



STRATEGIC BUSINESS PLAN

ISO/TC 184

Automation systems and integration

Contents

EXECUTIVE SUMMARY	3
1. INTRODUCTION	5
1.1 ISO technical committees and business planning.....	5
1.2 International standardization and the role of ISO	5
2. BUSINESS ENVIRONMENT OF THE ISO/TC 184.....	6
2.1 Description of the Business Environment.....	6
2.2 Quantitative Indicators of the Business Environment.....	7
3. BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC	17
4. REPRESENTATION AND PARTICIPATION IN THE ISO/TC.....	17
4.1 Membership.....	17
4.2 Analysis of the participation	17
4.3 Interested parties in ISO/TC 184 work.....	17
4.4 International organizations in liaison with ISO/TC 184.....	18
5. OBJECTIVES OF THE ISO/TC AND STRATEGIES FOR THEIR ACHIEVEMENT.....	19
5.1 Defined objectives of the ISO/TC	19
5.2 Identified strategies to achieve the ISO/TC's defined objectives	20
5.3 Strategies related to ISO/TC 184 standards work.....	21
5.3.1 General approach.....	21
5.3.2 Specific approaches.....	22

5.4	Strategies related to TC organization.....	23
6.	FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC WORK PROGRAMME.....	24
7.	STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC.....	25
7.1	Information on ISO online.....	25
Annex A -	Reference information	25
Annex A.1 -	Glossary of terms and abbreviations used in ISO/TC Business Plans.....	25
“Manufacturing”:	25
“Smart automation”:	25
“Smart manufacturing”:	25
Annex A.2 -	General information on the context, concepts and principles of ISO's technical work	26
Annex A.3 -	Other standards development and setting organizations that may be relevant to “smart manufacturing” standardization efforts	28
Annex A.3.1 -	Committees with deliverables that may directly impact standards for smart manufacturing.....	28
Annex A.3.2 -	Committees with deliverables that may indirectly impact smart manufacturing standards.....	29

EXECUTIVE SUMMARY

Globally, most industries that provide products, services and supporting utilities, face an increasing number of challenges in a very competitive marketplace. These challenges include:

- Varying rates of change in requirements of industrial applications in different market regions,
- Increasing complexity of the provided systems in solutions to industry applications, and
- Completely addressing a solution's system architecture and lifecycle.

To face these challenges, standardization efforts in ISO/TC 184 can help when undertaking the following actions:

- Reduce significantly the costs and time of each step of the solution's lifecycle - design, production, delivery and support of both the products and the production systems;
- Improve customer satisfaction with better quality and greater reliability of the products and systems integrated in the solutions;
- Enhance the composability and interoperability of the varied components of a system solution and its interaction with other systems throughout its lifecycle;
- Enable building, sustaining and growing supply and value chain alliances to rapidly meet market demands;
- Serve and grow the markets served with innovative, safe, secure, cost-effective and timely products and services.
- Address the multiple lifecycles of the product, the production system and the business entities.

The main business response to these challenges includes investments in increased use of automation system capabilities and exploitation of manufacturing-integrated electronic business applications to gain competitive advantage.

In concert with the ISO Technical Management Board (TMB) vision of "smart manufacturing" the standards developed by ISO/TC 184 are intended to add value to such an investment in several ways:

- Enable a more efficient and effective capture, organization and description of the system requirements throughout its lifecycle. Optimize for integration and operation of the physical, human and information-handling elements (IT-based) that compose a system solution, and therefore reduce the cost of procurement, implementation and deployment of the required technologies, techniques, services and tools in a combined advanced manufacturing and electronic business collaboration environment.
- Relevant, timely, trustworthy and accessible information is a major asset in the supply chain throughout a product's lifecycle, and needs to be protected through the evolution of application systems and implementation platforms. ISO/TC 184 standards allow

product information to be communicated independent from applications, resulting in easy but secure communication and long term archiving throughout the product lifecycle.

- Changing business requirements also demand the capability for enterprises to flexibly configure their human, physical and information resources to support continuous improvements to products and processes. Again, ISO/TC 184 standard interfaces and integration principles facilitate changes to the configuration of system elements, while retaining the investment in individual elements and system architectures.
- In a business environment where enterprises increasingly consist of collections of separate organizations, ISO/TC 184 standards facilitate the rapid creation and modification of the interdependencies between the organizations, particularly in the complex interactions of a global supply chain.

Per the details in clause 2.1 Description of the Business Environment regarding the scope of ISO/TC 184, its standardization work deals with automation technologies, techniques and tools, including automated design and manufacturing equipment, control systems and the supporting information handling systems, communications, and human / physical interfaces required to integrate them in the world of the digital tapestry for the product lifecycle.

Stakeholders in the successful development of ISO/TC 184 standards, who actively participate, include major international companies from Automotive, Aeronautics, Space & Defense, Electric Device, Energy, Food & Beverage, Life Sciences, Petro-chemical, Consumer Packaged Goods, Metals & Mining, and Pharmaceutical, as well as, automation system providers and integrators, IT companies, research institutes, trade associations, consortia, academia and government agencies.

1. INTRODUCTION

1.1 *ISO technical committees and business planning*

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work programme with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

In a recent effort of the ISO Strategic Advisory Group on “smart manufacturing”, one of the resulting recommendations is to establish a “Smart Manufacturing Coordination Committee (SMCC)” to coordinate an ISO-wide effort on standards development pertaining to the “smart manufacturing” vision. This ISO/TC 184 business plan includes the SMCC as a key consideration.

1.2 *International standardization and the role of ISO*

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade. Three bodies are responsible for the planning, development and adoption of International Standards: [ISO](#) (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of [IEC](#) (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of [ITU](#) (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 164 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the [International Standard](#). An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase (the ISO Technical Enquiry). ISO and its [Technical Committees](#) are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members.

An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

2. BUSINESS ENVIRONMENT OF THE ISO/TC 184

2.1 Description of the Business Environment

The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

The current major economic and technical trends in the stakeholder industries, including initiatives like “smart manufacturing” are reflected in:

- Increasing industrial use of the Internet with the associated information and communication technologies;
- Use of continuing innovations in material technologies for sensing, actuating and human-interface systems in automation applications;
- Enhanced wide-area control and automation capabilities through the use of advanced platforms, including cloud computing servers, location-based services, virtual reality ensembles and “big data” networks;
- Improved coordination, cooperation and collaboration among stakeholders participating in a supply- and value- chain with next generation transport, logistics, tracking and tracing systems; and therefore forms the evolving “automation system” requirements in terms of integration and operation in the industries that will benefit from advances in “smart manufacturing” systems”.

These requirements emerge from the growth of electronic business collaboration between enterprises – fully supporting e-commerce and e-trade with the full range of cyber-physical systems and mechatronics collaboration that characterizes the design, manufacture and lifetime support of complex and widely-used products.

ISO/TC 184 scope of work is in line with this major trend, as it states:

Standardization in the field of automation systems and their integration for design, sourcing, manufacturing, production and delivery, support, maintenance and disposal of products and their associated services. Areas of standardization include information systems, automation and control systems and integration technologies.

Note: There will be active collaboration with the relevant technical committees responsible for areas such as machines, manufacturing resources and facilities, robotics, electrical and

electronic equipment, PLC for general application, quality management, industrial safety, information technologies, multi-media capabilities, and multi-modal communication networks.

Further, manufacturing industries will continue to evolve according to the following drivers:

- Manufacturing businesses will compete, more and more, to deliver increased customer satisfaction and product quality, along with increased efficiency, at lower costs, in a shorter lead time.
- There will be increased use of collaborative structures, involving partnerships, which may be created and dissolved rapidly to meet changing market needs.
- The various business functions performed throughout the lifecycle of a product will be undertaken by increasingly integrated processes, which will continue to be optimized to drive down costs and timescales. For example, the support of a complex product will be integrated with the technical definition and engineering of the product, along with the design and operation of the manufacturing processes to make the product, and the management of its configuration through its lifecycle.
- Manufacturing equipment will need to be capable of being deployed more flexibly to support manufacture of a variety of products.
- Customers are moving away from traditional process-oriented standards to an overall performance-related approach to products, which gives businesses some flexibility in determining how the required performance is to be delivered.
- For the foreseeable future, computer- and information technologies will continue to change and progress very rapidly.
- To remain up to date on the state of the art, the companies have to identify partners and to build alliances in automation spaces.
- To retain customers, the companies have to hide the complexity of the systems and simplify the user experience.
- For allowing a reduction of environmental footprint thanks to resource and material efficiency, the circular economy suggests to maintain equipment alive as long as possible during the complete product's life-cycle including the design, the production or re-manufacturing, shipping and distribution, the repair, collecting and recycling of material and finally the management of waste.
- Sustainable workforce and experience.

2.2 Quantitative Indicators of the Business Environment

The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the ISO/TC:

A list of industry groups that will most likely benefit from the “automation system & integration” standards developed by ISO/TC 184 can be gleaned from the following classifications:

- The **International Standard Industrial Classification of All Economic Activities (ISIC – Rev.4, 2008)**, a United Nations industry classification system that is used to classify data according to kind of economic activity in the fields of production;
- The **Global Industry Classification Standard (GICS)**, an industry taxonomy used by the global financial community to categorize all major public companies and used as a basis for Standard & Poor's (S&P), FTSE, Citibank and Morgan Stanley Capital International (MSCI) financial market.

In this strategic business plan, the sectors of interest derived from the **ISIC** and **GICS** taxonomies are as follows:

- Durables & Consumer Discretionary - Automobile & Components, Home Appliances, Textiles & Apparels, Toys
- Capital Goods & Transport/Storage Infrastructure – Aerospace & Defense, Construction & Engineering, Building Products, Machinery, Electrical Equipment, Airlines, Marine, Road & Rail, Other Freight & Logistics Infrastructure
- Energy & Utilities – Oil, Gas, Consumable Fuels, Equipment, Services Oil, Gas, Consumable Fuels, Equipment, Services, Electric, Gas, Water
- Health Care & Consumer Staples – Food, Pharmaceuticals, Beverages, Personal, Cosmetics, Household & other Bio-tech Products, and related Equipment, Supplies & Services
- Materials - Chemicals, Metals & Mining, Paper & Forest Products, Containers & Packaging, Construction Materials
- Information and Communications Technologies – Software & Services, Hardware & Equipment for Distribution & Storage, Peripherals, Electronic instruments & Components, Semiconductors
- Automation systems & Integrators – Designs, components, services, application system solutions, support tools

Other sectors of interest which are involved in the development and utilization of ISO/TC 184 international standards are industrial consortia, scientific and technical institutes, academia, and regulatory agencies which directly impact the industrial sectors of interest.

The enterprises belonging to these industry sectors represent the “smart automation system” application stakeholders that can benefit from the deliverables of ISO/TC 184 standardization efforts. ISO/TC 184 standards are applicable to all sizes of business, offering improved opportunities for supply chain integration and for extending manufacturing across the globe through the exploitation of electronic business collaboration.

To gauge the impact of ISO/TC 184 work, quantitative business indicators about top stakeholders in the following major sectors selected from the above lists of industry groups, can

be used to illustrate the extent of usage of “smart automation system” solutions that have enabled by ISO/TC 184 standards.

NOTE: The tables reflect the information available from publicly available sources at the time of the preparation of the changes to this business plan. *Readers are solicited to provide updated information regarding the tables by sending these to the ISO/TC 184 Secretariat.*

Table 1: Durables & Consumer Discretionary Sectors

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
VW Group	Germany	246	Automotive	Thru Liaison (ASAM)
Toyota	Japan	236	Automotive	
Daimler	Germany	166	Automotive	Thru National Body and Liaison (ASAM)
General Motors	U.S.A.	152	Automotive	Thru Liaison (ASAM)
Ford	U.S.A.	150	Automotive	
Fiat Chrysler	UK	123	Automotive	
Honda	Japan	118	Automotive	
BMW	Germany	108	Automotive	Thru National Body and Liaison (ASAM)
SAIC	China	102	Automotive	
Nissan	Japan	101	Automotive	
Hyundai Motors	South Korea	81	Automotive	
PSA	France	61	Automotive	Thru ISO/TC 184 / SC5
Kia	South Korea	44	Automotive	
Volvo	Sweden	37	Automotive	Thru National Body

Table 2: Capital Goods & Infrastructure Sectors

Name	Country	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
Boeing	U.S.A.	96.1	Aerospace & Defense	Yes
EADS	France	71.5	Aerospace & Defense	Yes
Caterpillar	U.S.A.	47.0	Equipment & Machinery	
Lockheed-Martin	U.S.A.	46.1	Aerospace & Defense	Yes

Name	Country	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
Hyundai Heavy Industries	South Korea	41	Equipment & Machinery	
Honeywell Intl	U.S.A.	36.8	Aerospace & Defense	
Mitsubishi Heavy Industries	Japan	34.2	Equipment & Machinery	Yes
General Dynamics	U.S.A.	31.5	Aerospace & Defense	
John Deere	U.S.A.	28.0	Equipment & Machinery	
CNH Industrial	UK	26.4	Equipment & Machinery	
BAE Systems	UK	25.6	Aerospace & Defense	Yes
Sumitomo Electric	Japan	24.5	Equipment & Machinery	
Northrup Grumman	U.S.A.	23.5	Aerospace & Defense	
Raytheon	U.S.A.	23.2	Aerospace & Defense	
Rolls-Royce Holdings	UK	21.0	Aerospace & Defense	
Eaton	Ireland	21	Automotive, Equipment & Machinery	

Revenue from Forbes (May 2016);

Table 3: Energy & Utilities Sectors

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
Saudi Aramco	Saudi Arabia EMEA	478	Integrated Oil & Gas	
Sinopec	China Asia-Pacific	456	Integrated Oil & Gas	
China National Petroleum Corp	China Asia-Pacific	429	Integrated Oil & Gas	
Exxon-Mobil	U.S.A. Americas	406	Integrated Oil & Gas	

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
PetroChina	China Asia-Pacific	368	Integrated Oil & Gas	
Royal Dutch Shell	Netherlands EMEA	265	Integrated Oil & Gas	ISO/TC 184/WG6
BP	UK EMEA	223	Integrated Oil & Gas	ISO/TC 184/WG6
Chevron	U.S.A. Americas	212	Integrated Oil & Gas	
Total SA	France EMEA	212	Integrated Oil & Gas	
Glencore Intl	Switzerland EMEA	170	Mining & Metals	
Petrobras	Brazil Americas	156	Integrated Oil & Gas	
Eni SPA	Italy EMEA	132	Integrated Oil & Gas	
Valero Energy	U.S.A. Americas	131	Oil & Gas Refining and Marketing	
Gazprom	Russia EMEA	122	Integrated Oil & Gas	
Conoco-Phillips	U.S.A. Americas	97	Oil & Gas Refining and Marketing	
EDF	France EMEA	97	Electric Utility	
Rosneft	Russia EMEA	81	Integrated Oil & Gas	
Marathon Petroleum	U.S.A. Americas	64	Oil & Gas Refining and Marketing	
ArcelorMittal	Luxembourg EMEA	64	Mining & Metals	
Citic Pacific	Hong Kong Asia-Pacific	54	Mining & Metals	
Korea Electric Power	South Korea Asia-Pacific	52	Electric Utility	
Posco	South Korea Asia-Pacific	48	Mining & Metals	
Reliance Industries	India Asia-Pacific	42	Oil & Gas Refining and Marketing	
Rio Tinto	UK EMEA	35	Mining & Metals	

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
BHP-Billiton	Australia Asia-Pacific	31	Mining & Metals	Liaison (Joint WG)

Revenue and Production from Forbes, Fortune, Platts (2015)

Table 4: Health Care & Consumer Staples Sectors

Name	Country / Region	Revenue (US\$B)	Industry Focus	Participation in ISO/TC 184
McKesson	U.S.A.	189	Pharmaceuticals	
Amerisource Bergen	U.S.A.	139	Pharmaceuticals	
Cargill	U.S.A.	120	Food	Thru Liaison & Meeting Host
Cardinal Health	U.S.A.	112	Pharmaceuticals	
Nestle	Switzerland	92	Food & Beverage	Thru Liaison
Johnson & Johnson	U.S.A.	70	Pharmaceuticals	
Procter & Gamble	Germany	69	Consumer Goods	Thru Liaison & Meeting Host
Archer Daniels - Midland	U.S.A.	67	Food & Farming	
Pepsico	U.S.A.	63	Food & Beverage	
Unilever	Netherlands	59	Consumer Goods	
Bayer	Germany	52	Pharmaceuticals	
Roche	Switzerland	50	Pharmaceuticals	
Novartis	Switzerland	49	Pharmaceuticals	
Pfizer	U.S.A.	49	Pharmaceuticals	
Sysco	U.S.A.	49	Food & Beverage	
JBS	Brazil	49	Food & Beverage	
Anheuser- Busch/InBev	Belgium	44	Food & Beverage	
Coca-Cola	U.S.A.	44	Food & Beverage	
Sanofi	France	41	Pharmaceuticals	
Christian Dior	France	41	Consumer Goods	
Tyson Foods	U.S.A.	40	Food & Beverage	
Wilmar Intl	Singapore	39	Food & Beverage	
George Weston	Canada	37	Food & Beverage	
3M	U.S.A.	30	Consumer Goods	Thru Liaison
SAB-Miller-Coors	UK	21	Food & Beverage	Thru Liaison & Meeting Host
Kraft Heinz	Canada	20	Food & Beverage	

Revenues (2015) for Food & Beverage companies from globalEDGE.

Table 5: Materials Sectors

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
BASF	Germany	78	Chemicals	
International Paper	U.S.A.	25	Paper & Forest Products	
Du Pont	U.S.A.	28	Chemicals	
Dow Chemical	U.S.A.	49	Chemicals	Thru Liaison
Georgia Pacific	U.S.A.	23	Paper & Forest Products	Thru Liaison & Meeting Host

Table 6: Information and Communications Technologies Sector

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
Apple	U.S.A.	234	Electronics & Entertainment	
Samsung	South Korea	177	Electronics & Appliances	
Microsoft	U.S.A.	98	Software, Services & Electronics	
Hewlett-Packard	U.S.A.	88	Electronics & Services	
Hitachi	Japan	84	Equipment, Machinery, Appliances	
IBM	U.S.A.	83	Electronics, Software & Services	
Alphabet Google	U.S.A.	77	Software, Services & Electronics	
Sony	Japan	68	Electronics, Appliances, Entertainment	
United Tech	U.S.A.	59	Electronics, Space & Defence	
Intel	U.S.A.	56	Electronics	
Toshiba	Japan	53	Electronics, Appliances, Machinery	ISO/TC 184/WG 6

Name	Country / Region	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
LG Electronics	South Korea	50	Electronics, Appliances	
Cisco	U.S.A.	50	Software, Network services	
Oracle	U.S.A.	39	Software & Services	
SAP	Germany	23	Software & Services	ISO/TC 184/SC 5/WG 9

Note: Revenue and Human Resources quantities from Forbes 2015 report.

Table 7: Global automation companies supplying automation systems to industrial applications

Name	Country / Region	Automation / (Total Revenues) ** (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
Siemens	Germany	12 (86)	Automation, Energy, Machinery, Communications, Health Care, Electronics	Yes SC1, SC4, SC5/JWG5 & Meeting Host
ABB	Sweden, Switzerland	9.3 (36)	Automation, Energy, Equipment & Machinery	Yes
Emerson	U.S.A.	8.6 (21)	Automation, Electronics, Machinery, Appliances	
Schneider Electric	France	6.4 (30)	Automation, Energy, Equipment & Machinery	Yes SC5/JWG5, WG9, WG10 & Meeting Host
Rockwell Automation	U.S.A.	6.2 (6.2)	Automation	Yes ISO/TC 184, SC5, ISO/TC 184/WG6 & Meeting Host
Mitsubishi Electric	Japan	3.5	Automation, Equipment & Machinery	Yes

General Electric	U.S.A.	3.5 (122)	Aerospace, Equipment & Machinery, Health Care, Appliances, Electronics, Automation	
Honeywell	U.S.A.	3.4 (39)	Aerospace & Defence, Equipment, Automation, Appliances	
Danaher	U.S.A.	3.3 (21)	Automation, Equipment & Machinery	
Yokogawa Electric	Japan	3.1	Automation, Equipment	Yes ISO/TC 184/WG6 SC5/JWG5, WG10 & Meeting Host

** Revenue of global automation vendors in 2015 per ARC Advisory Group and Control Magazine.

Table 8: Software companies dedicated to industrial applications

Name	Country	Revenue (US\$B)	Industry focus & Comments	Participation in ISO/TC 184
OSIsoft	U.S.A.	0.330	Software & Services	Thru Liaison
Softing AG	Germany	0.087	Software & Services	
Aspen-Tech	U.S.A.	0.473	Software & Services	
Guardus Solutions AG	Germany		Software & Services	SC5/WG9
Accenture	U.S.A.	35	Software & Services	
Advanced Consulting Services (ACS)	Korea		Software & Services	SC5/WG9
Tekniker	Spain	0.025	Metrology Services	SC5/JWG5 & Meeting Host

Sources: BusinessWire

Industrial software and services sector includes companies involved in the design, development, marketing, and support of industrial software solutions and companies that provide computer-aided design (CAD), computer-aided engineering (CAE) and engineering software, computer

services such as design automation, design analysis and optimization, maintenance and system integration.

Table 9: Consortia serving “automation system” applications in “smart manufacturing” industries

Name	Country / Region	Membershi p	Industry focus & Comments	Participation in ISO/TC 184
Open Devicenet Vendors Association (ODVA)	U.S.A.		Automation, Communication	Thru Liaison
Profibus-Profinet	Germany		Automation, Communication	Thru Liaison
Industrial Internet Consortium (IIC)	U.S.A.		Communication & Services	
OPC	U.S.A.		Automation, Software & Services	
MESA Intl.	U.S.A.		Software & Services	Thru Liaison
OMG	U.S.A.		Software & Services	Thru Liaison
INCOSE	U.S.A.		Software & Services	Thru Liaison

3. BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC

The main benefit of ISO/TC 184 efforts is to enable the growth of the automation market by delivering “smart manufacturing” automation system standards that enable interoperability with IT and Internet platforms and support integration of applications within an enterprise and across the supply-chains in which the enterprise participates.

More precisely, the implementation of ISO/TC 184 standards in an electronic business collaboration environment will also serve to:

- Reduce the costs of integration for individual systems.
- Facilitate the integration of new processes and technologies, without disrupting the existing environment.
- Facilitate changes to the configuration of system elements, while retaining the investment in individual elements.
- Facilitate the rapid creation and modification of alliances between organizations, particularly in the complex interactions of a global supply chain.
- Avoid the expense for small companies in developing one-of-a-kind “automation system” solutions to serve a variety of customers.
- Integrate new technologies and techniques while exploiting existing investments in standards-based system architectures.
- Flexibly configure automated system elements to support continuous process improvement.
- Remove constraints of proprietary data as a barrier to trade.
- Provide open data to support the new industrial environment.
- Promote use at the regional, national and international level.
- Facilitate innovation and process improvement.

4. REPRESENTATION AND PARTICIPATION IN THE ISO/TC

4.1 Membership

Countries/ISO member bodies that are P and O members of the ISO committee – [see link](#).

4.2 Analysis of the participation

While there are twenty participating members of the TC, the very active countries are the ones which have the top market players in the major sectors listed in the tables in Clause 2.2 Quantitative Indicators of the Business Environment.

4.3 Interested parties in ISO/TC 184 work

The market for ISO/TC 184 standards comprises three main groups:

- Industrial enterprises and their product suppliers, who are customers for automation systems and services to meet their business needs, and have a substantial opportunity

to benefit from investment in the definition of standards to simplify the integration of the elements of the automation system solutions.

- Suppliers of elements of automation systems, such as, equipment, devices, software, services and IT products, to one or more industry sectors and the systems integrators, engineering, procurement and commissioning (EPC) groups, who provide services that combine elements from different suppliers into automation solutions and deliver these solutions to enterprises; such organizations may be considered as both users and suppliers.
- Governments and authorities having jurisdiction regarding the products and services covered by the standards of ISO/TC 184, as well as, direct consumers of industrial data and the transfer of the data to and from adjacent markets.

4.4 International organizations in liaison with ISO/TC 184

The standards and specifications required by manufacturing industry may come from a range of sources, such as:

- ISO, IEC, JTC1, UN/CEFACT, CEN (European Committee for Standardization) and CENELEC (European Committee for Electrotechnical Standardization), CANENA (Council for Harmonization of Electrotechnical Standards of the Nations of the Americas) and COPANT (Pan American Standards Commission);
- Coordination Groups (namely MoU Management Group on Electronic Business, IEC SyCC);
- Consortia (such as OMG, W3C, OASIS, ASAM, IAI, ODVA, PSLX, FDT, MESA, INCOSE);
- Industry Trade Association (like ASD and AIA)
- Sectorial organizations (like ISA, IEEE, NEMA and NIST);
- Workshops of all types, recognizing their different scope, expertise and competencies;
- Regional initiatives, such as, Industrie du Futur (FR), Industry 4.0 (DE), Smart Manufacturing (US), China 2025 (CN), Manufacturing 3.0 (KR), Smart Industry (SE), etc.
- Organizations noted in the list of liaisons included in clause 7.1 Information on ISO online.

Consequently, a strong and effective liaison policy along with a specific procedure called the “harvesting procedure” has been set up to accommodate work developed outside ISO/TC 184.

5. OBJECTIVES OF THE ISO/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

5.1 *Defined objectives of the ISO/TC*

As noted in its scope statement, the overall mission of standardization pertaining to automation systems and integration within ISO/TC 184 and its SCs is to ensure timely availability of a consistent and coherent set of globally relevant standards for the design, development and delivery of the products. In addition, ISO/TC 184 enables the associated procurement, manufacturing and delivery systems and their integration within and across enterprises, including support for supply chain management and electronic business collaboration. Finally, ISO/TC 184 standards meet current and planned industry requirements according to ISO vision and policy.

The ISO/TC 184 standards are developed through collaboration between many different interested parties and must be interoperable to support the integration of manufacturing systems.

For those reasons, the specific objectives of ISO/TC 184 and its SCs are to:

- Act as a focal point at the international level for the identification of standardization needs to address manufacturing automation and business issues throughout the product lifecycle.
- Offer frameworks to describe standardization requirements for automation and information systems to address those issues.
- Identify or develop internationally accepted standards for manufacturing systems, information support platforms and integration architectures to meet the requirements, seeking them from other sources where appropriate.
- Ensure that the resulting standards can be implementable, testable and harmonized with other complementary and supplementary standards.
- Facilitate technological innovation and business cooperation, using good quality and relevant standards as agents for expressing industry application requirements and multi-sourced solutions.
- Promote the understanding and use of ISO/TC 184 work and outcomes in companies throughout the global market.
- Promote the exploitation of ISO/TC 184 standards by other standards groups.
- Propose a common approach to specify classes and properties of multi-sourced products to facilitate integration in smart automation systems.
- Promote the use of ISO/TC 184 standards at the regional, national and international level.

5.2 Identified strategies to achieve the ISO/TC's defined objectives

In elaborating the scope of ISO/TC 184, restated below,

Standardization in the field of automation systems and their integration for design, sourcing, manufacturing, production and delivery, support, maintenance and disposal of products and their associated services. Areas of standardization include information systems, automation and control systems and integration technologies.

Note: There will be active collaboration with the relevant technical committees responsible for areas such as machines, manufacturing resources and facilities, robotics, electrical and electronic equipment, PLC for general application, quality management, industrial safety, information technologies, multi-media capabilities, and multi-modal communication networks.

The design, sourcing, manufacturing/production, delivery, support, maintenance and disposal of the products and associated services reflect the various phases of a product's entire lifecycle, as well as, the lifecycles of the systems required to perform the phases of a product lifecycle.

An important tool for ISO/TC 184 work is a standardization framework to identify the various areas in the "smart automation system" domain that can be enabled with international standards.

The ISO/TC 184 "Big Picture" project, done in collaboration with IEC/TC 65, is one example of an approach to characterize and organize standards, in terms of their intended use within the domain of "smart manufacturing" applications.

This "Big Picture" framework can assist the ISO/TC 184 team when participating in the task of the ISO/TMB Coordinating Committee on "Smart Manufacturing" standardization across the various ISO technical committees and related external organizations. Such a framework can assist in denoting gaps, overlaps and conflicts among the standardization work items proposed, planned, under development or published in the relevant standards development and setting organizations. The target audience for the framework include the developers of standards and the manufacturers and users of the standards-enabled "automation systems".

Also, a "Smart Thru-Life Automation Architecture" Ad Hoc Group is being undertaken in ISO/TC 184 to support the ISO/TMB Coordinating Committee initiative on "smart manufacturing".

5.3 Strategies related to ISO/TC 184 standards work

5.3.1 General approach

The scope of interest of ISO TC/184 includes both:

- Those areas of standardization which fall directly within its scope,
- And the task of ensuring that manufacturing automation standards originating either inside or outside ISO/TC 184 can be integrated into operational systems.

To reach its objectives, ISO/TC 184 has therefore adopted the following strategies:

- 1.** Development of high-level architectures for automation systems, which form an essential framework tool for assessing standards opportunities arising from new technologies and techniques. These architectural-oriented standards form a crucial tool for managing the standards process and their direct value for the market come from the interoperability and integration methodologies.
- 2.** Development of standards for automation within the scope of ISO/TC 184, including but not limited to the following:
 - Enterprise modelling, integration services, and system architectures.
 - Numerical control of machine tools.
 - Integration of robotic systems and their physical interfaces.
 - Product definition data through the entire lifecycle, including engineering analysis and component libraries.
 - Manufacturing management information, including Manufacturing Operations Management (MOM) and Manufacturing Execution Systems (MES).
 - Manufacturing communication systems.
 - Manufacturing terminology.
 - Integration and control of elements of manufacturing systems.
 - Integration of manufacturing systems into the total enterprise.
 - Interoperability of manufacturing processes.
 - Neutral representation of manufacturing ontologies.
 - Manufacturing application integration frameworks.
 - Enterprise (domain)-control (domain) integration.
 - Manufacturing software and its environment.
 - Modeling of manufacturing technology.
 - Industrial data quality.
 - Industrial data quality management systems.
 - 3D Visualization for industrial purposes.
 - Oil and Gas process data.
- 3.** Assessment of those standards for gaps and overlaps contributing to a complete standards portfolio against the high-level architectural framework with roadmaps of development for these standards.

5.3.2 Specific approaches

In particular, recent periodic strategy reviews in the subcommittees resulted in identifying the following focus areas for integration, interoperability and composability frameworks for applications of automation systems in enterprises participating in the “smart manufacturing” industries. The committee will progress towards a working document that expresses this architectural framework in collaboration with other committees of related areas of scope. These focus areas for new work items for standardization include the following:

- interoperability between “automation system” entities involving the transfer, sharing or exchange of data, information, knowledge and the software to handle the associated processing.
- interoperability between processes involving the transfer, sharing or exchange of activity sequences and the synchronization of these sequences and conveyance aspects.
- integration of various types of entities to compose systems consisting of automation applications and business applications to form an enterprise application.
- “thru life” architecture of automation applications composed of a system of resources and processes.
- interoperability, composability, integration, modeling, simulation and architectures for enterprise solutions involving combinations of automation applications and business applications to enable participation in a supply chain.
- interoperability, composability, integration, and architectures for enterprise automation system solutions involving emerging technical disciplines, such as, Internet of Things.
- integration of “automation systems” to support enterprise functions of planning, procuring, scheduling, dispatching, executing and tracking enterprise resources, assets and supporting infrastructures.

Consideration of areas of standardization which are undertaken by other standards bodies, from the viewpoint of integration. This work is undertaken through appropriate liaisons and includes:

- Physical and electrical interfaces in machine tools.
- Cutting tools.
- Industrial robotic systems.
- Coordinate measuring machines.
- Electronic commerce, including electronic business collaboration coordination.
- Other product definitions, including PCB and chip design, optical instruments, shipbuilding, geographic information systems.
- Information derived from product definitions, such as technical documentation.
- Power supply and other environmental issues.
- Automatic data capture for manufacturing applications.
- Distributed control systems for industrial process control.

- Diagnostic processes and condition based monitoring.
- Device, communication, equipment, information exchange and application profiles.

Promotion of ISO/TC 184 results in other standards groups through appropriate liaisons, to maximize synergy and facilitate integration.

5.4 Strategies related to TC organization

In order to maximize the value to industry, a number of organizational strategies are used to foster ISO/TC 184 work:

- Maintain a high level of participation of the International leaders from the main Manufacturing sectors to ensure relevance of the standardization work to new industrial requirements.
- Optimize the standard development processes within ISO/TC 184 in order to get timely and unambiguous standards. ISO/TC 184 work is divided among three Sub-Committees:
 - Physical device control (ISO/TC 184/SC 1 work).
 - Modelling of industrial, technical and scientific data to support electronic communication and commerce (ISO/TC 184/SC 4 work).
 - Modelling of enterprise architecture, communications, resources, processes and applications to support manufacturing system integration and application integration frameworks (ISO/TC 184/SC 5 work).
- Establish clear rules of co-ordination with other organizations to ensure that the development of the required automation system standards is as efficient as possible, where standards are developed outside the scope of ISO/TC 184.
- Maximize the synergies within ISO/TC 184 in order to develop a programme for the promotion of the work.
- Define the reference system architecture for “Smart Manufacturing” domain in collaboration with relevant standardization bodies.

6. FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC WORK PROGRAMME

Considering the strong links needed between ISO/TC 184 work and the development of advanced manufacturing IT tools and the Internet, the main factors that could negatively impact the work appear to be:

- Insufficient collaboration among developers and implementers of standards and conformity assessment schemes dealing with key components of a “smart automation” system, such as machines, robotics, and software.
- Late publication of standards that turn out to be incompatible with the demands of the advanced manufacturing applications or no longer meet industrial requirements.
- Wrong choices of New Work Items to be initiated or inappropriate view of what is to be standardized and not to be standardized.
- Lack of a detailed and practical guideline to assist proposers in preparing globally relevant NWIs.
- Copyright protection and paid access to our standards when the products of other groups are freely available at no cost.
- Lack of overarching reference model.
- Demographic profile of participating experts.
- Lack of collaborative attitude by individuals TCs pursuing their own separate strategies.
- Succession plans of TCs in large blocks contributing to knowledge transition gaps.

A further negative factor emerges from inadequate support to promote and to assist in the use of standards regarding high-level architectural requirements for smart automation systems. The likelihood of this situation may be minimized by making such documents freely available to the stakeholders in the smart manufacturing sectors, such as promotional material that also describe the more concrete product, information and integration standards.

Last but not least, there is also a risk that, due to the size of the sectors to which ISO/TC 184 is relevant, some competing initiatives that can provide smart automation system solutions not based on ISO/TC184 standards, can gain momentum in isolation.

7. STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC

7.1 Information on ISO online

The link below is to the TC's page on ISO's website:

<https://www.iso.org/committee/54110.html>

Click on the tabs and links on this page to find the following information:

- About (Secretariat, Secretary, Chair, Date of creation, Scope, etc.)
- Contact details
- Structure (Subcommittees and working groups)
- Liaisons
- Meetings
- Tools
- Work programme (published standards and standards under development)

Annex A - Reference information

Annex A.1 - Glossary of terms and abbreviations used in ISO/TC Business Plans

“Manufacturing”:

Activity domains involving a system of resources, personnel, activities, procedures and approaches, enabled by a broad range of “smart” technologies (e.g. material, energy, information, communication, control, human interfacing and automation) and associated techniques, tools and service platforms, such that in terms of functional, technical and organizational views, the system’s architecture and thru-life operation, are intended to provide capabilities to enable the enterprise to achieve its business goals;

Also, a particular way of looking at, or thinking about or describing an activity, process or operation when making a product.

“Smart automation”:

Optimal system of resources, and procedures that provides a well-defined set of capabilities required to accomplish a particular objective associated with a “manufacturing application” of an enterprise, in a manner considered to be autonomous, efficient, effective, safe, secure and sustainable, within the target industry.

“Smart manufacturing”:

A manufacturing paradigm enabled by advanced technologies, especially “smart automation” and supported by proven, as well as, emerging techniques, tools and service platforms, in order to extend an enterprise’s capabilities to make and execute timely, comprehensive and actionable decisions to achieve the business goals, throughout the lifetime of an enterprise. The adoption and maturity level of “smart manufacturing” will progress at different rates across various industries and regions.

Annex A.2 - General information on the context, concepts and principles of ISO's technical work

"Smart Manufacturing" Industry:

Industries within an economy which are involved in the (i) development, production and delivery of goods and related services; (ii) extraction, conversion and transport of materials and energy; (iii) provision of information and communications platforms and services to enable the activities in (i) and (ii).

An industry is often named after its principal product; for example, the auto industry. For statistical purposes, industries are categorized generally according a uniform classification code such as Standard Industrial Classification (SIC).

An industry is considered to be comprised of enterprises involved in one or more phases of the lifecycle of the principal product in an industry, located in some country, region or economy.

"Industrial revolution":

Changes in one or more industries driven by the combined developers of the key technologies enabling the major principal products in the period of interest and the majority of the adopters and consumers of these principal products.

Examples of industrial revolutions:

- 1st (before mid-19th century): Major shift from animals and human effort to fossils fuels and mechanical power, such as, use of water and steam power to mechanize production to reduce human effort;
- 2nd (circa end of 19th century to first 20 years of 20th century): Significant increase in use of electric power to realize mass production in order to provide to the population.
- 3rd (around 1950-1998): Widespread use of electronics and information technology to automate production and improved product quality to leverage data.
- 4th (starting 2000-present): Emergent forms of interdependent production, management and regulatory systems driven by fusion of physical, digital and biological technologies and mathematical techniques to leverage ubiquitous connectivity independent of location.

The 4th Industrial Revolution continues to occur in the well-developed economies while the 3rd Industrial Revolution continues to spread and mature across the emerging economies. The increased use of advanced manufacturing and robotic systems can reduce those comparative advantages realized when manufacturing labor-intensive goods and services in developing economies.

In general, some expectations of the 4th industrial revolution:

- Continued improvements in productivity and distribution leading to lower costs of business, commerce and trade, and fostering economic growth.
- Rapid technology innovation that can significantly change product quality, price and availability and create intensive producer-consumer relationships.
- Increasing displacement of skill-limited workers by smart automation systems, but enhanced safety of the operating environment.
- Better access to needed information, resources and other personnel via widely connected smart, mobile devices.

Examples of key technologies impacting use of “automation systems” in “smart manufacturing applications”

The complexity of the technologies and the extent of their impact require more innovative approaches, in particular, when dealing with the development, commercialization and utilization these combined technologies. Technology innovations in areas, such as, advanced sensors and actuators, quantum computing, nanotechnology, robotics and artificial intelligence, energy and information storage, 3D printing, virtual reality rendering platforms, internet-of-things networks, bio-mimetic machines, and autonomous transport units will require more cross-technology standards to facilitate composability of advanced cyber-physical “automation” systems.

For example:

- Massively parallel computing platforms that can handle very large amounts of streaming live data, and can support deep pattern analysis and rapid decision-making, potentially exceeding the processing capacity of humans.
- Networks of very large number of sensors, embedded in identifiable and traceable automation units, distributed across a wide area and sharing streaming data that enable coordination, cooperation and collaboration among autonomous automation systems.
- 3D printing systems that enable greater precision and higher accuracy in producing the results of more complex CAD, CAE and CAM outputs, with a broad range of advanced materials, including nanomaterials and bio-chemical synthetics.
- Blockchain-based trustworthy transaction systems to support a more secure “smart manufacturing” supply chain.

NOTE: The scope and work programmes of the following technical committees have not been reviewed in detail. These efforts are noted for future consideration. The lists will be revised to include only those committees that ISO/TC 184 will have either joint efforts or liaison arrangements.

Annex A.3 - Other standards development and setting organizations that may be relevant to “smart manufacturing” standardization efforts

Annex A.3.1 - Committees with deliverables that may directly impact standards for smart manufacturing

<i>ISO/TC 10</i>	<i>Technical product documentation</i>
<i>ISO/TC 12</i>	<i>Quantities and units</i>
<i>ISO/TC 14</i>	<i>Shafts for machinery and accessories</i>
<i>ISO/TC 39</i>	<i>Machine tools</i>
<i>ISO/TC 44</i>	<i>Welding and allied processes</i>
<i>ISO/TC 51</i>	<i>Pallets for unit load method of materials handling</i>
<i>ISO/TC 59</i>	<i>Buildings and civil engineering works</i>
<i>ISO/TC 67</i>	<i>Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries</i>
<i>ISO/TC 94</i>	<i>Personal safety -- Protective clothing and equipment</i>
<i>ISO/TC 108</i>	<i>Mechanical vibration, shock and condition monitoring</i>
<i>ISO/TC 122</i>	<i>Packaging</i>
<i>ISO/TC 145</i>	<i>Graphical symbols</i>
<i>ISO/TC 94</i>	<i>Personal safety -- Protective clothing and equipment</i>
<i>ISO/TC 108</i>	<i>Mechanical vibration, shock and condition monitoring</i>
<i>ISO/TC 122</i>	<i>Packaging</i>
<i>ISO/TC 145</i>	<i>Graphical symbols</i>
<i>ISO/TC 199</i>	<i>Safety of machinery</i>
<i>ISO/TC 203</i>	<i>Technical energy systems</i>
<i>ISO/TC 204</i>	<i>Intelligent transport systems</i>
<i>ISO/TC 195</i>	<i>Building construction machinery and equipment</i>
<i>ISO/TC 207</i>	<i>Environmental management</i>
<i>ISO/TC 211</i>	<i>Geographic information/Geomatics</i>
<i>ISO/TC 242</i>	<i>Energy Management</i>
<i>ISO/TC 261</i>	<i>Additive manufacturing</i>
<i>ISO/PC 283</i>	<i>Occupational health and safety management systems</i>
<i>ISO/PC 286</i>	<i>Collaborative business relationship management – Framework</i>
<i>ISO/TC 292</i>	<i>Security</i>
<i>ISO/TC 299</i>	<i>Robotics</i>
<i>ISO/TC 307</i>	<i>Blockchain and electronic distributed ledger technologies</i>

ISO/TMB/CC “Smart manufacturing” Standards Coordinating Committee

<i>IEC/TC 1</i>	<i>Terminology</i>
<i>IEC/TC 2</i>	<i>Rotating machinery</i>
<i>IEC/TC 3</i>	<i>Information structures and elements, identification and marking principles, documentation and graphical symbols</i>
<i>IEC/TC 8</i>	<i>Systems aspects for electrical energy supply</i>
<i>IEC/TC 13</i>	<i>Electrical energy measurement and control</i>
<i>IEC/TC 22</i>	<i>Power electronic systems and equipment</i>
<i>IEC/TC 23</i>	<i>Electrical accessories</i>
<i>IEC/TC 25</i>	<i>Quantities and units</i>
<i>IEC/TC 44</i>	<i>Safety of machinery - Electrotechnical aspects</i>
<i>IEC/TC 48</i>	<i>Electrical connectors and mechanical structures for electrical and electronic equipment</i>
<i>IEC/TC 56</i>	<i>Dependability</i>
<i>IEC/TC 57</i>	<i>Power systems management and associated information exchange</i>
<i>IEC/TC 64</i>	<i>Electrical installations and protection against electric shock</i>
<i>IEC/TC 65</i>	<i>Industrial-process measurement, control and automation</i>
<i>IEC/TC 66</i>	<i>Safety of measuring, control and laboratory equipment</i>
<i>IEC/TC 72</i>	<i>Automatic electrical controls</i>
<i>IEC/TC 78</i>	<i>Live Working</i>
<i>IEC/TC 79</i>	<i>Alarm and electronic security systems</i>
<i>IEC/TC 85</i>	<i>Measuring equipment for electrical and electromagnetic quantities</i>
<i>IEC/TC 91</i>	<i>Electronics assembly technology</i>
<i>IEC/TC 100</i>	<i>Audio, video and multimedia systems and equipment</i>
<i>IEC/TC 103</i>	<i>Transmitting equipment for radiocommunication</i>
<i>IEC/TC 108</i>	<i>Safety of electronic equipment within the field of audio/video, information technology and communication technology</i>
<i>IEC/TC 110</i>	<i>Electronic display devices</i>
<i>IEC/TC 111</i>	<i>Environmental standardization for electrical and electronic products and systems</i>
<i>IEC/TC 113</i>	<i>Nanotechnology</i>
<i>IEC/TC 116</i>	<i>Safety of motor-operated electric tools</i>
<i>IEC/PC 118</i>	<i>Smart grid user interface</i>

IEC/SEG 7 *Smart Manufacturing*

ISO/IEC JTC 1 *Information technologies*

Annex A.3.2 - Committees with deliverables that may indirectly impact smart manufacturing standards

<i>ISO/TC 17</i>	<i>Steel</i>
<i>ISO/TC 22</i>	<i>Road vehicles</i>
<i>ISO/TC 23</i>	<i>Tractors and machinery for agriculture and forestry</i>

<i>ISO/TC 29</i>	<i>Small tools</i>
<i>ISO/TC 37</i>	<i>Terminology and other language and content resources</i>
<i>ISO/TC 38</i>	<i>Textiles</i>
<i>ISO/TC 46</i>	<i>Information and documentation</i>
<i>ISO/TC 72</i>	<i>Textile machinery and accessories</i>
<i>ISO/TC 154</i>	<i>Processes, data elements and documents in commerce, industry and administration</i>
<i>ISO/TC 159</i>	<i>Ergonomics</i>
<i>ISO/TC 176</i>	<i>Quality management and quality assurance</i>
<i>ISO/TC 232</i>	<i>Learning services outside formal education</i>
<i>ISO/TC 269</i>	<i>Railway applications</i>
<i>ISO/PC 288</i>	<i>Educational organizations management systems - Requirements with guidance for use</i>
<i>IEC/TC 80</i>	<i>Maritime navigation and radio communication equipment and systems</i>