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ON THE RELATION BETWEEN THE READINESS FRONTIER TECHNOLOGIES INDEX AND ISO 9001:2015 STANDARD INDEX

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Abstract

Improving life quality is necessary for humans to use technology and standards in all of their activities. The primary goal of this research was to determine the relationships between the readiness frontier technologies index and quality management. This was accomplished by conducting a regression analysis between the readiness frontier technology index and the ISO 9001 Index to compare Hypothesis H1 (no relationship between the RFT Index and the ISO 9001 Index) to Hypothesis H0 (strong relationship between the RFT Index and the ISO 9001 Index). The study discovered that, while humans strive to better their quality of life, there is no link or association between readiness frontier technology and quality management (as expressed primarily in ISO 9001:2025 standards). The research concludes that all interested parties, individuals, public and private institutions, decision-makers, and civil society should look forward to improving life quality by applying quality management principles and ISO standards as efficient and effective tools, combined with technology usage and that all parties should look forward to building relations and connections between RFT Index and ISO standards, which are currently lacking.

Keywords: *readiness frontier technologies index, ISO 9001:2015 index, quality management, life quality*

Introduction

Life quality requires standards and technologies advancement. Quality of life (QOL) is defined by the World Health Organization as "an individual's perception of their position in life in the context of the culture and value systems in which they live and about their goals, expectations, standards, and concerns" [1]. Standard indicators of the quality of life include wealth, employment, the environment, physical and mental health, education, recreation and leisure time, social belonging, religious beliefs, safety, security, and freedom (Gregory, Derek; Johnston, Ron; Pratt, Ger-

aldine; Watts, Michael; et al., 2009; Martha Nussbaum and Amartya Sen, ed. 1993; Barcaccia, Barbara, 2013). QOL has a wide range of contexts, including the fields of international development, healthcare, politics, and employment. Health-related (HRQOL) is an evaluation of QOL and its relationship with health (Bottomley, Andrew. 2002).

It is considered that there is a substantial relationship between technology and quality management ideas, especially with ISO standards, the most important of which is ISO 9001:2015.

This was the main question investigated in this study, which employed quantitative approaches in conjunction with regression analysis to investigate the correlations between the FRT Index and the ISO 9001 index.

There were previously separated existing data and materials about the preparedness frontier technologies index, quality management, and ISO 9001:2015, as well as previously published works and research publications, books, and online libraries.

It is believed that scientific management, including quality management, combined with technology use, creates opportunities for life quality improvement, ensuring future generations' normal life and societal wealth, and promoting economic growth, at a time when factors of production are becoming increasingly vulnerable to risks of misuse, damage, pollution, and corruption, among other things.

To achieve and maintain life quality and sustainable development scenarios, all interested parties, individuals, and public and private institutions, particularly decision-makers and civil society, must improve the situation because there is a lack of methods, systems, techniques of use, and management of production factors, as well as a lack of quality management principles and standardizations on the subject.

Improving technology usage and quality management principles and standards can improve the quality of life for individuals and societies.

Literature review

Readiness frontier technology index

The United Nations Conference on Trade and Development (UNCTAD) published a report titled "Technology and Innovation" in 2022. The study is a valuable tool for guiding policies and strategies for leading-edge technology adoption. UNCTAD ranks countries' economies in terms of their respective "Country-Readiness Index" in this report. The Index assesses economies based on their ability to use, adopt, and adapt "frontier technologies" equitably. The index is made up of five components, which are as follows (UNCTAD. 2022).

ICT Infrastructure Deployment – This is the level of ICT infrastructure. Using, adopting, and adapting cutting-edge technologies necessitates adequate ICT infrastructure, particularly as AI, IoT, big data, and blockchain are all internet-based technologies. Two components of ICT infrastructure must be considered: the prevalence of access to ensure that no one is left behind, and the quality of infrastructure that allows for more advanced and efficient use. For these reasons, internet users as a percentage of the population reflect the presence of internet infrastructure, whereas mean download speed reflects the quality of the internet connection.

This block seeks to measure the level of the spread of information and communication technology to ensure access to all societies, and to evaluate the quality of infrastructure that allows for more use that is effective and includes (1) Internet users (percentage of population), and 92) Mean download speed (Mbps) (UNCTAD. 2022).

Skills – Using, adopting, and adapting frontier technologies needs people equipped with relevant skills. These may be advanced but are generally lower than those required to originate the technologies. Two types of skills need to be considered: skills acquired through education and skills acquired in the workplace through practical training or learning by doing. The overall educational attainment of the population is measured through expected years of schooling, while the skill level in the labor market is measured by the extent of high-skill employment – defined by the ILO as the sum of managers, professionals, and technicians and associate professionals following the International Standard Classification of Occupations (ISCO). These indicators need to be interpreted with caution, especially in

developing countries, because of the emigration of highly trained or skilled people, the "brain drain", as a result of which the actual skill level could be lower than the official estimate. This block seeks to measure the skills required to support the adoption of the concept of technology based on acquiring knowledge through the educational environment, and acquiring skills through the work environment and includes 1) Expected years of schooling, and 2) High-skill employment (% of the working population) (UNCTAD. 2022).

Research & Development – R&D work is required not only for the development of cutting-edge technologies but also for their adoption and adaptation, as these technologies frequently require adjustment or modification for local applications. The number of publications and patents filed on a country's 11 frontier technologies is used to measure R&D activities. The publication and patent search queries used are identical to those described in the Technical note in Annex B, except for the year of interest, which is a single year for the index rather than 1996–2018. The authors' and patent assignees' countries of publication were investigated. It should be noted that there are informal R&D operations that may not result in a publication or patent, so the R&D scores may not reflect the actual scale of activities. This block is considered essential to measure the extent to which countries can improve technology and match it with the requirements of the local market and includes 1) the Number of scientific publications on frontier technologies, and 2) the Number of patents filed on frontier technologies (UNCTAD. 2022).

Industry Activity – This building element intends to record ongoing industry actions relating to the use, adoption, and adaptation of cutting-edge technologies. It looks at three industries that are early adopters: manufacturing, with high-tech manufacturing leading the way; finance; and ICT, which interacts with other technologies. Then it employs export data on high-tech manufacturers as well as digitally deliverable services in finance and ICT. However, particularly in developing nations, operations are carried out by enterprises in the informal sector, which are frequently excluded from official statistics. As a result, the scores from these countries may be lower than the real activity. This block measures the ability of the local industry to manufacture advanced technology and export digital services, and includes 1) High technology manufactures exports (% of total merchandise trade), and 2) Digitally deliverable services exports (% of total service trade) (UNCTAD. 2022).

Finance – This analyzes the availability of private-sector finance. Better access to funding could hasten the use, adoption, and adaptation of cutting-edge technologies. Domestic credit to the private sector as a proportion of GDP was chosen as part of the index for this purpose. This statistic measures financial corporations' resources, such as finance and leasing companies, money lenders, insurance companies, pension funds, and foreign exchange companies. It also comprises a variety of financial instruments like loans, non-equity securities purchases, trade credits, and other accounts receivable. However, alternative, unorthodox finance providers or financial instruments may exist that are not adequately represented by this measure. This block seeks to measure the availability of financing to the private sector and the resources provided by other financial companies to the private sector and includes the Domestic credit to the private sector (% of GDP).

And based on data for these five subindexes, the Readiness Frontier Technology Index was calculated (UNCTAD. 2022).

International Standards Organization and quality standards

The International Standards Organization (ISO) improves life quality by aiding members in maximizing the benefits of international standardization and assuring ISO standard acceptance. ISO standards directly address the three major domains of life quality: economic, environmental, and societal factors (URL: https://www.iso.org/sdgs.html). ISO has released over 25 000 worldwide Standards and related documents, expressing globally accepted ideas and frameworks based on global collaboration. They are crucial tools for governments, industry, and consumers to contribute to life quality enhancement since they are built on consensus. ISO has determined the standards that

contribute the most significantly to achieving the United Nations Sustainable Development Goals too, and several ISO standards correspond to each of the SDGs**.** ISO's standards help to make the 2030 Agenda a reality, ensuring that no one falls behind (Sergio Mujica, 2023; ISO. 2018).

Quality Management, doing business, and global trends on ISO Certificates (Rose, Kenneth H., 2005)

Quality management is the act of overseeing all actions and obligations required to maintain a goal level of excellence. Quality assurance and planning, as well as quality control and improvement, are all part of this. Quality management ensures that an organization, product, or service is consistent. It is separated into four sections: quality planning, assurance, control, and improvement (Ceko Enriko, 2013). Quality management is concerned not only with product and service quality but also with the techniques for obtaining it. Quality management involves quality assurance and control of processes as well as products to achieve more consistent quality. Following corporate rules and guidelines, such as ISO certificates, which are more focused on the quality of procedures that private and public subjects follow, resulting in higher-quality products and services (ISO. 2014), is one technique to achieve quality management.

Because societies require regulation, and businesses are no exception, ISO certificates are now part of business and trade regulations because they are the minimum requirements for the characteristics of processes, products, and services used by private and public entities/subjects to be acceptable to their clients and markets. These qualities are essential for modern private and public companies. When markets are left unregulated, undesirable outcomes and, ultimately, poor living conditions for citizens occur.

When starting a new business or entering a new phase of enterprise development, entrepreneurs must establish certain procedures and standards to allow the business to live beyond minimum frontiers, export and import, participate in public procurement procedures, and finally attract as many clients as possible to maximize profits and achieve other business objectives. All of these issues relate to standards, which make commercial transactions easier and allow businesses to run more efficiently. ISO 9001:2015 is one of the most commonly used ISO standards, with over 1.3 million certificates issued worldwide (Ceko Enriko, 2022).

Research framework, the purpose of the case study

The research framework was the worldwide and global ecosystem linkages between the Readiness Frontier Technologies Index and the ISO 9001:2015 index.

Given the scarcity of numerical, statistical, and algebraic reasoning on the links between the RFT Index and the ISO 9001:2015 Index, this study employs a theory-building technique to address the following research questions:

1 Ho: There is a strong connection/relation between RFT Index and ISO 9001:2015 Index.

2 H1: There is not a string connection/relation between RFT Index and ISO 9001:2015 Index.

Methodology

While acknowledging the significance of connections/relationships between readiness frontier technologies and ISO standards, particularly ISO 9001:2015, prior empirical research does not explain statistically verified, if there is any connection/relationship between them; thus, theory development, supported by analysis and evidence, is required. The exploratory technique should be used in conjunction with a single-depth case study approach, which is ideal for building a full understanding of a phenomenon and allowing for a closer exploration of theoretical structures.

Case selection

The scenario was chosen based on three major criteria: a theoretical approach, the applicability of genuine beneficial impacts of relationships on the RFT Index, and ISO 9001:2015 Index links. The case project was separated into three stages: 1) identifying needs for technology usage, 2) identifying needs for quality management and ISO 9001:2015 certification, and 3) identifying nations' rankings for RFT and ISO 9001:2015 certification.

Data collection

The data for the RFT Index came from the UNCTAD Report 2022, an annual ranking of countries based on their technological progress.

The ISO 9001:2015 index was created using data from the ISO Certifications Report 2022.

HitHorizon offered information on the number of businesses registered globally.

I built the ISO 9001:2015 Index by dividing the number of ISO certificates awarded to each nation by the number of enterprises registered in the country, obtaining the ISO 9001:2015 index per country, and then creating a list of countries based on this index (Sergio Mujica, 2023).

Data analysis

RFT and ISO 9001 standard indicators were correlated and regressively analyzed (inferential statistics) in 128 countries worldwide.

The RFT Index (taken from the UNCTAD Report 2022) and the ISO 9001:2015 Index (created as indicated in the preceding paragraph) are mentioned in the table below.

I developed a regression between the SDG Index and the number of ISO certificates given per country using this data and secondary sources. The ISO 9001 index is determined by dividing the number of ISO 9001 certificates issued in each country by the country's total number of business entities.

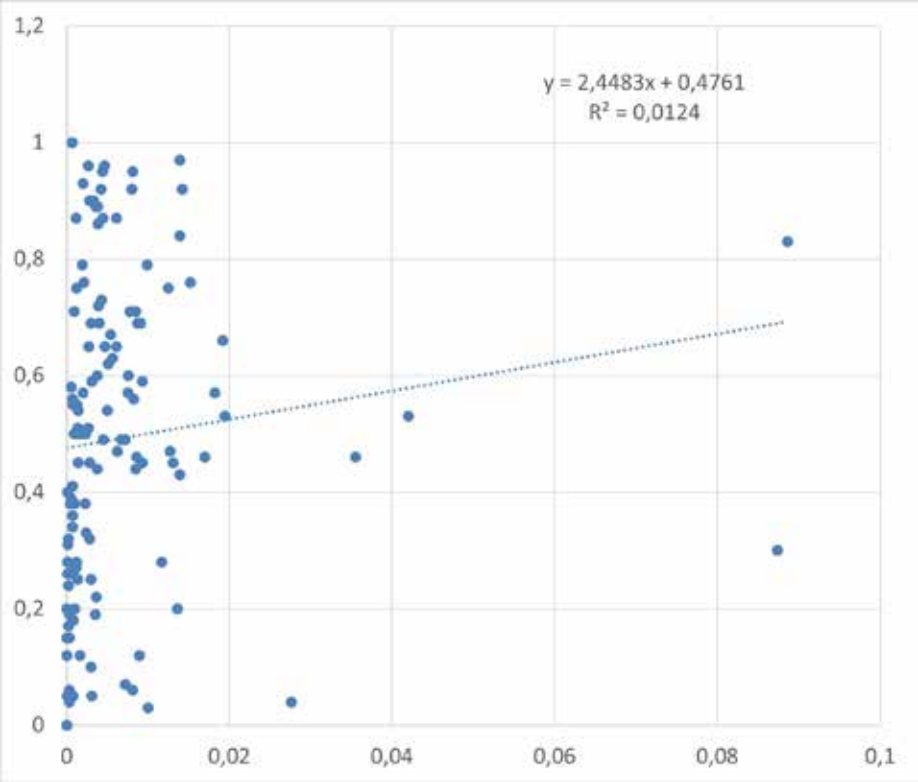
I ran a regression analysis between the RFT Index and the ISO 9001 Index after listing countries based on this index, which revealed that the relationships between the RFT Index and the ISO 9001 Index are not strong, confirming the H1 hypothesis, "There is no relation between the RFT Index and the ISO 9001 Index", as opposed to the Ho hypothesis, "There is a strong relation between the RFT Index and the ISO 9001 Index".

Table 1. *List of countries based on the ISO 9001:2015 index and RFT Index*

№	Country	ISO 9001 index	Readiness Index	№	Country	ISO 9001 index	Readiness Index
1	Spain	0.0886	0.83	23	Serbia	0.0093	0.59
2	Azerbaijan	0.0874	0.3	24	Slovakia	0.0091	0.69
3	Belarus	0.042	0.53	25	Benin	0.0089	0.12
4	Qatar	0.0355	0.46	26	Slovenia	0.0087	0.69
5	Sudan	0.0276	0.04	27	Macedonia	0.0086	0.46
6	Kuwait	0.01947	0.53	28	Georgia	0.0085	0.44
7	Greece	0.0192	0.66	29	Portugal	0.0085	0.71
8	Chile	0.0182	0.57	30	Croatia	0.0082	0.56
9	Iran	0.017	0.46	31	Mozambique	0.0081	0.06
10	Italy	0.0152	0.76	32	Singapore	0.0081	0.95
11	Germany	0.0142	0.92	33	Ireland	0.008	0.92
12	B&H	0.0139	0.43	34	Malaysia	0.00777	0.71
13	Israel	0.0139	0.84	35	Romania	0.00756	0.6
14	Switzerland	0.0139	0.97	36	Bulgaria	0.0075	0.57
15	Pakistan	0.0136	0.2	37	Argentina	0.0072	0.49
16	Morocco	0.0131	0.45	38	Djibouti	0.0072	0.07
17	Brunei	0.0127	0.47	39	Viet Nam	0.0067	0.49
18	Czech Rep.	0.0125	0.75	40	Uruguay	0.00624	0.47
19	Guatemala	0.0117	0.28	41	Montenegro	0.0062	0.47
20	Yemen	0.01	0.03	42	Japan	0.0061	0.87
21	Austria	0.0099	0.79	43	Latvia	0.0061	0.65
22	Oman	0.0093	0.45	44	UAE	0.00562	0.63

№	Country	ISO 9001 index	Readiness Index	№	Country	ISO 9001 index	Readiness Index
45	Hungary	0.0054	0.67	87	Maldives	0.00138	0.25
46	India	0.0051	0.62	88	Tunisia	0.00134	0.51
47	Bahrain	0.005	0.54	89	South Africa	0.00128	0.55
48	Lithuania	0.0047	0.65	90	Ghana	0.0012	0.28
49	UK	0.00464	0.96	91	Russia	0.0012	0.75
50	Panama	0.0045	0.49	92	Luxembourg	0.00116	0.87
51	Finland	0.00444	0.87	93	El Salvador	0.00114	0.27
52	Netherlands	0.0044	0.95	94	Honduras	0.001	0.2
53	Poland	0.00426	0.73	95	Sri Lanka	0.001	0.38
54	Denmark	0.0042	0.92	96	Kazakhstan	0.00095	0.5
55	Malta	0.004	0.69	97	Iceland	0.00091	0.71
56	Estonia	0.0039	0.72	98	Uganda	0.00083	0.18
57	Norway	0.00384	0.86	99	Ethiopia	0.00078	0.05
58	Canada	0.0038	0.89	100	Bangladesh	0.00076	0.26
59	Colombia	0.00375	0.44	101	Turkey	0.000747	0.55
60	Philippines	0.00373	0.6	102	Ukraine	0.00074	0.56
61	Myanmar	0.00363	0.22	103	Namibia	0.00073	0.34
62	France	0.0036	0.89	104	Moldova	0.00071	0.41
63	Iraq	0.0035	0.19	105	Peru	0.0007	0.36
64	Australia	0.0033	0.9	106	USA	0.000654	1
65	Guinea	0.0031	0.05	107	Barbados	0.00055	0.58
66	Thailand	0.0031	0.59	108	Armenia	0.0005	0.39
67	Kyrgyzstan	0.003	0.25	109	Egypt	0.00047	0.38
68	Tajikistan	0.003	0.1	110	Burkina Faso	0.00036	0.06
69	Cyprus	0.00296	0.69	111	Laos	0.00035	0.19
70	Trind&Tobg	0.00284	0.45	112	Botswana	0.00034	0.26
71	Belgium	0.0028	0.9	113	Cameroon	0.00033	0.15
72	Jamaica	0.0028	0.32	114	Haiti	0.00033	0.04
73	Brazil	0.0027	0.65	115	Belize	0.00025	0.32
74	Sweden	0.00266	0.96	116	Senegal	0.00023	0.24
75	Costa Rica	0.00265	0.51	117	Togo	0.00022	0.17
76	Dominic. Rep	0.0024	0.33	118	Algeria	0.0002	0.31
77	Lebanon	0.00235	0.5	119	Cambodia	0.00015	0.26
78	Albania	0.0023	0.38	120	Rwanda	0.00015	0.15
79	China	0.0021	0.76	121	Kenya	0.000134	0.28
80	Korea Rep	0.00199	0.93	122	Indonesia	0.00011	0.4
81	Saudi Arabia	0.00199	0.57	123	Nepal	0.000098	0.26
82	New Zealand	0.0019	0.79	124	Sierra Leone	0.00008	0.05
83	Malawi	0.00165	0.12	125	Tanzania	0.00003	0.12
84	Jordan	0.0016	0.5	126	Zambia	0.00002	0.15
85	Mauritius	0.00144	0.45	127	Gambia	0.0000087	0
86	Mexico	0.0014	0.54	128	Nigeria	0.000008	0.2

The graph below represents a graphical regression analysis that shows there is no strong connection/relationship between the RFT Index and the ISO 9001: 2015 Index.



The three tables that follow provide statistical information on the connections/relationships between the RFT Index and the ISO 9001:2015 index, with R2 = 0.12414 suggesting a weak connection/relationship between these two indexes.

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.11142
R Square	0.012414
Adjusted R Square	0.004576
Standard Error	0.267869
Observations	128

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.113649	0.113649	1.583875	0.21053
Residual	126	9.040994	0.071754		
Total	127	9.154643			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.476053	0.026954	17.66147	6.89E-36	0.422711	0.529395	0.422711	0.529395
ISO 9001 index	2.448349	1.945418	1.258521	0.21053	-1.40158	6.298273	-1.40158	6.298273

These findings demonstrate that there is no connection or relationship between the RFT Index and the ISO 9001:2015 Index in practice.

Theory and Practice Implications

Concerning the theory, based on the final results of this research, a new window has been opened for further research on the field of relationships between technology development and quality management, particularly between the RFT Index and the ISO 9001:2015 Index, both of which are regarded as tools for improving life quality all over the world.

Limitations and further research

This study was conducted utilizing a large amount of RFT Index data and presenting for the first time statistics on the ISO 9001:2015 Index for the year 2021.

More study is needed to confirm that these relationships will be strengthened in the future, making RFT and the ISO 9001:2015 standard real tools for life quality improvement all around the world.

Conclusions and Recommendations

1. Scientific management of factors of production creates opportunities for long-term technology development, ensuring future generations' normal life and societal wealth, promoting economic growth, and improving quality of life without harming the environment, and this is urgently needed, using quality management principles and ISO standards as efficient and effective tools.

2. On the other hand, scientific management of production aspects involves the adoption of ISO standards, thus there should be a link and relationship between the RFT and ISO standards, ISO 9001:2015.

3. The research concludes that all interested parties, including individuals, public and private institutions, decision-makers, and civil society, should strive for and maintain sustainable development scenarios by utilizing quality management principles and ISO standards as efficient and effective tools. As an immediate priority, all stakeholders should work to establish the missing relationships and links between RFT and ISO standards.

4. There are no long-term and significant links between technology development and quality management / ISO standards, particularly the ISO 9001:2015 standard.

5. Improving quality management systems and adhering to ISO standards, in parallel with working toward technology development goals, will have a genuine impact on improving life quality around the world.

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