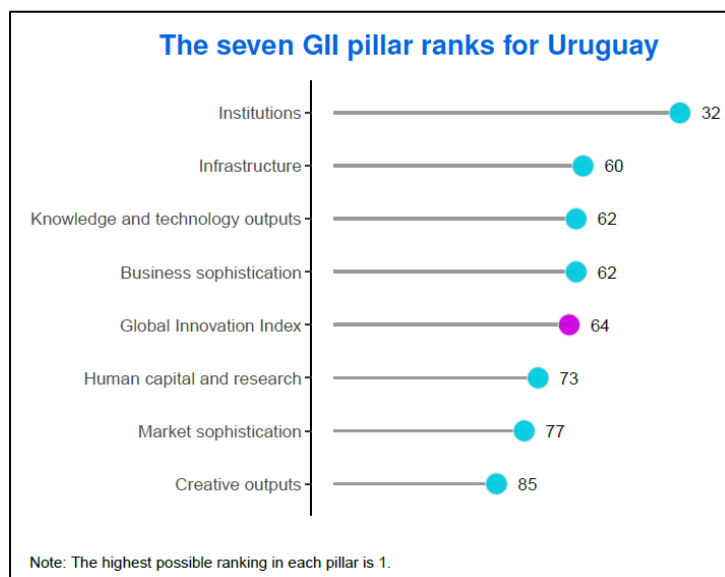


Figure 3 - Uruguay pillar ranks GII 2022

Uruguay's major strengths lie mainly in its political and operational stability:

- ranked 1st in 1st: Democracy Index (The EIU 2017);
- 1st: Rule of Law (World Justice Project 2017-2018);
- 1st: Corruption Perception Index (Transparency International 2018)

Another strength is in the policy for doing business, so much so that Argentinian companies are investing and registering in Uruguay due to its advantageous taxation systems (Bukstein, Hernández et al. 2019)

Uruguay has a poor rank in Domestic industry diversification, Graduates in science and engineering and Global brand value, top 5,000, % GDP making it a less attractive proposition than Brazil.

Buenos Aires (Argentina)

Argentina has the poorest ranking out of the 3 countries, sitting at 69th on the global index and 8th in the regional one. It has historically underperformed when it comes to innovative activities, despite its relatively strong resource base (Wilsdon, Haderi et al. 2020).

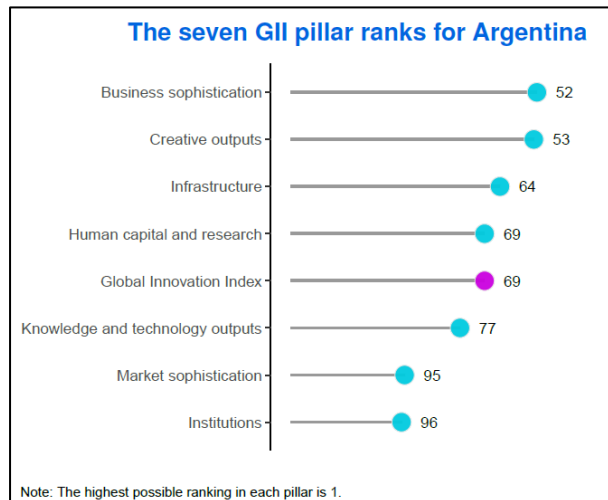


Figure 4 Argentina GII pillar ranks 2022

Strengths are in the mostly in the Education and business sophistication pillars: Tertiary enrolment in education, Entrepreneurship policies and culture, Intellectual property payments, % total trade.

Its weaknesses are found in its institutions and political system. It ranks lower than 110 other countries in Policies for doing business, New Businesses, Labour productivity Growth and High cost of redundancy.

Selected Location – Porto Alegre (Brazil)

Porto Alegre, Montevideo and Buenos Aires are all located in relative proximity on the South American Bank of the Atlantic Ocean. Argentina is the least attractive proposition of the pack due to its ailing political and labour current situation. Uruguay's political stability is an advantage compared to Brazil and Argentina. Infrastructure is a weakness for all 3 – therefore not a deciding factor. However, when considering the larger picture, out of the 3 potential destinations, Porto Alegre stands as the better opportunity due to the country's position when it comes to economy size, population, strength in R&D investment (Brazil 2022), and Brazil's membership in BRICs which will allow for an easier global penetration of this emerging economies group compared to Uruguay and Argentina (Chen 2022).

Asia



Figure 5 - Asia Locations Map

Shenzhen (China)

China is in the 11th position on the Global Index, it is 1st when compared to other upper-middle income economies. China ranks 3rd among the 17 economies in South East Asia, East Asia, and Oceania.



Figure 6 China GII pillar ranks 2022

China does very well when it comes to Knowledge and technology outputs, and it is the 1st in the world in 10 indicators including PISA scales in reading, maths and science, Domestic market scale, bn PPP\$ and Labour productivity growth, %.

This success comes, however, with a heavy cost when it comes to any environmental indicators, as China ranks 115th in its performance, globally – pollution being a real concern.

The city of Shenzhen is often dubbed China's Silicon Valley and it is the country's fastest growing city (Upton, Huld 2022). It has enjoyed over 40 years the establishment of Shenzhen Special Economic Zone in 1980 (Zhang, Kuria 2019).

Shenzhen has a mix of advantages, starting with its strategic location in proximity to Hong Kong and acting as a gateway to mainland China. In addition to this, the local authorities have developed a world class education system which has attracted the top skilled individuals, entrepreneurs and innovators (Bevan 2020).

Mumbai (India)

India is on the 40th position according to the Global Innovation Index 2022. This is not the full picture, as India is the fastest improving country (relative to its grouping) in the world year-on-year. It holds the 1st spot amongst the 36 lower-middle-income group economies. It is also ranked first among the 10 economies in Central and Southern Asia.

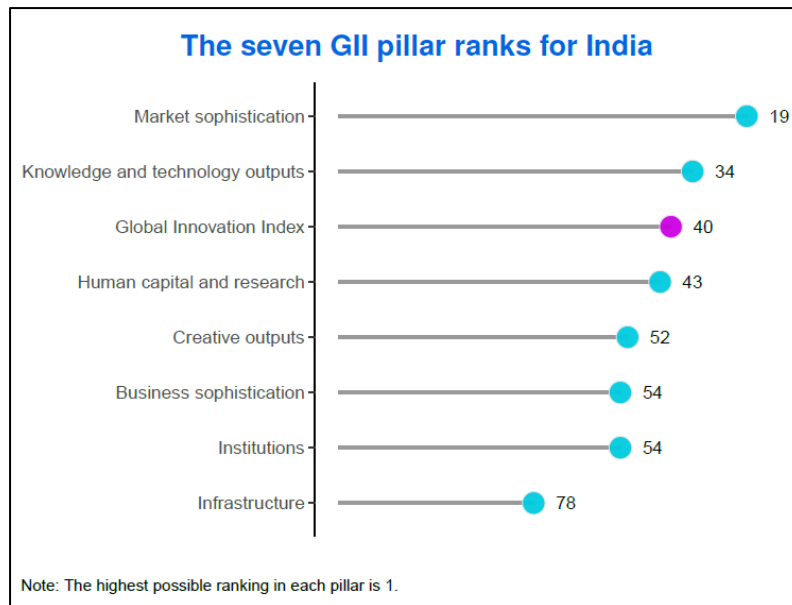


Figure 7 India GII pillar ranks 2022

Highlights in India's performance are Entrepreneurship policies and culture, and the percentage of Graduates in science and engineering – both of which are in keeping with the Indian concept of frugal innovation - Jugaad (Ananthram, Chan 2021). India ranks first in the world in two indicators: Domestic market scale, bn PPP\$ and ICT services exports, % total trade.

The gap to be closed lies in India's poor track record in environmental performance and the percentage of Females employed with advanced degrees.

India and Mumbai, in particular, have the same many traits as China and Shenzhen, as it attributes its success to the strategic location and connectivity to the global stage and large pool of young talent ready to make contribution to new businesses in any area of activity. The local government support is also encouraging investments (Mantralaya 2020).

Taipei (Taiwan)

Out of all the countries covered in this report, Taiwan is the only one not present in the GII index for 2022.

Taiwan's openness towards foreign investment (Hass 2021) can be considered both a strength and a weakness due to its unruly political relationship with China. The uncertainty over the country's very survival as an independent nation will be of great concern to any foreign companies looking to invest in Taiwan.

GDP	USD789.51bn (IMF 2021)
Population	23.38mn (IMF 2021)
Form of state	Multiparty Democracy
Head of government	Tsai Ing-wen (President)
Next elections	January 2024, presidential and legislative

Figure 8-Taiwan National Facts (Allianz.com 2022)

Selected Location – Shenzhen (China)

The geography of innovation is continuing to shift towards Asia (WIPO 2022). In this continent there is, in fact, a two-horse race between global innovation giants. G&W must hedge it's bets as to which country will dominate the world economic stage in the future (Babasaheb, Jadhav 2017), but at present the balance leans in China's favour as it still represents the poster child for industrial innovation (Larson 2010).

Africa

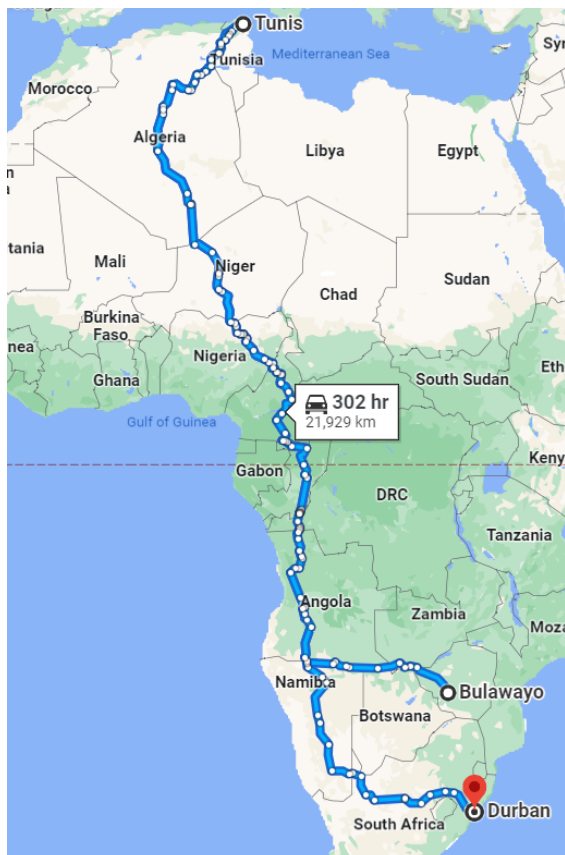


Figure 9 Africa Locations Map

Durban (South Africa)

South Africa is ranked 61st in the world in 2022, maintaining its position from the year before, but underperforming in the innovation input pillars (69 vs 55) while achieving a better result in the innovation output pillars (61 vs 68).

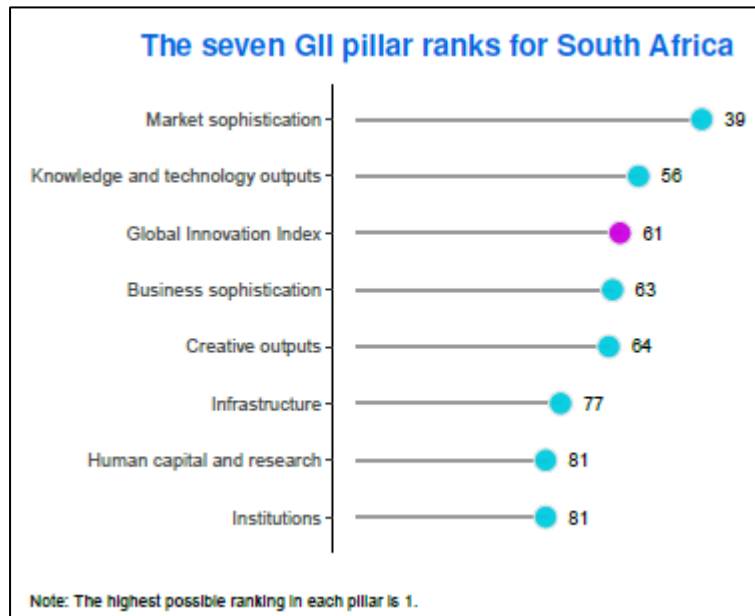


Figure 10 - South Africa GII pillar ranks 2022

It performs well in new businesses per th pop. 15-64, Expenditure on education, % GDP and it is placed 1st globally in Market capitalization, % GDP. South Africa's weaknesses lie in Policies for doing business, Pupil-teacher ratio, secondary; Gross capital formation, % GDP, and GDP/unit of energy use.

A SWOT analysis of the South-African economy reveals that it's diversity in races, languages and other factors constitute both a strength and a weakness – attracting both interest from different European economies, but also being susceptible to violence and regional wars (Frue 2019). The cheap labour costs, and abundance of raw materials are two of the major factors for considering opportunities in South Africa. The port of Durban is at the front of South Africa's innovative approach and G&W may be able to access funding the UK Cross Government Prosperity Fund worth £1.3 billion put in place to support emerging economies (UK Gov, Foreign & Commonwealth Office 2019)

Bulawayo (Zimbabwe)

Zimbabwe is the lowest placed economy presented in this report (other than Taiwan, which does not feature), sitting at 107th in the global index.

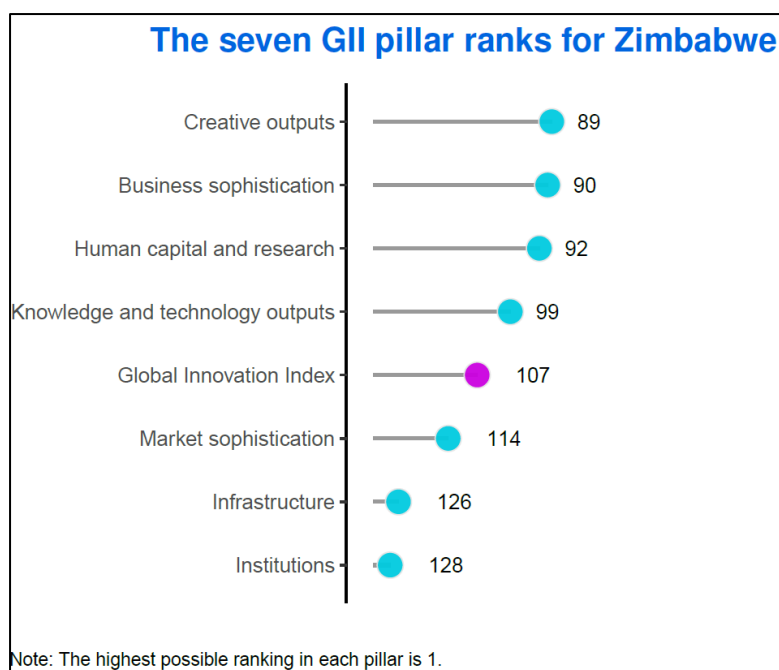


Figure 11 - Zimbabwe GII pillar ranks 2022

Zimbabwe's performance has improved year on year and its strong indicators include the percentage of graduates in science and engineering, and the joint venture/strategic alliance deals/bn PPP\$ GDP.

These positives are insufficient when compared to the very poorly developed infrastructure and institutions that scored 126 and 128, respectively. This location should not be pursued by G&H.

Tunis (Tunisia)

The rankings for Tunisia have deteriorated in the last 3 years going from 65th in 2020 to 73rd in 2022. In spite of a decline in performance, Tunisia is still achieving above expectations relative to the country's development level.

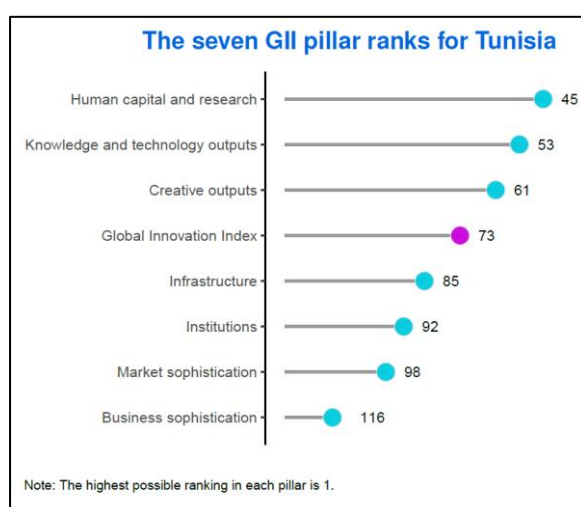


Figure 12- Tunisia GII pillar ranks 2022

The strengths are represented by the following indices: Expenditure on Education- ranked 7th globally; Percentage of graduates in science and engineering – 5th. At the other end of the scale are High tariff rates and Gross capital formation, % GDP.

Tunisia's economy is largely based on trade with the EU, with over 57% of Tunisian trade going to the EU, and 70% of exports (European Commission 2021).

Selected Location – Durban (South Africa)

Professor Erika Kraemer-Mbula postulates that the innovation landscape of Africa goes hand in hand with the development of the African countries (AUDRETSCH, FELDMAN 2004). It can vary from region to region, country to country and, even within the same country, different industries see varied levels of innovation (Kraemer-Mbula 2022). Bulawayo comes in third on the podium, while the choice is between Tunis and Durban. The fine margins for choosing Durban come from the fact that G&H, a Welsh based company, may find the English-speaking South Africa more accessible than the French-speaking Tunisia. Another motivator can be that transport and port facilities are better in Durban, due to its larger status as a seafreighting node, whereas Tunisia and its territorial waters are often used by immigrants in search of a better life in Europe (Karam 2022).

ISO 5600 series – Innovation Management Systems

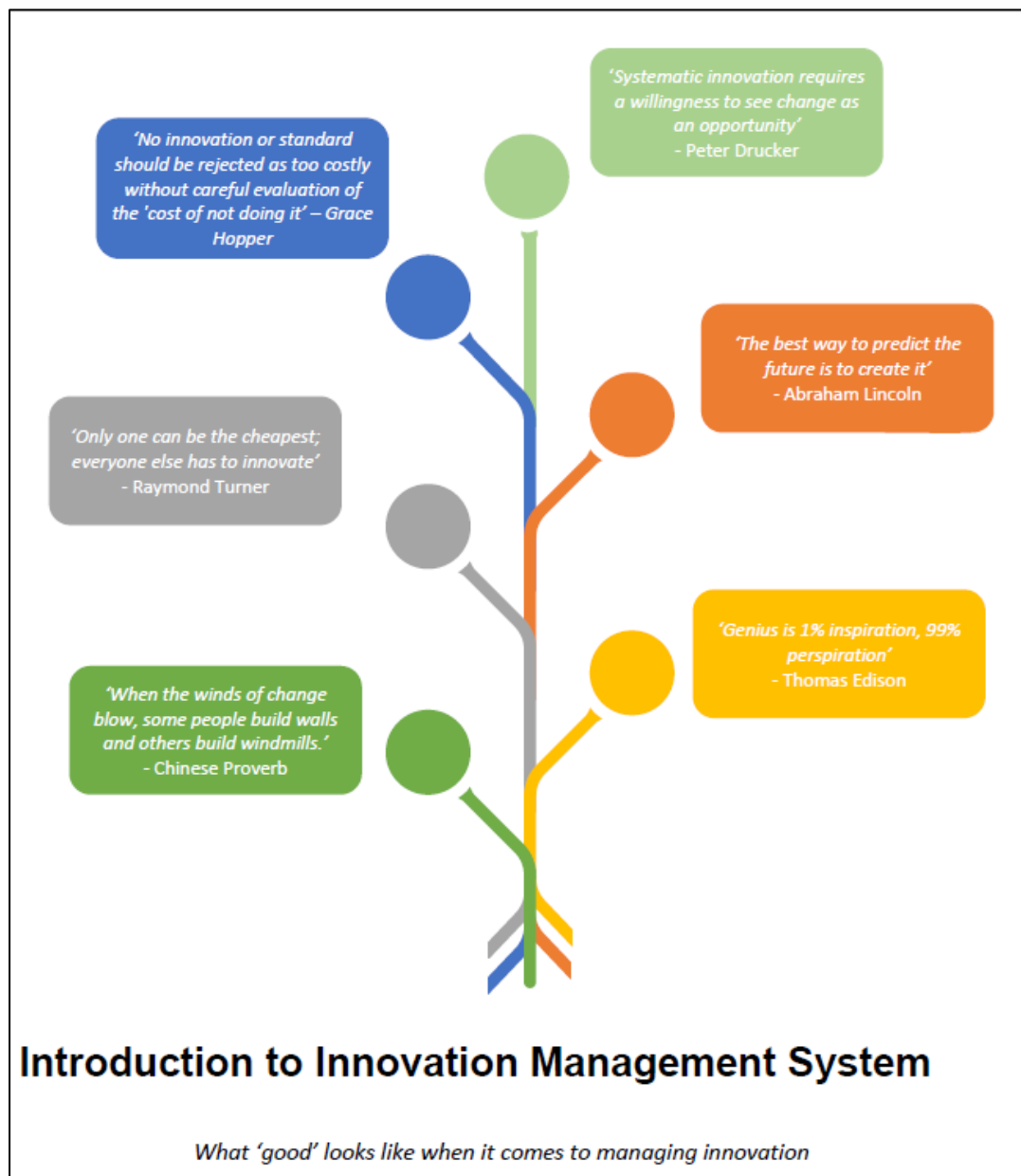


Figure 13 Introduction to IMS

Implementing of the ISO 56000 standards suite is and will be very important for companies as they begin to follow the standards. Businesses accessing these resources will be able to use the suite as a template of good practice when it comes to innovation management, as a minimum. The comprehensive benefit can only be fully achieved by following the standards when elaborating the business strategy, organigram, and engraining the ISO 56000 within the very culture of the organisation. It will positively impact the human element – increasing efficiencies through improved management. This will in turn also mitigate risks and enhance opportunities when it comes to the businesses products and processes. Another benefit of wider use of the same standard will be a better understanding of customer needs – as both client and company will be adhering to the same set of rules/ guidance.

The ISO 56002 covers the systematic approach to 'what good looks like' (ISO 2019) in the field of innovation management systems and is based on the experience and reporting of experts from over 50

countries. This guidance will be beneficial for G&H because of its clear top-down approach through all the steps required to having a sustainable growing organisation, which requires the company's senior management to commit to develop and maintain a business environment in which innovation procedures are part of the structure and innovative behaviours are part of the culture. The standard goes on to discuss the innovation objectives and the planning that must take place in order to achieve them. It covers in depth the various resources, tools and methods required to support the Innovation Management Systems (internal and external). Following on from chapters 5 and 6, the standard goes on to talk about the actual operation of such a system. It then goes on to conclude with the checks that must be put in place as part of the continuous monitoring and improvement of the processes.

The next standard in the series, ISO 56003, explores potential partnerships in innovation (ISO 2019) that companies like G&H may explore to aid with decision making on matters such as the present reports subject – choosing new locations for expansion. This standard presents the methods and tools that should be used by organisations to firstly identify internal weaknesses that must be supplemented by entering in an external collaboration, followed by identifying suitable partners (local authorities, universities, companies, and community based initiatives). The other two steps in the process being Alignment and Interaction, as presented in Figure xxx. ISO 56003 lists associated toolsets to be followed when forming Innovation Partnerships. Implementing these Templates will be of great benefit to G&H in the next period, should the company wish to explore the locations identified in this report.

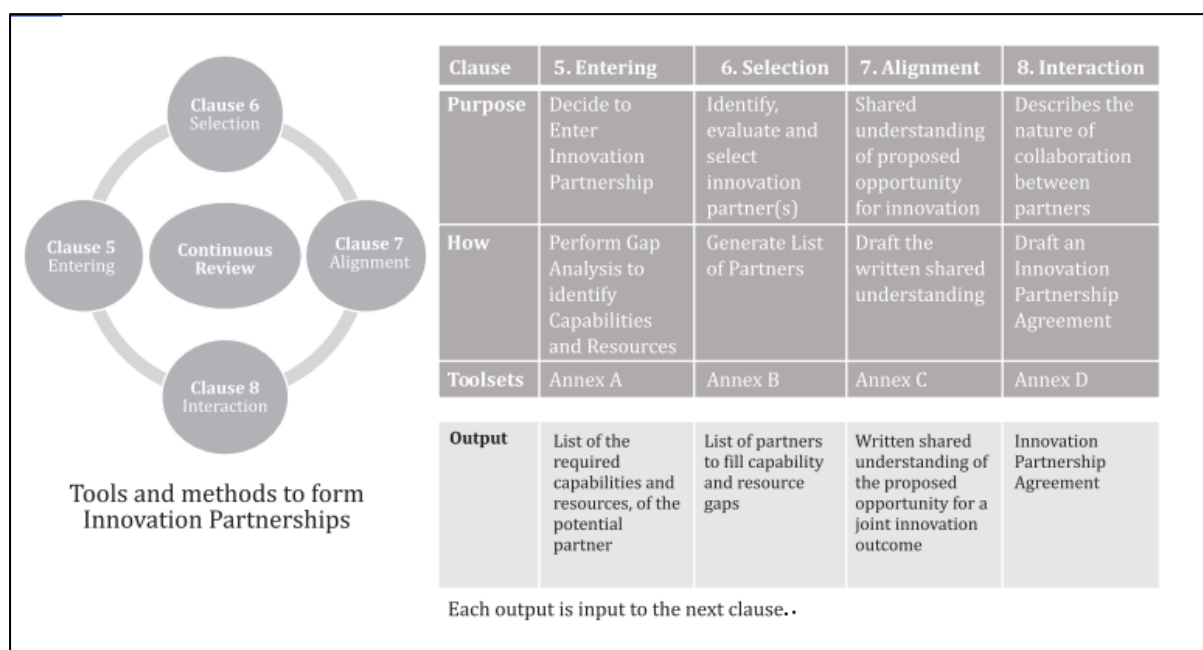


Figure 14 ISO 56003 tools and methods

The other standards in the series will become useful to the company as follows – ISO 56004 provides guidance on assessing innovation management; ISO 56005 focuses on Intellectual Property Management, ISO 56006 on guidance for strategic intelligence management and ISO 56007 looks at idea management.

In **Conclusion**, G&H is evaluating the three more suitable locations to strategically position themselves to control the manufacture, marketing, and distribution of their products on a global scale. Making use of the ISO 56000 series will be of benefit to the organisation as it grows to a sustainable and prosperous future and in particular ISO 56002 and 56003 will provide a framework for the expansion of G&H.

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Appendix A – GII 2022 7 pillars with 81 indicators

- Institutions with 7 indicators

 Institutions	
1.1 Political environment	
1.1.1 Political and operational stability*	
1.1.2 Government effectiveness*	
1.2 Regulatory environment	
1.2.1 Regulatory quality*	
1.2.2 Rule of law*	
1.2.3 Cost of redundancy dismissal	
1.3 Business environment	
1.3.1 Policies for doing business†	
1.3.2 Entrepreneurship policies and culture*	

Figure 15 - Innovation input pillar - Institutions -GII 2022

- Human Capital and Research with 12 indicators

 Human capital and research	
2.1 Education	
2.1.1 Expenditure on education, % GDP	
2.1.2 Government funding/pupil, secondary, % GDP/cap	
2.1.3 School life expectancy, years	
2.1.4 PISA scales in reading, maths and science	
2.1.5 Pupil-teacher ratio, secondary	
2.2 Tertiary education	
2.2.1 Tertiary enrolment, % gross	
2.2.2 Graduates in science and engineering, %	
2.2.3 Tertiary inbound mobility, %	
2.3 Research and development (R&D)	
2.3.1 Researchers, FTE/mn pop.	
2.3.2 Gross expenditure on R&D, % GDP	
2.3.3 Global corporate R&D investors, top 3, mn USD	
2.3.4 QS university ranking, top 3*	

Figure 16- Innovation input pillar – Human Capital and Research -GII 2022

- Infrastructure with 10 indicators

 Infrastructure	
3.1	Information and communication technologies (ICTs)
3.1.1	ICT access*
3.1.2	ICT use*
3.1.3	Government's online service*
3.1.4	E-participation*
3.2	General infrastructure
3.2.1	Electricity output, GWh/mn pop.
3.2.2	Logistics performance*
3.2.3	Gross capital formation, % GDP
3.3	Ecological sustainability
3.3.1	GDP/unit of energy use
3.3.2	Environmental performance*
3.3.3	ISO 14001 environmental certificates/bn PPP\$ GDP

Figure 17- Innovation input pillar – Infrastructure -GII 2022

- Market Sophistication with 10 indicators

 Market sophistication	
4.1	Credit
4.1.1	Finance for startups and scaleups*
4.1.2	Domestic credit to private sector, % GDP
4.1.3	Loans from microfinance institutions, % GDP
4.2	Investment
4.2.1	Market capitalization, % GDP
4.2.2	Venture capital investors, deals/bn PPP\$ GDP
4.2.3	Venture capital recipients, deals/bn PPP\$ GDP
4.2.4	Venture capital received, value, % GDP
4.3	Trade, diversification, and market scale
4.3.1	Applied tariff rate, weighted avg., %
4.3.2	Domestic industry diversification
4.3.3	Domestic market scale, bn PPP\$

Figure 18- Innovation input pillar – Market sophistication -GII 2022

- Business Sophistication with 15 indicators

 Business sophistication	
5.1	Knowledge workers
5.1.1	Knowledge-intensive employment, %
5.1.2	Firms offering formal training, %
5.1.3	GERD performed by business, % GDP
5.1.4	GERD financed by business, %
5.1.5	Females employed w/advanced degrees, %
5.2	Innovation linkages
5.2.1	University-industry R&D collaboration [†]
5.2.2	State of cluster development and depth [†]
5.2.3	GERD financed by abroad, % GDP
5.2.4	Joint venture/strategic alliance deals/bn PPP\$ GDP
5.2.5	Patent families/bn PPP\$ GDP
5.3	Knowledge absorption
5.3.1	Intellectual property payments, % total trade
5.3.2	High-tech imports, % total trade
5.3.3	ICT services imports, % total trade
5.3.4	FDI net inflows, % GDP
5.3.5	Research talent, % in businesses

Figure 19- Innovation input pillar – Business sophistication -GII 2022

- Knowledge and Technology Outputs with 14 indicators

 Knowledge and technology outputs	
6.1	Knowledge creation
6.1.1	Patents by origin/bn PPP\$ GDP
6.1.2	PCT patents by origin/bn PPP\$ GDP
6.1.3	Utility models by origin/bn PPP\$ GDP
6.1.4	Scientific and technical articles/bn PPP\$ GDP
6.1.5	Citable documents H-index
6.2	Knowledge impact
6.2.1	Labor productivity growth, %
6.2.2	New businesses/th pop. 15–64
6.2.3	Software spending, % GDP
6.2.4	ISO 9001 quality certificates/bn PPP\$ GDP
6.2.5	High-tech manufacturing, %
6.3	Knowledge diffusion
6.3.1	Intellectual property receipts, % total trade
6.3.2	Production and export complexity
6.3.3	High-tech exports, % total trade
6.3.4	ICT services exports, % total trade

Figure 20- Innovation output pillar – Knowledge and Technology Outputs -GII 2022

- Creative Outputs with 13 indicators

 Creative outputs	
7.1	Intangible assets
7.1.1	Intangible asset intensity, top 15, %
7.1.2	Trademarks by origin/bn PPP\$ GDP
7.1.3	Global brand value, top 5,000, % GDP
7.1.4	Industrial designs by origin/bn PPP\$ GDP
7.2	Creative goods and services
7.2.1	Cultural and creative services exports, % total trade
7.2.2	National feature films/mn pop. 15–69
7.2.3	Entertainment and media market/th pop. 15–69
7.2.4	Printing and other media, % manufacturing
7.2.5	Creative goods exports, % total trade
7.3	Online creativity
7.3.1	Generic top-level domains (TLDs)/th pop. 15–69
7.3.2	Country-code TLDs/th pop. 15–69
7.3.3	GitHub commit pushes received/mn pop. 15–69
7.3.4	Mobile app creation/bn PPP\$ GDP

Figure 21- Innovation output pillar – Creative Outputs -GII 2022

Appendix B – GII 2022 Results

Table 4 Heatmap: GII 2022 rankings overall and by innovation pillar

Country/economy	Overall GII	Institutions	Human capital and research	Infrastructure	Market sophistication	Business sophistication	Knowledge and technology outputs	Creative outputs
Switzerland	1	2	4	4	8	7	1	1
United States	2	13	9	19	1	3	3	12
Sweden	3	19	3	1	13	1	2	8
United Kingdom	4	24	6	8	5	22	8	3
Netherlands	5	4	14	14	18	10	5	10
Republic of Korea	6	31	1	13	21	9	10	4
Singapore	7	1	7	11	4	2	13	21
Germany	8	20	2	23	14	19	9	7
Finland	9	11	8	3	17	5	4	18
Denmark	10	9	10	5	15	15	12	14
China	11	42	20	25	12	12	6	11
France	12	18	15	17	10	17	15	6
Japan	13	21	21	12	9	8	11	19
Hong Kong, China	14	10	13	6	2	27	60	5
Canada	15	15	12	30	6	20	24	20
Israel	16	41	24	42	7	6	7	36
Austria	17	8	11	9	38	18	19	26
Estonia	18	12	34	10	3	25	21	24
Luxembourg	19	5	32	40	31	4	33	9
Iceland	20	14	29	22	41	14	22	13
Malta	21	28	42	27	33	16	32	2
Norway	22	3	19	2	28	21	25	30
Ireland	23	16	23	15	55	13	14	29
New Zealand	24	7	18	21	24	31	29	22
Australia	25	17	5	18	20	24	37	27
Belgium	26	29	16	37	45	11	18	32
Cyprus	27	36	39	28	29	23	20	17
Italy	28	58	28	26	35	33	16	16
Spain	29	38	26	16	30	32	27	28
Czech Republic	30	43	33	20	76	28	17	37
United Arab Emirates	31	6	17	7	23	26	59	45
Portugal	32	47	22	39	42	34	35	25
Slovenia	33	37	25	24	68	29	26	56
Hungary	34	48	37	35	67	30	23	46
Bulgaria	35	67	68	34	62	40	30	23
Malaysia	36	34	38	51	26	41	39	41
Türkiye	37	101	41	48	37	47	47	15
Poland	38	65	36	43	61	38	38	38
Lithuania	39	26	44	45	32	37	48	47
India	40	54	43	78	19	54	34	52
Latvia	41	35	48	52	65	36	44	42
Croatia	42	77	46	31	56	46	45	39
Thailand	43	78	71	54	27	43	43	49
Greece	44	69	31	46	64	55	46	54
Mauritius	45	22	66	70	16	96	82	31
Slovakia	46	68	59	41	70	45	28	70
Russian Federation	47	89	27	62	48	44	51	48
Viet Nam	48	51	80	71	43	50	52	35
Romania	49	75	74	33	63	51	31	57
Chile	50	39	57	47	46	57	54	55
Saudi Arabia	51	50	30	53	22	53	65	66
Qatar	52	25	56	29	47	73	69	59
Iran (Islamic Republic of)	53	131	54	75	11	115	50	33
Brazil	54	102	50	65	49	35	55	51
Serbia	55	53	52	38	83	65	42	76
Republic of Moldova	56	98	62	84	58	79	49	43
Ukraine	57	97	49	82	102	48	36	63
Mexico	58	93	58	63	54	76	58	50
Philippines	59	90	86	81	78	39	41	58
Montenegro	60	59	61	44	53	58	72	71
South Africa	61	81	81	77	39	63	56	64
Kuwait	62	86	55	36	73	101	68	60
Colombia	63	72	79	59	66	42	67	75
Uruguay	64	32	73	60	77	62	62	85
Peru	65	61	47	79	40	49	90	65
North Macedonia	66	88	75	49	34	59	57	93

4th quartile (best performers, ranks 1st to 33rd) 3rd quartile (ranks 34th to 66th) 2nd quartile (ranks 67th to 99th) 1st quartile (ranks 100th to 132nd)

Table 4 Continued

Country/economy	Overall GII	Institutions	Human capital and research	Infrastructure	Market sophistication	Business sophistication	Knowledge and technology outputs	Creative outputs
Morocco	67	85	83	89	74	94	64	44
Costa Rica	68	44	77	66	88	60	61	81
Argentina	69	96	69	64	95	52	77	53
Bosnia and Herzegovina	70	94	67	55	25	98	63	83
Mongolia	71	76	64	92	97	61	85	40
Bahrain	72	27	78	32	75	93	73	98
Tunisia	73	92	45	85	98	116	53	61
Georgia	74	30	70	83	72	64	75	86
Indonesia	75	71	90	68	36	92	78	72
Jamaica	76	56	84	99	110	67	89	34
Belarus	77	130	35	67	96	72	40	91
Jordan	78	45	76	100	52	75	76	78
Oman	79	57	40	56	71	97	94	80
Armenia	80	55	91	80	85	84	71	73
Panama	81	70	94	50	89	105	86	62
Uzbekistan	82	63	65	74	60	74	80	102
Kazakhstan	83	52	60	58	90	68	81	118
Albania	84	84	89	57	91	56	96	82
Sri Lanka	85	119	120	73	108	71	66	69
Botswana	86	40	51	88	112	70	88	100
Pakistan	87	118	113	114	100	81	70	67
Kenya	88	82	119	107	111	80	74	79
Egypt	89	111	97	93	86	103	79	84
Dominican Republic	90	80	108	69	84	83	93	88
Paraguay	91	115	100	76	82	86	105	74
Brunei Darussalam	92	23	53	61	101	66	127	125
Azerbaijan	93	46	87	90	80	77	117	105
Kyrgyzstan	94	113	63	86	51	107	92	121
Ghana	95	100	101	96	119	88	103	77
Namibia	96	49	72	106	81	108	113	113
Cambodia	97	87	99	103	44	117	101	104
Ecuador	98	121	98	72	103	85	102	96
Senegal	99	60	103	105	69	124	97	112
El Salvador	100	107	107	97	99	87	108	90
Trinidad and Tobago	101	66	88	87	123	102	87	117
Bangladesh	102	109	127	94	92	125	95	87
United Republic of Tanzania	103	74	126	104	79	112	114	94
Tajikistan	104	91	85	121	94	128	84	116
Rwanda	105	33	106	95	115	113	111	126
Madagascar	106	120	105	132	109	118	115	68
Zimbabwe	107	128	92	126	114	90	99	89
Nicaragua	108	124	110	111	50	82	121	103
Côte d'Ivoire	109	73	122	98	122	95	104	108
Guatemala	110	122	121	119	107	89	91	99
Nepal	111	117	123	108	59	91	119	101
Lao People's Democratic Republic	112	103	111	118	57	104	122	114
Honduras	113	125	96	101	104	78	110	120
Nigeria	114	112	109	112	126	69	123	97
Algeria	115	99	82	102	125	120	118	109
Myanmar	116	123	102	128	93	130	100	106
Ethiopia	117	110	131	123	113	122	83	115
Zambia	118	126	118	116	106	100	116	110
Uganda	119	62	129	109	127	126	106	123
Burkina Faso	120	105	104	115	118	123	112	127
Cameroon	121	104	116	113	132	99	98	124
Togo	122	108	117	117	105	129	126	111
Mozambique	123	129	114	91	120	121	120	107
Benin	124	64	115	110	117	114	129	132
Niger	125	79	130	129	116	106	109	131
Mali	126	114	128	125	124	110	107	122
Angola	127	116	125	122	121	131	130	92
Yemen	128	132	124	120	87	127	124	95
Mauritania	129	83	112	127	129	111	132	130
Burundi	130	106	95	130	130	119	128	128
Iraq	131	127	93	124	128	132	125	129
Guinea	132	95	132	131	131	109	131	119

4th quartile (best performers, ranks 1st to 33rd) 3rd quartile (ranks 34th to 66th) 2nd quartile (ranks 67th to 99th) 1st quartile (ranks 100th to 132nd)