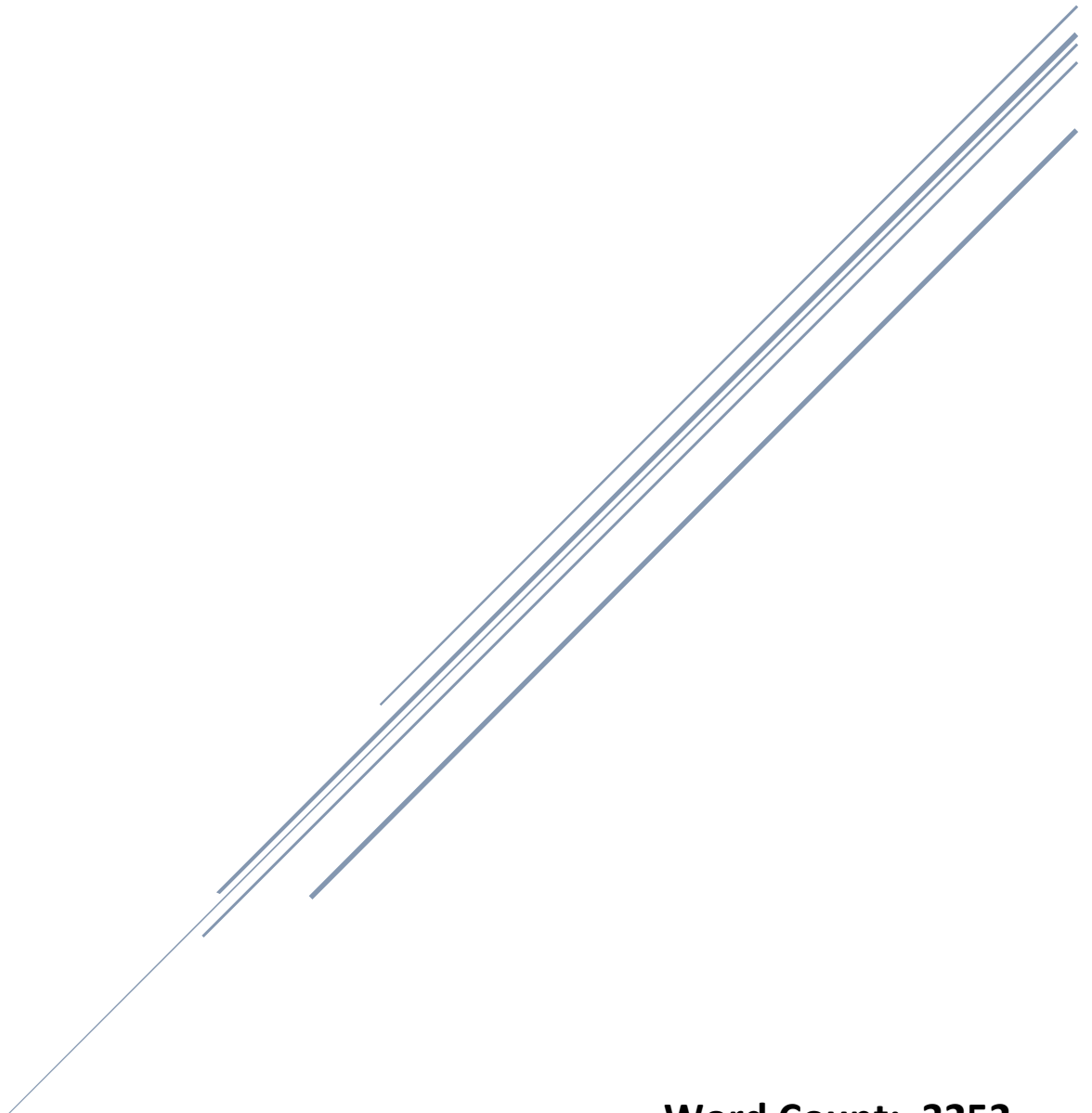


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1.0 Synopsis

The intent of this report is to consider potential global locations for Organisation X to expand their manufacturing production from their Head office in Wales, into international markets.

The report will consider how ISO56000 can offer an insight into sustainable and prosperous growth for the organisation and will review potential opportunities and challenges presented by, but not limited to:

Logistics; Politics; Manufacturing and production; Quality management and Social and Cultural implications in the location review.

The organisation produces Security systems including:

Home security cameras with mobile app - viewing access; Commercial CCTV equipment; Body Temperature Scanners; Commercial Facial recognition scanners. The organisation has developed an incremental change to their machines to include retinal scans for employees to gain secure access to buildings. This sector is known as the Biometric sector.

2.0 Background

The organisation has provided 9 locations, for which they have conducted an initial investigation of manufacturing facilities. This consultancy will need to understand the business case and organisations objectives, prior to making recommendations. An information request will be submitted to gain further information, whilst a general overview based on infrastructure to include Logistics, Politics, Quality, Culture and Manufacturing suitability will be completed.

3.0 Market Potential – Biometric technologies

Biometric technologies (Biometrics – the measurement and analysis of people’s physical characteristics).

The organisation has stated their objective is to strategically position itself to control the manufacture and distribution of their products on a global scale. It is recommended that prior to reviewing the manufacturing potential that the organisation, considers potential negative targets customers and positive target customers. Completing a thorough Market Intelligence exercise, as this could impact upon multiple levels of decision making, that would impact Logistics, Export, Trade, QMS, IP and registrations benefitting the management of uncertainty and risk.

Future Growth in this sector includes Gait recognition, voice metrics, etc. Identifying and recognising disruption in the sector will be a key contributor to success and growth. E.g. Apple has filed for a patent on a biometric anti-eavesdropper app for its Air Pods. (Biometrics Update, 2022) Being able to develop algorithms or to develop associations to support technological development, is likely to be a significant factor in establishing competitive difference. Patent registration is an aspect worth of note, as competitors will be vying for competitive difference. Challenges around data collation and privacy and security of information are growing concerns for the sector. In which there is opportunity to increase public confidence. (Supriya V G)

ISO 56000:2020(E)

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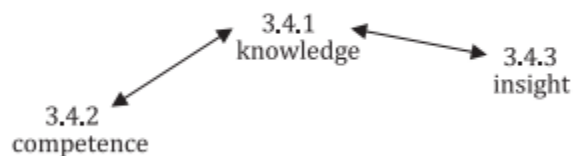


Figure A.7 — 3.4 Terms related to knowledge

Utilising ISO56000 management systems set of interrelated or interacting elements of an organization to establish strategies (3.3.4), policies (3.3.2) and objectives (3.3.3) and processes (3.1.5) to achieve those objectives. This would be beneficial when planning this next business phase: The management system processes include the organization's structure, roles and responsibilities, planning, support and operation. (ISO, 2020)

3.1 Sales Growth

Some of the largest growth will occur in Biometric sales in Retina and facial recognition, with market opportunities growing in hosted access control for: (Biometric Update.com, 2020)

Commercial Opportunities:	Military & Defence:
• Enterprise & data centres • Banks • Financial Buildings • Hotels • Stadiums • Amusement parks etc	• Government • Manufacturing & Industrial • Transportation • Residential • Education • Healthcare

Biometric authentication provides organisations with the ability to identify and control access for individuals. The digital identity solutions market is set to double in size in the coming years, with the potential to reach 50 billion U.S. dollars worldwide.

The global facial recognition market is estimated at 3.8 billion U.S. dollars in 2020 with it forecast to reach 8.5 billion dollars by 2025. (Statista, 2021)

3.2 Market Trends:

- Over the past few years, there has been a rise in the number of crimes and the threat of terrorist attacks across the globe. These incidences have prompted government facilities to install high-tech biometric systems to improve security conditions and preventing fraudulent activities. This remains one of the primary factors that are driving the growth of the market.
- Manufacturers are developing iris recognition technology so that it can be integrated with various devices such as smartphones, banking systems and ATMs. These innovations are attracting investors who are interested in conducting large-scale R&D for applying these designs in real-life applications which, in turn, is influencing the market growth positively.
- Healthcare providers are making efforts to use iris-recognition for addressing patient identity challenges. The combination of iris biometric technology and healthcare focused PTOYNet blockchain network will help in delivering improved administrative, financial and clinical efficiencies. (Imarc Group, 2021)

3.3 Competitive Landscape:

- The competitive landscape of the market is made up, with some of the key players being BioEnable, Iris ID, IrisGuard, M2SYS Technology, Gemalto Cogent, IriTech, Inc, SRI International, Crossmatch, EyeLock LLC, etc. (Imarc.com, 2021)
- Further research of competitor analysis is recommended when planning the organization's next steps.

4.0 Location and Supply chains

When considering the potential locations for the creation of manufacturing facilities, it is recommended that organisation X, consider their supply chain providers and logistical access. As demand for biometric products grows, so will the demand for component parts, software and service provision.

When considering the potential locations shortlisted by the organisation for further consideration for their manufacturing facility it is important to consider the continual development and changes in SMART city rankings, due to the developed infrastructures that may be relevant to the organisations desire to grow a sustainable and prosperous future.

5.0 Digital Infrastructure

Digital infrastructure is a key consideration and is worthy of in-depth investigation, particularly when considering locations in developing countries, who are developing and not yet established. E.g., Tunisia.

A gap in the digital infrastructure of a potential location could impact upon: Sales, communications with Head office, supply chains and potential and existing customers.

There is an interesting document by the world bank showing how export of Manufacturing Enterprises are impacted by internet access. (George. R.G. Clarke, 2004). The report shows that even when the study endogenizes Internet use by using regulatory variable as instruments, that the study finds that Internet penetration in developing countries is positively correlated with exports to developed countries. (dyason_david, 2005)

Table 1: % of Manufacturing Enterprises with Internet Access

Country	Year	ALL	Exporters	Non-Exporters	Difference between exporters and non-exporters
Albania	2002	38.2%	65.3%	26.9%	38.4%
Algeria	2002	41.5%	78.9%	39.6%	39.3%
Armenia	2002	43.3%	84.6%	31.1%	53.6%
Azerbaijan	2002	34.1%	63.0%	28.2%	34.8%
Bangladesh	2002	70.6%	86.0%	58.9%	27.1%
Belarus	2002	56.0%	79.2%	46.6%	32.5%
Bosnia and Herzegovina	2002	60.4%	75.4%	52.6%	22.8%
Bolivia	2001	56.3%	86.0%	50.8%	35.2%
Bulgaria	2002	63.2%	95.9%	49.1%	46.8%
China	2001	71.2%	81.8%	64.7%	17.0%
Croatia	2002	79.7%	89.0%	72.1%	16.9%
Czech	2002	77.2%	90.5%	69.6%	20.9%
Estonia	2002	91.8%	98.6%	86.0%	12.5%
Ethiopia	2001	39.2%	93.8%	35.1%	58.7%
FYR of Macedonia	2002	50.0%	70.6%	41.0%	29.6%
Georgia	2002	41.4%	72.7%	30.8%	42.0%
Hungary	2002	75.2%	92.8%	66.3%	26.5%
Kazakhstan	2002	45.6%	75.6%	38.7%	36.8%
Kyrgyz Republic	2002	34.1%	58.1%	27.6%	30.5%
Latvia	2002	63.1%	93.0%	53.8%	39.2%
Lithuania	2002	72.0%	98.4%	60.1%	38.2%
Moldova	2002	38.5%	65.5%	25.0%	40.5%
Morocco	1999	49.3%	59.0%	35.9%	23.1%
Mozambique	2002	73.8%	95.0%	70.6%	24.4%
Pakistan	2002	33.8%	74.9%	23.7%	51.2%
Peru	2002	57.5%	77.0%	40.4%	36.6%
Poland	2002	69.0%	88.5%	60.3%	28.2%
Romania	2002	59.2%	84.4%	50.8%	33.6%
Russia	2002	57.3%	88.2%	49.1%	39.1%
Slovakia	2002	84.7%	91.5%	78.4%	13.1%
Slovenia	2002	92.6%	97.1%	87.2%	9.8%
Tajikistan	2002	13.1%	25.7%	10.1%	15.6%
Turkey	2002	54.3%	77.8%	45.1%	32.6%
Ukraine	2002	60.0%	85.2%	51.0%	34.2%
Uzbekistan	2002	23.1%	60.6%	17.6%	43.0%
Yugoslavia	2002	71.2%	88.4%	62.2%	26.2%

Source: Investment Climate Surveys, The World Bank.

6.0 Manufacturing. Production and Transportation

A significant consideration when considering a new location is the logistical costs of transporting from the manufacturing facility by road, to a port or air location for export and how these impacts upon the cost of production. LMIC's (Low, Middle-Income Countries) have had less investment in infrastructure, and this has been a barrier for investors historically. (China is investing significantly, in S.Africa) (Deloitte.com, 2019) However, it is recommended this be weighed against governmental incentives for trade and innovation and new investment occurring in LMIC's, compared against the entry cost into a location with established infrastructure such as SMART cities. (dyason_david, 2005)

7.0 Infrastructure

The findings of a report into whether infrastructure increases export and reduces trade deficits suggests that infrastructure positively promotes exports while negatively affecting trade deficits. (Journal of Economic Structures, 2020)

SMART Cities:

According to The World Bank Smart Cities, usually go in one of 2 directions. (Worldbank.org, 2015)

A technology-intensive city	A city that cultivates a better relationship between citizens and governments - leveraged by available technology.
Sensors everywhere; Highly efficient public services, thanks to information that is gathered in real time by thousands of interconnected devices. (e.g., trash cans have sensors that indicate when they are full, and trash collectors follow a specific route based on this information.). All buildings are "intelligent", with smart meters and energy saving systems, and transport is painless.	They rely on feedback from citizens to help improve service delivery and creating mechanisms to gather this information. For example, Citizens are more active in managing their neighbourhoods. Open government data is used by civil society to co-create smartphone applications (or an SMS service), e.g., to report a full trash can, and trash collectors can accommodate their routes based on this information.



(infraroi, 2020)

The world bank believes that both approaches are not mutually exclusive and that these approaches can be adopted in developing countries also. Through a new framework. (Worldbank.org, 2015)

When considering manufacturing locations in South America; Asia; Africa. The World Bank's new Framework. [Smart Cities \(worldbank.org\)](https://www.worldbank.org), provides considerations, for developing countries to be as significant as the current Top 50 Smart Cities., as these cities through investment in infrastructure and political will, have the potential to fit the current criteria of a SMART City, in the future. Early adopters and investors into these countries may benefit from an untapped market and larger share of the market in the future.

'Developing countries without the immediate infrastructure or budget to become a technology-intensive city. As they create a longer-term technology investment plan, they can start leveraging existing technologies.' (Worldbank.org, 2015)

As the organisation continues its growth pattern, continuous measurement and assessments against the organisation's objectives will support the organisations' ability to maintain competitive difference through, the management of the business objectives, this will be a key component to achieving the organisations vision.

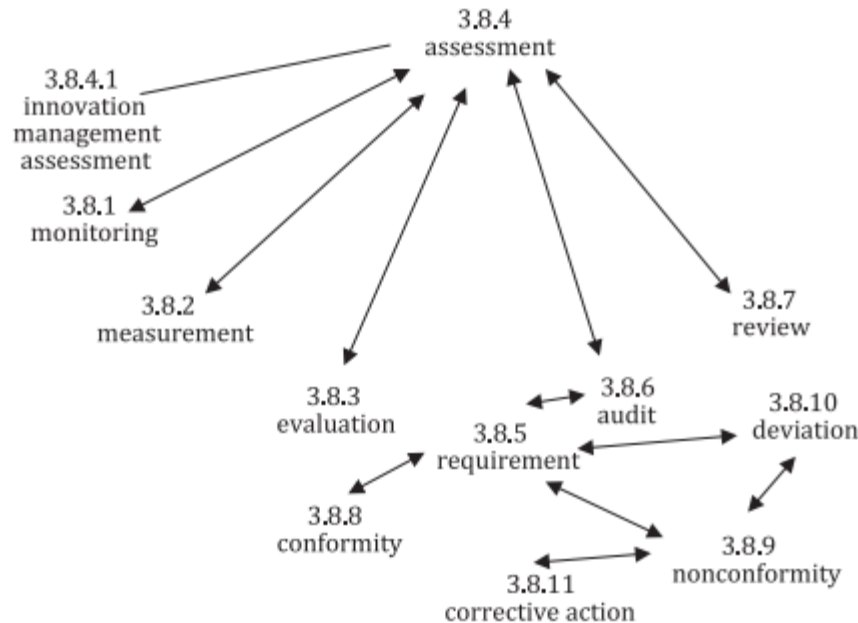


Figure A.11 — 3.8 Terms related to assessment

The SMART city aspects of logistic/transportation/political aspects/Manufacturing & Production; Quality and Social and Cultural implications are relevant factors when selecting the profile of possible locations.

Covid-19 has been a measure of SMART cities in terms of resilience, adaptability, foresight and proactiveness. Covid has been an additional challenge compared to the expected challenges of urban challenges, civil unrest, climate change and political challenges and the ability to innovate, be creative and show resilience. Countries able to be proactive in the face of these challenges are worthy of note for any organisation considering a new location to expand their business.

According to the world bank 'The economy predicts the global economy is expected to grow at the fastest rates since the global financial crisis for the next couple of years, it's the developing nations that stand out, in terms of rate of growth.' The nations that stand out are those with resilience and momentum to overcome challenges. (usnews.com, 2022) 'The Best Countries Movers sub ranking is predictive of a countries future, per capita, purchasing power and parity gross domestic product. 78 countries are assessed on 76 different metrics. Sub ranking is based on attributes: different. Dynamic, unique' (usnews.com, 2022)

The United Arab Emirates is named as the most competitive in the Arab World, with Manufacturing giant India claiming the second spot, Egypt, Singapore and China rounded the top 5. Brazil finished at no: 9, Mexico 15 and South Africa (an economy damaged by Covid) dropped to 25. Economic Potential is concentrated in Asia. (usnews.com, 2022)

8.0 Transportation and Logistics

According to Statista: Of the 3 African countries selected by Organisation X South Africa (Durban) has the best infrastructure for transport, followed by Tunisia and then Zimbabwe (Bulawayo) (data source is the African Infrastructure Development Index). (statista.com, 2020)

According to the (BRI) The road and belt initiative. China 57.3 has the best index score followed by India 52.6 (Statista.com, 2019) China is investing in the logistical infrastructure of South Africa.

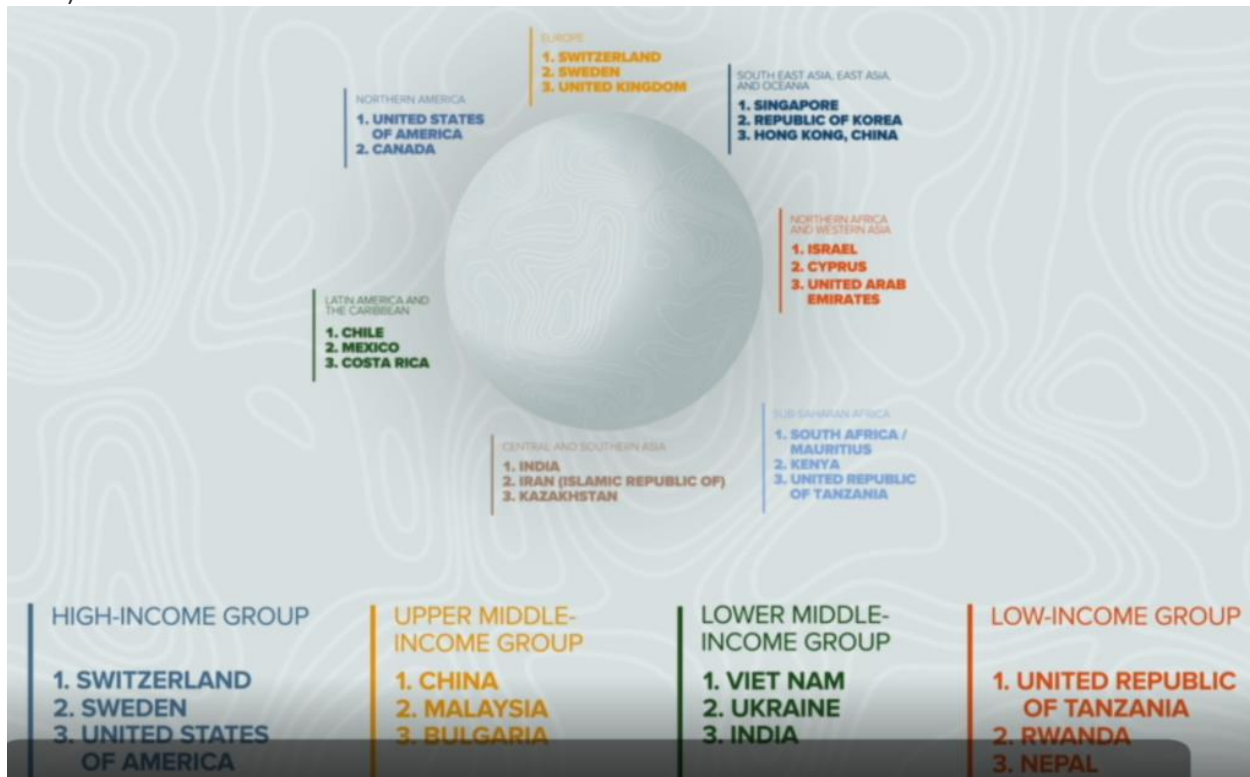
9.0 Innovation

According to The Global Innovation Index (GII) Mexico ranked 2nd in Latin America and scoring 55th out of 130 countries. Showing significant change from its 2011 ranking of 81st place. (Global Innovation Index 2021, 2021)

Considering Innovation Performance levels from the world innovation index, it should be noted that of the countries selected for further consideration, within their income group:

China, Brazil, Mexico, India, Tunisia, South Africa and Zimbabwe have an innovation performance above expectation level of development. Only Mexico has consistently upped their ranking over the past 10 years. (WIPO, 2021)

The fastest growing International, patent filings occurred in Pharmaceuticals, followed by Biotechnology and of the selected countries, with China showing the fastest IP registration growth at 16%. (WIPO, 2021)



(Global Innovation Index, 2021)

Country	pg. index WIPO	%R & D	%Knowledge workers	%Political stability	%Knowledge Impact	% Market sophistic ation	% ISO Quality certs.	%Innovation Linkages
China	67	59.8	77.7	71.4	52.2	61.5	12	31.3
India	93	32.5	26.4	64.3	33.3	55.5	3.6	24.1
Brazil	58	31.9	46.1	66.1	35.5	44.9	5.6	21.4
Mexico	117	25.6	28.7	55.4	29.6	48.8	3	17.5
S.Africa	151	23.7	32.2	64.3	32.7	57	4.6	23.4
Uruguay	168	9.4	27	83.9	32.2	37.6	13.2	17
Tunisia	160	8.2	19.6	62.5	29.7	40.7	8.6	13.9
Zimbabwe	173	0.3	22.3	48.2	20.2	46.7	3.7	17.5

(WIPO, 2021)

8/9 of the countries selected for further investigation by Organisation X appear on the WIPO innovation index. Depending on the aspects of innovation that the organisation considers most relevant to their business objectives and expansion strategy, it is recommended that the organisation look more intensively at the relevant country index pages, for correlations.

The extract inserted above highlights areas of specified interest e.g. (Quality) Iso certificates – with Uruguay performing better even than China. Highest percentages are noted in Green and Lowest percentages in Red. With Amber representing the second highest.

10.0 Cultural Alignment

Cultural Alignment Insights and tools (e.g., Hofstede's insights model) can be used to assess correlations in cultural alignment for any potential locations that may present opportunities or challenges. (Hofstede Insights, 2022)



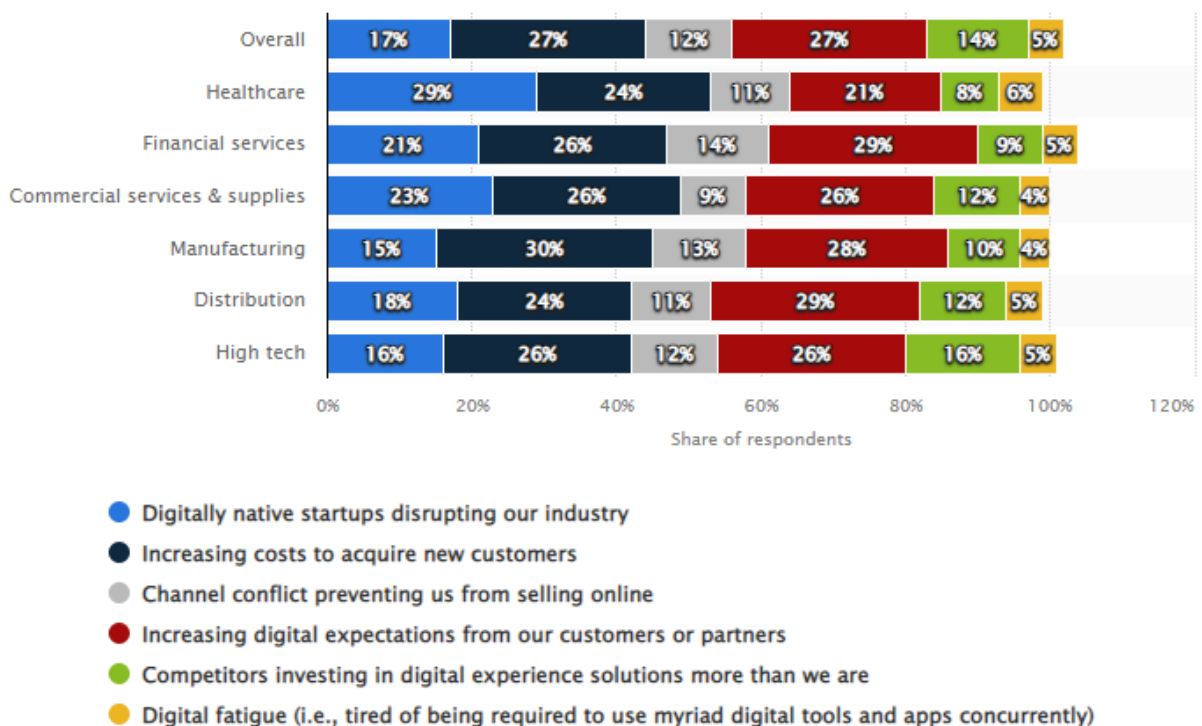
For example: When making comparisons between the selected cultures there are some similarities in: Power distance; individualism; masculinity and indulgence between South Africa and the U.K.

This has the potential to assist with understanding characteristics of a new workforce. There is less similarity in uncertainty avoidance and long-term orientation, which could be attributed to the difference between LMIC low incomes vs Western privilege.

11.0 Manufacturing & Production

According to Statista: a 2020 survey of manufacturing, global B2B decision makers. 30% of manufacturing companies felt that their greatest threat to business, was the increasing cost to acquire new customers. (Statista.com, 2020) It is recommended Organisation X consider this through their value chain exercise and risk mitigation plans and how this would impact upon a new location.

Biggest external threat to organization according to global B2B decision makers as of March 2020, by vertical (Statista.com, 2020)



12.0 Ethics/IP/Legislation

One of the more challenging aspects for organisation X to consider prior to investing in international expansion, is:

How, international legislation, is likely to change and which international ethics and regulations, fit, with the organisation's values. (Biometricupdate.com, 2022)

Due to the youth of the sector, regulation, has been very much hands off at the early stages, but across the world ethics, values and regulation differ. Gaining greater understanding of how organisation X considers their role in ethical behaviour and as a contributor to R & D and legislation in the sector, has potential to alter decision making during the development of the organisations expansion plans.

13.0 Summary

13.1 Evaluation Asia

Political unrest between Taiwan and China suggests Taipei as a location to reject at the early stages, as there is no solution in site from the threat of potential invasion by China. (East Asia Forum, 2022)

Shenzhen sits on the SMART city index at 25, a city that has shown great innovation and that has grown incredible quickly. Which might suggest, as a digitally capable, manufacturing location it will be much in demand and a competitive location to access. For further reading: [story of shenzhen combined-pages-deleted-merged 1 1.pdf \(unhabitat.org\)](#)

Ethically, China views data collation and observation very differently from the U.K. and government controls and restrictions, differ broadly.

Visakhapatnam is a coastal, port city in Andhra Pradesh. It is often called "The Jewel of the East Coast", located on the Eastern coast of India.

Biometric systems are increasingly being rolled out in India.

According to Biometric.com 'Gurugram is one of the first cities in India to have a strong AI-powered surveillance system. Which has been implemented by [NEC](#) (industry competitor) as principal contractor. Gurugram is said to be one of the first cities in India to have a strong AI-powered surveillance system. (Biometricupdate.com, 2021)

With a biometric token and surveillance system with drone cameras being installed at the Visakhapatnam rail station. [Times of India](#) reports that the technology is intended to control the flow of passengers, especially during peak periods, as well as enhance security at the station. (The Times of India, 2022).

Of the three locations suggested, further assessment, of Visakhapatnam is recommended. To ascertain whether it will align to organisation X's value chain objectives.

Visakhapatnam is in a growth period and has the potential to produce similar development to Shenzhen, which is much more established and competitive. Regional placement close to a port is also an attractive aspect for export.

Based on information provided by WIPO, India is a country performing better than expected against the criteria for innovation performance for developing countries.

13.2 Evaluation South America

Of the 3 locations selected In South America: Mexico, Brazil and Uruguay.

Each has strong possible criteria to fulfil the desired expansion possibilities; Mexico has consistently upped their rankings on the World Innovation Index over the past 10 years and has infrastructure that sits well in SMART city rankings.

Both Mexico and Brazil have an innovation performance that is above expectation levels of development.

However, Uruguay cannot be eliminated from further investigation as the score for ISO Quality certification exceeds China and they have good political stability and digital growth. (WIPO, 2021) However, they appear they have close links to China, in 2019 receiving donated facial recognition cameras to monitor borders. This suggests they are more willing to interact with (Huawei) China and may not be as receptive to other competitors. (Biometric Update, 2019)

13.3 Evaluation Africa

Of the 3 locations selected in Africa: Durban, Bulawayo (Zimbabwe), Tunisia.

Zimbabwe has moved up the WIPO index list for LMIC's, but with low percentage scores in political. R & D and Knowledge impact, they maybe one to monitor for the future and not for now.

Tunisia whilst showing growth and improvement on the innovation index, are still struggling to develop their digital infrastructure and this could impact upon manufacturing exports. Once this been rectified, they will be worthy of further consideration.

Durban is the largest harbour for the export of manufactured goods from South Africa and receives the bulk of exports from Gauteng. More than 80% of manufactured exports from South Africa come from metropolitan areas. (dyason_david, 2005). From a cultural perspective there are also some similarities in: Power distance; individualism; masculinity and indulgence between South Africa and the U.K.

14.0 Conclusion

When offering feedback regarding the location options provided by organisation X. Certain locations are easy to exclude due to political factors, e.g., Taipei (Taiwan).

After which many of the locations have developed infrastructures, E.g., Mexico, Brazil, Uruguay, Shenzhen, (e.g., Shenzhen) and score well or show growth on the WIPO.

The differentials in strengths and weaknesses of many of the potential locations suggest that further information from the organisation is required and decision making is dependent upon: What factors are crucial to the Value Chain of organisation X.

In order to deliver upon the brief, the consultancy requires further understanding of:

The business case:

- What is the business case for considering an international manufacturing location?
- Is the organisation trying to access a specific target?
- What are the organizations, internal company values? How will this affect the choice of location?
- Does the organization have a clear objective, strategy and innovation plan prior to expanding?
- Has the organization completed and innovation management audit?
- How will the organization integrate itself into a new international location?
- Which locations have the skillsets, required to fulfill the organizations objectives?
- How will the organizations culture, fit with the new location?
- What are the potential risks of manufacturing in a new international location?
- What is the organizations R & D policy?
- Who are the organizations stakeholders?
- Where is the organization current supply chain located?
- What are the future supply chain opportunities/threats, once integrated into the new location?
- What will the logistical difference mean for import and export costs?
- What are the additional logistical costs of moving the product from the manufacturing location to the port or air freight?
- What will the organization need to outsource?
- What internal skillsets will be transferable to support the development of the new location and the employees that will be sourced from the area?

Gaining a complete understanding of Organization X's Business Case may provide the opportunity to provide other potential locations:

Example Monterrey: Alternative Destinations for further Investigation

40% of the world's biggest manufacturers now operate in Monterrey. Monterrey's industrial roots and continuous growth, plus its highest per capita income in the country, the high quality of life it offers for locals and foreigners alike, make it an attractive proposition. Industries that operate from Monterrey include - Automotive; Aerospace; Electronics.

With an infrastructure that includes the fastest growing airports in the country, 300 daily flights and a 15-acre cargo terminal and the largest, most strategically placed inland port, it has excellent connectivity for supply chain and logistics. In addition, there is a highly skilled workforce and an attitude of innovation. For further insight: (NAPS, 2021)

'Monterrey offers an alternative location worthy of investigation in North America. Considered a Sustainable, Inclusive and Balanced City

Many experts point out that the city of Monterrey has great potential to design a comprehensive action plan, even more so than Mexico City for example. This is due to the large number of resources available, as well as its geographical location and the participation and involvement of the government, businesses and academia, which make Monterrey a good laboratory to become a smart city. (E-Ziguarat.com, 2019)

15.0 Recommendations

In order to understand why Organisation X, consider it necessary to expand their operation from the U.K.? It would be useful to understand - How this benefit growth and a sustainable prosperous future? Completion of an ISO56000 assessment. (ISO TR 56004 Innovation management assessment) will help guide the fundamentals of this process. (ISO, 2020).

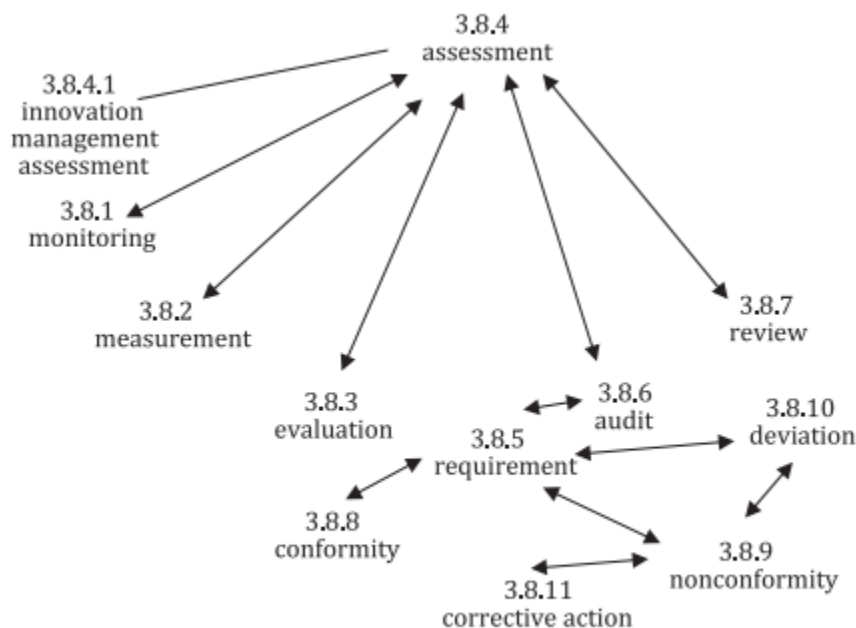


Figure A.11 — 3.8 Terms related to assessment

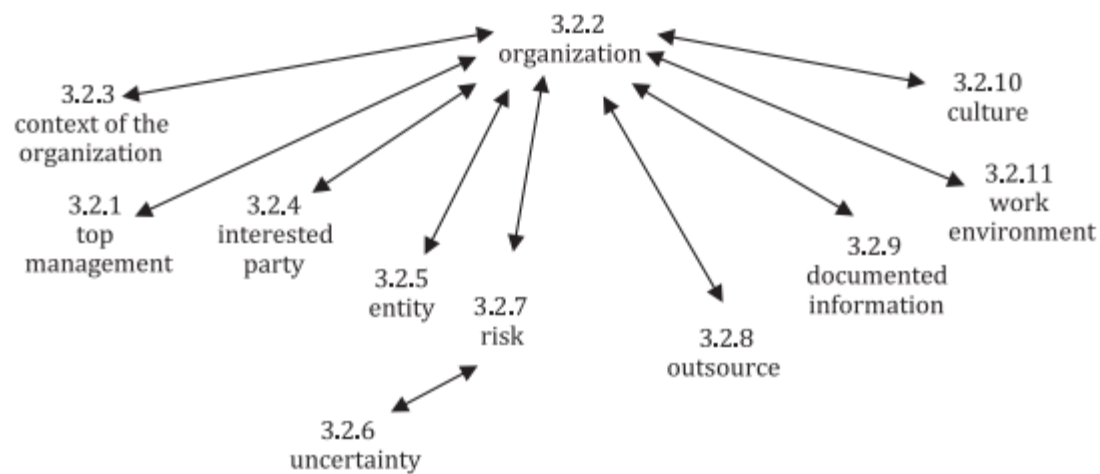


Figure A.5 — 3.2 Terms related to organization

Following ISO56000 can act as a guide for the organisation to develop the structures of the business to a standard that is recognised internationally to support the expansion and security of the organisation in the future.

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