HL-LHC Project risks assessment

EDMS 2505691

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MARP meeting #33 - https://indico.cern.ch/event/1015481/

Outline

1. Risk assessment. Main approach
2. Methodology
3. Risk Register – How is it done?
4. Main Outcomes from last exercise
5. Conclusions

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Frame

Risks affecting organizations can have **consequences** in terms of **economic performance** and **professional reputation**.

Managing risk effectively helps organizations to perform well in an **environment** full of **uncertainties**.

The standards used worldwide are:

- **ISO 31000:2018** *Risk management – Principles and guidelines*, provides principles, framework and a process for managing risk. It can be used by any organization regardless of its size, activity or sector.
- **ISO Guide 73:2009**, *Risk management - Vocabulary* complements ISO 31000 by providing a collection of terms and definitions relating to the management of risk.
- **IEC 31010:2019**, *Risk management – Risk assessment techniques* focuses on risk assessment.

What?

Risk assessment attempts to answer the following **fundamental questions**:

- What can happen and why (by risk identification)?
- What are the consequences?
- What is the probability of their future occurrence?
- Are there any factors that mitigate the consequence of the risk or that reduce the probability of the risk to occurr?

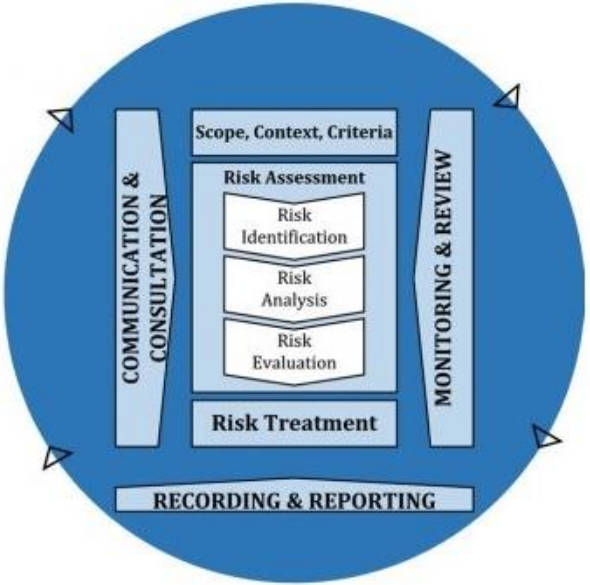
Why?

The **purpose** of risk assessment is to provide **evidence-based information** and **analysis** to make **informed decisions** on how to treat particular risks and how to **select between options**. Some of the principal benefits of performing risk assessment include:

- Understanding the risk and its potential impact upon objectives;
- Providing information for decision makers;
- Contributing to the understanding of risks, in order to assist in their treatment options;
- Identifying the important contributors to risks;
- Comparing risks in alternative systems, technologies or approaches;
- Assisting with establishing priorities;
- Contributing towards incident prevention based upon post-incident investigation;

Steps to be done

- Risk **Identification**
- Risk **Analysis**
- Risk **Evaluation**
- Risk **Treatment**
- Risk **Monitoring and Review**
- Risk **Communication**



Risk identification

- The purpose of **risk identification** is to **identify** what might happen or what **situations** might exist that might affect the achievement of the objectives of the system or organization. Once a risk is identified, the organization should identify any existing controls such as design features, people, processes and systems.
- The risk identification process includes **identifying** the **causes** and **source** of the risk (hazard in the context of physical harm), **events**, **situations** or **circumstances** which could have a material impact upon objectives and the nature of that impact.

Risk Analysis

- Risk **analysis** consists of determining the **Consequences** and their probabilities for identified risk events, taking into account the presence (or not) and the effectiveness of any existing controls
- An event can have multiple consequences and can affect multiple objectives. Existing risk controls and their effectiveness should be taken into account
- **Vulnerability** can replace Probability when a consequence can occur as a result of a range of different events or conditions, or where the specific event is not identified

Risk evaluation and Treatment

Risk **evaluation** involves **comparing** estimated levels of risk with risk criteria defined.

Risk **evaluation** uses the understanding of risk obtained during risk analysis **to make decisions about future actions**. Ethical, legal, financial and other considerations, including perceptions of risk, are also inputs to the decision. **Decisions** may include:

- whether a risk needs treatment;
- priorities for treatment;
- whether an activity should be undertaken;
- which of a number of paths should be followed.

Monitoring & review and communication

- The risk assessment process will highlight context and other **factors** that might be expected **to vary over time** and which could change or invalidate the risk assessment. These **factors** should be specifically **identified** for on-going **monitoring and review**, so that the risk assessment can be updated when necessary.

- **Data** to be **monitored** in order to **refine** the **risk assessment** should also be identified and collected.

- The **effectiveness** of controls should also be **monitored** and **documented** in order to provide data for use in risk analysis. Accountabilities for creation and reviewing the evidence and documentation should be defined.

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Risks and Risks

Risk is very **subjective**. Whatever methodology we use will be subject to the “willingness” to take risks and to the subjective appreciation of the impact of the identified risks

Methodology used

- Since 2017 we have used the **methodology** implemented in **2012** for **CERN** as an action requested by the Council to the DG to be integrated within the Auditing System.
- This implementation was supported by '**Deloitte**' to implement at CERN a **Risk management system adapted to our "Special nature"**.
- From the more than 50 known methodologies **was selected** the "**Risk intelligence map**" with **Brainstorming sessions**.
- For HL-LHC, the same exercise is repeated within the WPs
  (See EDMS 1518363 with the full procedure)
  - From the Risk intelligence map, the HL-LHC management selects those that are applicable to the HL-LHC Project for further assessment
  - The WPLs asses the impact and the vulnerability following a pre-agreed matrix
  - The results are fine tuned (discussion between WPL and HL management for clarifications and /or major discrepancies
  - The top risks are then identified and action plans are established
  - The risks and the actions are re-evaluated every year

Risk Intelligence map

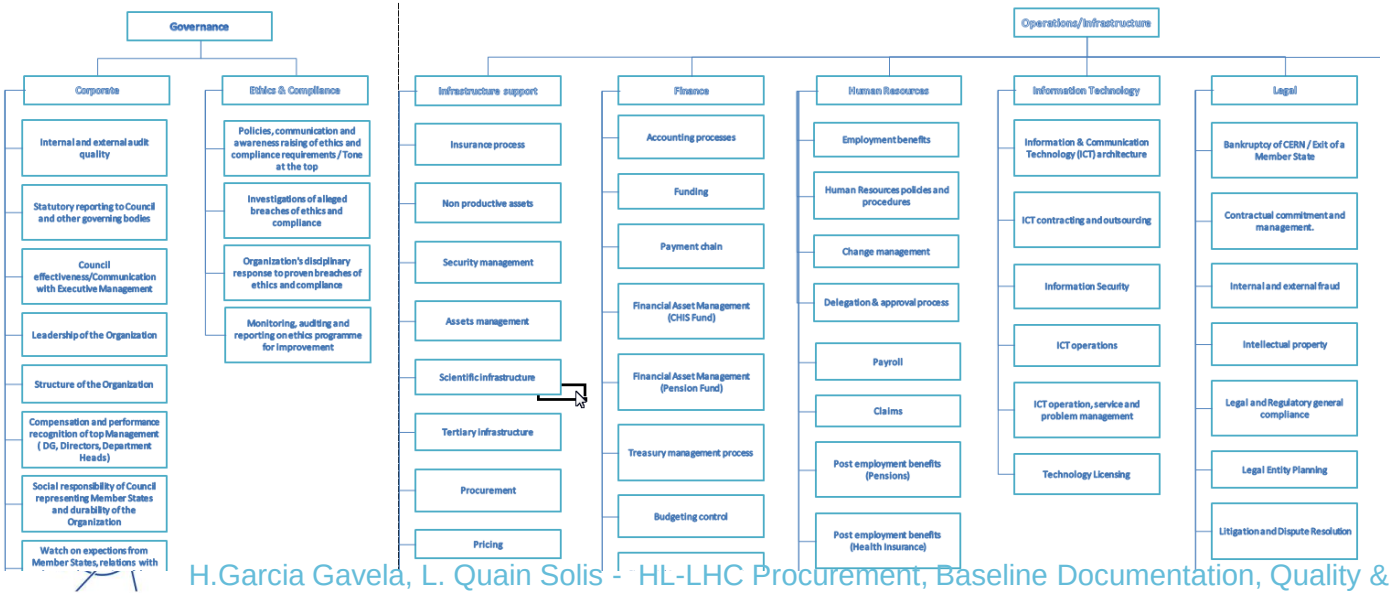
Standardized business catalog to inventory most critical risks

Governance	Corporate
	Ethics & Compliance
Strategy and Planning	Corporate Responsibility & Sustainability
	Strategy
	Planning
	External Factors
Delivering on mission	Hosting of Scientific Collaborations
	Knowledge transfer and training
	Research tools
Operations/Infrastructure	Infrastructure support
	Corporate Image
	Finance
	Human Resources
	Information Technology
	Legal

Risk Intelligence map

Risk Intelligence map

- Adapted to our Organization
- Every area that could create value also carries the potential for risk
- For every area of activity, we should understand the threats and the opportunities, where we are weak and where we are strong



Assessing the Risk

Risk impact

- There are several things that can go “wrong”
- Danger can come from inside (Weakness) or from outside (Threats)
- It can affect directly or indirectly the achievement of our objectives

Impact assessment	Assessment scale	Financial loss	Reputation	Legal/ Regulatory	Safety	Environmental	Alignment with Business Objectives (WP Deliverables)	Who I shall inform in the project
Catastrophic / Extreme	5	Greater than 1 MCHF	Large media (or scientific media) coverage - International coverage	Any State action	Several losses of life or permanent disability or multiple fatalities	Persistent environmental damage or sever nuisance extending over a large area	Occurrence of the risk will significantly deter the achievement of all of the entity's business objectives (magnet, cold mass, cryoassembly)	PL, WPL, WPE
Major	4	Up to 1 MCHF	Host MS press coverage - Scientific media - Escalating community activism	Any State scrutiny or Local action	Single loss of life or permanent disability or multiple fatalities	Significant nuisance or environmental damage over a large area	Occurrence of the risk will significantly hamper the achievement of the entity's business objectives (magnet, cold mass, cryoassembly)	PL, WPL, WPE
Moderate	3	Up to 100 KCHF	Local press coverage - Neighbourhood reputation (public, suppliers, etc.)	Any Local scrutiny	Extensive injury including permanent partial disability and occupational illness	Significant nuisance or environmental damage within the fenced perimeter or limited nuisance or environmental damage outside the fenced perimeter	Occurrence of the risk will have some adverse effect on the achievement of the entity's business objectives (magnet, cold mass, cryoassembly)	WPL, WPE
Minor	2	Up to 10 KCHF	No one has heard of the occurrence of risk outside CERN; Problem dealt with at CERN's management level.		Minor reversible injury or health effects requiring medical attention but not causing permanent disability.	Sufficiently large contamination or discharge to damage the environment but within the fence and without lasting effect	Occurrence of the risk will have minimal impact on the achievement of the entity's business objectives (magnet, cold mass, cryoassembly)	WPE
Negligible	1	Up to 1 KCHF	No one has heard of the occurrence of the risk outside he department who owned the risk; problem dealt at department management level		No injury or damage to health, or slight injury or health effects not causing disability	No significant environmental damage or slight reversible environmental damage within the fence and recoverable	Occurrence of the risk will have very little or no impact on the achievement of the entity's business objectives (magnet, cold mass, cryoassembly)	WPE

Assessing the Risk

Risk vulnerability

- The same adverse event can affect us very differently if we have bust our resilience capacity
- Do we have the right persons, control systems, or the experience to deal with this scenario …?

Vulnerability assessment	Assessment scale	INTERNAL CONTROL Assurance Risk mitigation process Information system	PREVIOUS RISK EXPERIENCE	CAPABILITY People	RATE OF CHANGE Expansion or Contraction (business, people, process, systems)
Severe vulnerability	5	Absence of control	VERY HIGH recent previous adverse experience	No staff in the organization to manage the risk or VERY LIMITED competency	Risk is managed by or directly impacts people, processes, systems or businesses that have experienced a VERY HIGH rate of change over the last 6 months
High vulnerability	4	Lack of control	HIGH recent previous adverse experience	A limited # of staff or staff has LIMITED competency to manage the risk	
Moderate vulnerability	3	Inadequate control	MEDIUM recent previous adverse experience	A limited # of staff or staff has MODERATE competency	Risk is managed by or directly impacts people, processes, systems or businesses that have experienced a MODERATE rate of change over the last 6 months
Mild vulnerability	2	Control adequate with risk	LOW recent previous adverse experience	Sufficient staff and has HIGH competency	
No evidence of vulnerability	1	State-of-the-art control	VERY LOW recent previous adverse experience	All staff has HIGH competency (“right people, right place, right time”)	Risk is managed by or directly impacts people, processes, systems or businesses that have experienced a VERY LOW rate of change over the last 6 months

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Meetings

Once a year, a discussion takes place with the members of the HL-LHC Project Office and individually with each Work-package leader to:

- Evaluate the action plan discussed during the previous exercise.
- Reassess the **Impact** of the entries of the risk register considering the situation in the future.
- Revise the **Vulnerability** to each risk based on the resilience achieved.
- Establish an updated **Action Plan**.
- Evaluate if any adverse events originated from previously non-identified risks.

Vulnerability matrix

Vulnerability assessment	Assessment scale	INTERNAL CONTROL Assurance Risk mitigation process Information system	PREVIOUS RISK EXPERIENCE	CAPABILITY People	RATE OF CHANGE Expansion or Contraction (business, people, process, systems)
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Impact matrix

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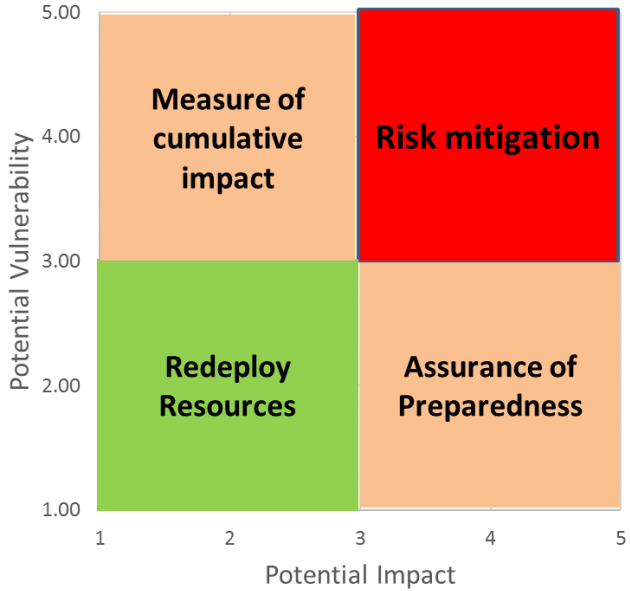
Major	**4**	Up to 1 MCHF	Host MS press coverage - Scientific media - Escalating community activism	Any State scrutiny or Local action	Single loss of life or permanent disability or multiple fatalities	Significant nuisance or environmental damage over a large area	Occurrence of the risk will significantly hamper the achievement of the entity's business objectives
Moderate	**3**	Up to 100 KCHF	Local press coverage - Neighbourhood reputation (public, suppliers, etc.)	Any Local scrutiny	Extensive injury including permanent partial disability and occupational illness	Significant nuisance or environmental damage within the fenced perimeter or limited nuisance or environmental damage outside the fenced perimeter	Occurrence of the risk will have some adverse effect on the achievement of the entity's business objectives
Minor	**2**	Up to 10 KCHF	No one has heard of the occurrence of risk outside CERN; Problem dealt with at CERN's management level.		Minor reversible injury or health effects requiring medical attention but not causing permanent disability.	Sufficiently large contamination or discharge to damage the environment but within the fence and without lasting effect	Occurrence of the risk will have minimal impact on the achievement of the entity's business objectives
Negligible	**1**	Up to 1 KCHF	No one has heard of the occurrence of the risk outside he department who owned the risk; problem dealt at department management level		No injury or damage to health, or slight injury or health effects not causing disability	No significant environmental damage or slight reversible environmental damage within the fence and recoverable	Occurrence of the risk will have very little or no impact on the achievement of the entity's business objectives

MARCI

- Only the Risks with the highest impact and vulnerability require an action. A **MARCI** (**Mitigate, Assure, Redeploy, and Cumulative Impact**) chart has been used to define the risk requiring treatment strategy (**I*V ≥ 9**).



Action plan

- Every action under “Risk mitigation” (I*V ≥ 9) has an Action Plan
- Actions are revised by the Project Management together with the WPLs and monitored periodically.
- Summary of updated actions for the year 2021: EDMS 2471805

WP	IxV	ID	Risk	Actions	Comments
WP2	From 9 to **9**	47	Project management	Review of WP1 of all the potential options still open so that we can "close" them or give a deadline before the end of the year.	Not all the options are decided yet. It will be revaluated next year
WP2	From 9 to **9**	54	Technology diversification	See Risk 47	Still open options
WP2	From 4 to **9**	28	Delegation & approval process	Explore some automatic control tools	The number of documents/drawings for approval is so high that there is the risk that one of the documents is not commented or not commented on time and there is also the factor of overloading and therefore delaying the process (time).
WP3	From 16 to **9**	5	Delivery	Monitoring of the schedule including those of the collaborations	AUP accepted to have a version of their schedule without contingency for failures. It has been demonstrated that we can have coil manufacturing at the nominal speed.

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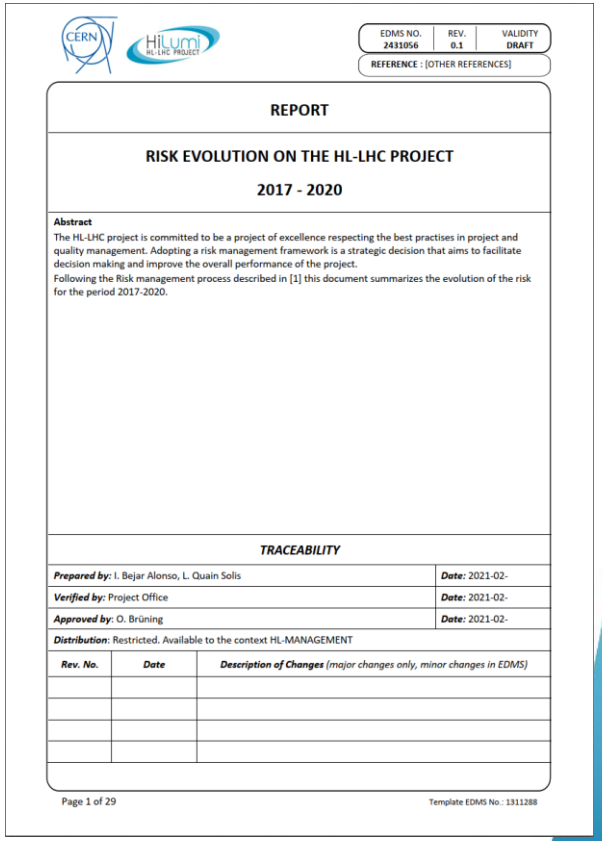
Outputs

Risk ID	First Level	Second level	Risk	Description	Inherent risk	Vulnerability	Matrix 1 PIxPV
1	Delivering on mission	Collaborations	Knowledge transfer	Risk of inefficient or inexisting transfer of knowledge/documentation between the collaborations and the project	2.78	2.33	6.48148148
2	Delivering on mission	Collaborations	Monitoring of collaborations	Inadequate monitoring of the collaboration with claims from the collaboration to the project or lack of deliverables on time	3.33	2.33	7.77777778
3	Delivering on mission	Collaborations	Scientific value	Risk of transfering to the collaboration core technologies endangering the capacity of continuing the project without them	3.56	2.33	8.2962963
4	Delivering on mission	HL-LHC	Commissioning	Failure on the commissioning of HL-LHC	3.78	1.67	6.2962963
5	Delivering on mission	HL-LHC	Delivery	Delay on the global HL-LHC Schedule	4.11	3.22	13.2469136
6	Delivering on mission	HL-LHC	Installation	Covers risks related to the installation of HL-LHC, such as inadequate planning, insufficient tests, etc.	3.56	2.33	8.2962963
7	Delivering on mission	HL-LHC	Interface of components	Lack of study of interfaces between WPs	3.89	2.67	10.3703704
8	Delivering on mission	HL-LHC	Interface with LHC	Lack of study of interfaces between componenta and present LHC machine	3.33	2.22	7.40740741
9	Delivering on mission	HL-LHC	Obsolescence	Risks linked to the obsolescence of components provided by other projects (LIU for instance)	2.78	1.67	4.62962963
10	Delivering on mission	HL-LHC	Operation & Maintenance	Covers all risks linked to the operation of Cincluding correct transmition of documentation from the project to operation	2.67	1.89	5.03703704
11	Delivering on mission	HL-LHC	Planning	All risks related to the planification of production of goods by CERN, such as inaccurate supply forecast, inadequate capacity planning, inadequate costing considerations, inability to determine and maintain optimum safety stock, etc. This include planning os Long shut down periods.	3.33	2.67	8.88888889
12	Delivering on mission	HL-LHC	Product Design/ Quality	Failure related the design/quality of the components of the accelerator or other research tools. Wrong technical decision because of budget interest	3.67	2.44	8.96296296
13	Delivering on mission	HL-LHC	Production	Failure on the production of components for the accelerators. Interface of equipment during assembly. Issues during the assembly of components. Wrong production speed	3.44	2.78	9.56790123
14	Delivering on mission	HL-LHC	R&D	Failure in the R&D for the development of new machines or no consideration of substitutes (timing , planning resources, collaboration and coordination on R&D projects).R&D timeline not enough in the R&D phase of the project	3.33	1.89	6.2962963
15	Delivering on mission	Knowledge transfer and training	Knowledge and technology transfer	Risks related to the K&T Transfer process	1.67	1.78	2.96296296
16	Delivering on mission	Knowledge transfer and training	Outreach activities	Covers risks such as inadequate outreach activities, lack of monitoring, absence of objectives, inappropriate resources, over dependency on some providers etc.	2.00	1.56	3.11111111
	Delivering on mission	Knowledge transfer and training	Scientific publications	Risks related to the scientific publications (approval process, absence of monitoring, etc.). Lack of traceability of existing scientifi production from the project			



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REFERENCE : [OTHER REFERENCES]

REPORT

RISK EVOLUTION ON THE HL-LHC PROJECT

2017 - 2020

Abstract

The HL-LHC project is committed to be a project of excellence respecting the best practises in project and quality management. Adopting a risk management framework is a strategic decision that aims to facilitate decision making and improve the overall performance of the project.

Following the Risk management process described in [1] this document summarizes the evolution of the risk for the period 2017-2020.

TRACEABILITY

Prepared by: I. Bejar Alonso, L. Quain Solis	***Date:*** 2021-02-
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Approved by: O. Brüning	***Date:*** 2021-02-
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Rev. No.	*Date*	*Description of Changes (major changes only, minor changes in EDMS)*

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Template EDMS No.: 1311288

EDMS 0000212513

Evolution

Increased

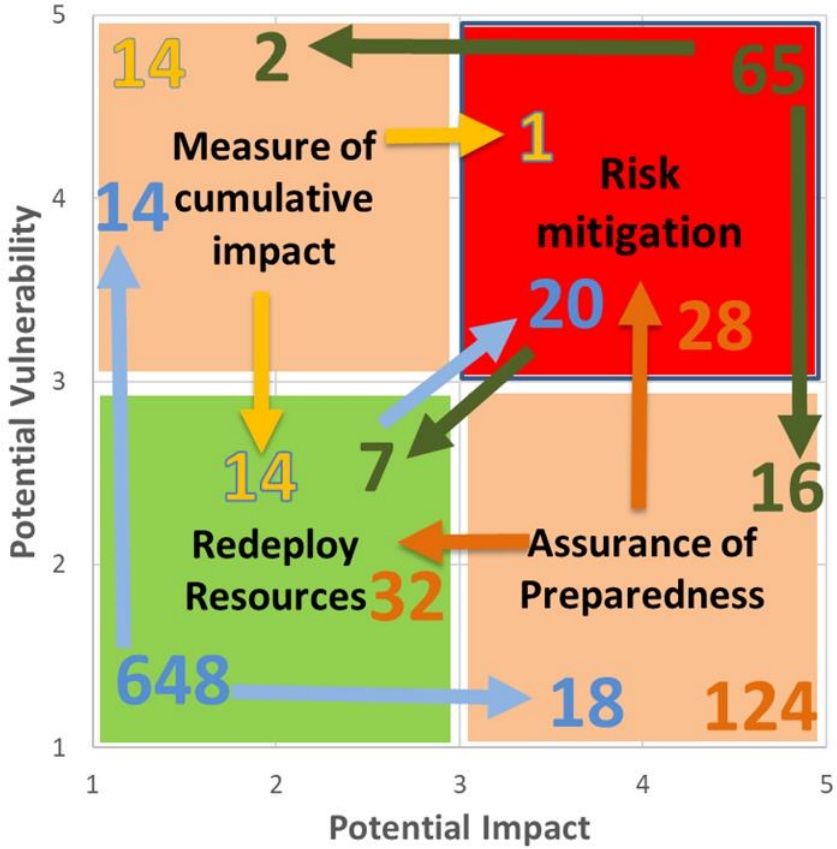
First Level	Second level	Risk	#
Delivering on mission	Knowledge transfer and training	Scientific publications	1
	Collaborations	Monitoring of collaborations	2
		Knowledge transfer	2
		Scientific value	2
	HL-LHC	Planning	2
		Commissioning	3
		Installation	2
		Operation & Maintenance	2
		Product Design/ Quality	1
		Production	2
		Delivery	1
		Aging	1
Governance	Corporate	Leadership	1
		Recognition	2
		Structure	3
		Reporting	2
		Communication with Executive Management	1
Operations/Infrastructure	Finance	Budgeting control	1
		Accounting processes	3
	Human Resources	Change management	2
		Delegation & approval process	3
		Recruitment/Talent pipeline	3
		Performance management and recognition	1
		Training and Development	1
	Infrastructure support	Assets management	2
		Records and Information Management	1
		Pricing	2
		Tertiary infrastructure	2
Strategy and Planning	Corporate Responsibility & Sustainability	Short term impact on the environment	1
		Waste reduction and elimination	1
	External factors	**Changes of applicable laws and regulations**	11
		Hazards/Catastrophic Loss	1
		Macro-economic in-kind	1
		Shift of public opinion	1
	Planning	**Project management**	4
	Strategy	Choice of technology	1
		Technology diversification	1
		Collaborations	5
		Collaborations enlargement	4
		Dependency on external collaborations	4
		Strategy for outsourcing	2
		Suppliers resilience and dependency	1

Decreased

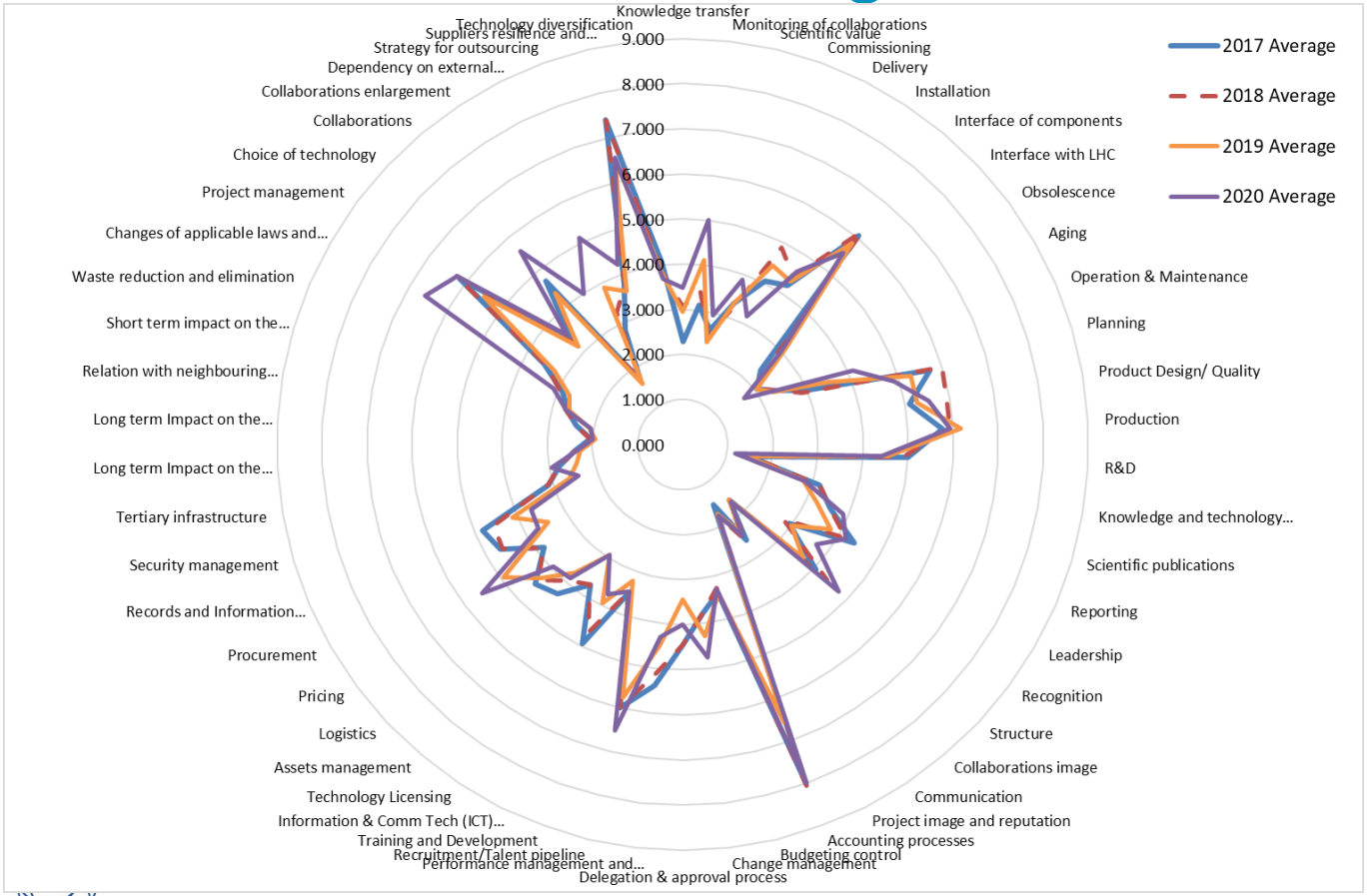
First Level	Second level	Risk	#
Delivering on mission	Collaborations	Knowledge transfer	1
		R&D	2
	HL-LHC	Installation	1
		Interface of components	1
		Interface with LHC	2
		Delivery	1
		Planning	1
		Product Design/ Quality	2
		Production	2
		Obsolescence	1
		Aging	1
	Knowledge transfer and training	Knowledge and technology transfer	1
Governance	Corporate	Leadership	1
		Recognition	1
Operations/Infrastructure	Finance	Accounting processes	2
		Budgeting control	1
	Human Resources	Change management	1
		Performance management and recognition	1
		Recruitment/Talent pipeline	2
	Information Technology	Information & Comm Tech (ICT) architecture	1
	Infrastructure support	Assets management	1
		Logistics	1
		Pricing	1
		Records and Information Management	1
Strategy and Planning	Planning	Project management	1
	Strategy	Technology diversification	1
		Dependency on external collaborations	1
		Suppliers resilience and dependency	1

Domains where the V* I has increased and decreased

Effect of the actions



Evolution average I*V

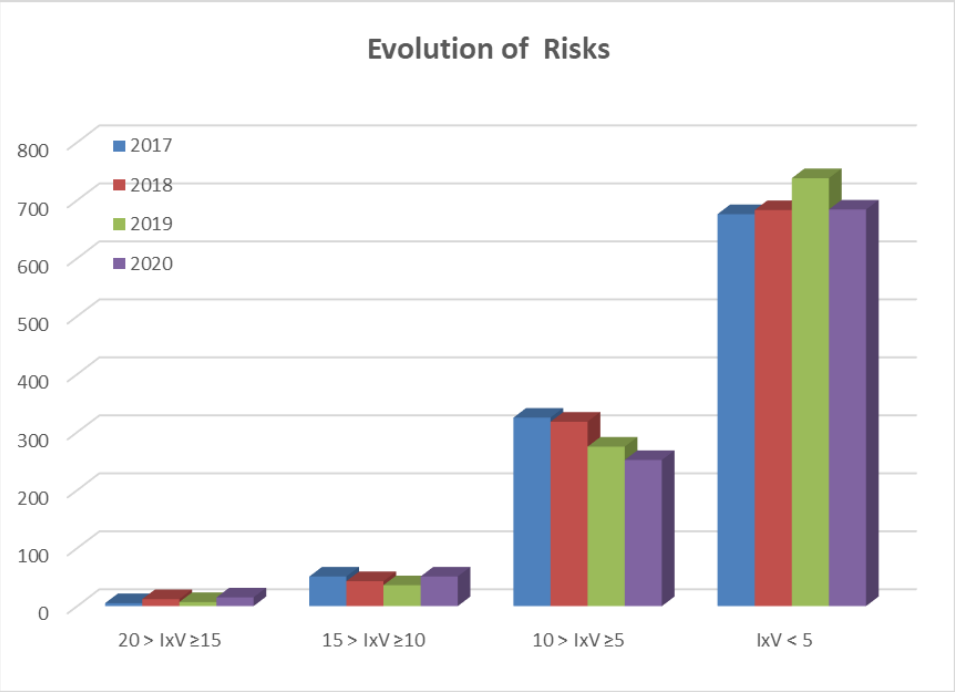


GLOBAL VALUES

SINCE 2017

Evolution of the IxV

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
2017	0	5	51	325	676
2018	1	12	43	318	683
2019	1	7	36	275	738
2020	1	15	51	252	684



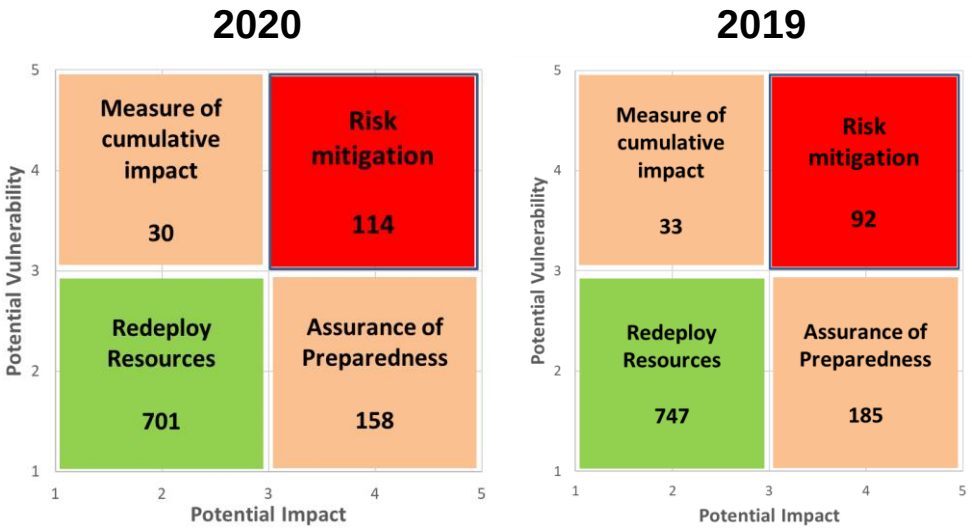
MARCI - GLOBAL

2017	#
Redeployment	682
Preparedness	239
Impact	38
Risk Mitigation	98

2018	#
Redeployment	690
Preparedness	220
Impact	36
Risk Mitigation	111

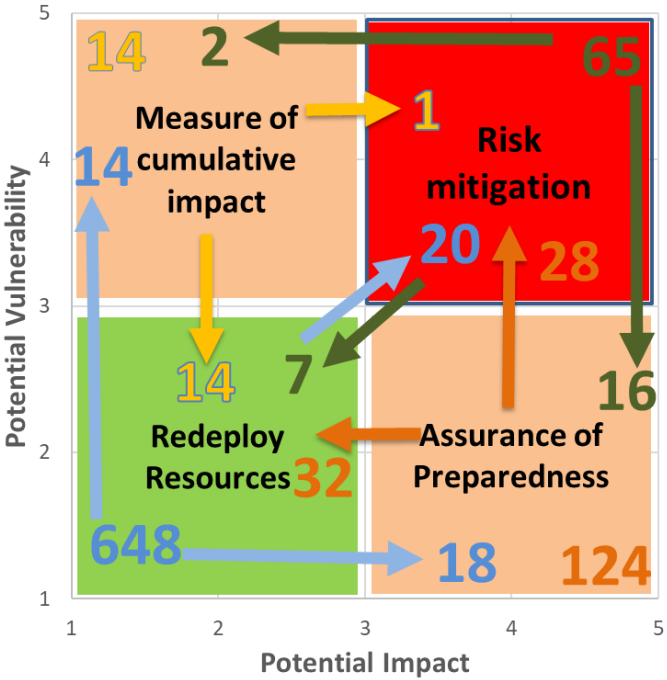
2019	#
Redeployment	747
Preparedness	185
Impact	33
Risk Mitigation	92

2020	#
Redeployment	701
Preparedness	158
Impact	30
Risk Mitigation	114



- The average I*V has evolved from 3.59 in 2019 to 3.92 in 2020 in the WPs
- WP1 accounts for 18% of the actions and its I*V has also evolved negatively, from 6.89 to 7.47

Risk Movements



		2020			
		Impact	Preparedness	Redeployment	Risk Mitigation
2019	Impact	14	0	14	1
	Preparedness	0	124	32	28
	Redeployment	14	18	648	20
	Risk Mitigation	2	16	7	65

“IN” AND “OUT” - OUT

Global ID	First Level	Second level	Risk	Matrix 2020	Matrix 2019
R.1.44	Operations/Infrastructure	Information Technology	Technology Licensing	8.98	10.00
R.3.1	Delivering on mission	Collaborations	Knowledge transfer	4.00	9.00
R.3.27	Operations/Infrastructure	Human Resources	Change management	6.00	12.00
R.3.30	Operations/Infrastructure	Human Resources	Recruitment/Talent pipeline	6.00	9.00
R.3.51	Strategy and Planning	Strategy	Dependency on external collaborations	8.00	12.00
R.5.25	Operations/Infrastructure	Finance	Accounting processes	6.00	9.00
R.5.26	Operations/Infrastructure	Finance	Budgeting control	4.00	9.00
R.5.35	Operations/Infrastructure	Infrastructure support	Logistics	4.00	9.00
R.6A.16	Delivering on mission	Knowledge transfer and traini	Knowledge and technology transfer	4.00	9.00
R.6A.20	Governance	Corporate	Recognition	4.00	9.00
R.7.13	Delivering on mission	HL-LHC	Product Design/ Quality	6.00	9.00
R.8.8	Delivering on mission	HL-LHC	Interface with LHC	6.00	9.00
R.9.29	Operations/Infrastructure	Human Resources	Performance management and recognition	4.00	9.00
R.12.25	Operations/Infrastructure	Finance	Accounting processes	6.00	9.00
R.12.30	Operations/Infrastructure	Human Resources	Recruitment/Talent pipeline	6.00	9.00
R.15.6	Delivering on mission	HL-LHC	Installation	8.00	12.00
R.15.8	Delivering on mission	HL-LHC	Interface with LHC	8.00	12.00
R.15.29	Operations/Infrastructure	Human Resources	Performance management and recognition	8.00	9.00
R.15.47	Strategy and Planning	Planning	Project management	8.00	12.00
R.16.12	Delivering on mission	HL-LHC	Planning	6.00	16.00
R.16.32	Operations/Infrastructure	Information Technology	Information & Comm Tech (ICT) architecture	6.00	9.00
R.16.34	Operations/Infrastructure	Infrastructure support	Assets management	6.00	9.00
R.16.38	Operations/Infrastructure	Infrastructure support	Records and Information Management	4.00	9.00

“IN” AND “OUT” - IN

Global ID	First Level	Second level	Risk	Matrix 2020	Matrix 2019
R.1.19	Governance	Corporate	Reporting	9.38	8.30
R.1.26	Governance	Ethics & Compliance	Breaches of ethics and compliance	9.75	7.38
R.1.64	Strategy and Planning	External Factors	Changes of applicable laws and regulations	13.08	7.00
R.1.66	Strategy and Planning	External Factors	Hazards/Catastrophic Loss	13.41	5.86
R.1.68	Strategy and Planning	External Factors	Macro-economic in-kind	15.41	8.44
R.1.73	Strategy and Planning	Planning	Performance monitoring	9.00	8.80
R.1.83	Strategy and Planning	Strategy	Strategy for outsourcing	11.25	8.89
R.2.28	Operations/Infrastructure	Human Resources	Delegation & approval process	9.00	4.00
R.4.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	9.00	6.00
R.6A.50	Strategy and Planning	Strategy	Collaborations enlargement	9.00	1.00
R.6B.12	Delivering on mission	HL-LHC	Planning	16.00	6.00
R.6B.27	Operations/Infrastructure	Human Resources	Change management	12.00	4.00
R.6B.28	Operations/Infrastructure	Human Resources	Delegation & approval process	9.00	6.00
R.6B.30	Operations/Infrastructure	Human Resources	Recruitment/Talent pipeline	9.00	6.00
R.6B.36	Operations/Infrastructure	Infrastructure support	Pricing	9.00	4.00
R.6B.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	9.00	6.00
R.8.3	Delivering on mission	Collaborations	Scientific value	12.00	6.00
R.8.30	Operations/Infrastructure	Human Resources	Recruitment/Talent pipeline	9.00	4.00
R.8.50	Strategy and Planning	Strategy	Collaborations enlargement	12.00	6.00
R.8.51	Strategy and Planning	Strategy	Dependency on external collaborations	9.00	4.00
R.9.52	Strategy and Planning	Strategy	Strategy for outsourcing	9.00	1.00
R.10.25	Operations/Infrastructure	Finance	Accounting processes	12.00	1.00
R.12.14	Delivering on mission	HL-LHC	Production	12.00	6.00
R.12.50	Strategy and Planning	Strategy	Collaborations enlargement	12.00	1.00
R.14.49	Strategy and Planning	Strategy	Collaborations	9.00	6.00
R.14.53	Strategy and Planning	Strategy	Suppliers resilience and dependency	9.00	4.00
R.15.1	Delivering on mission	Collaborations	Knowledge transfer	9.00	1.00
R.15.2	Delivering on mission	Collaborations	Monitoring of collaborations	9.00	1.00
R.15.18	Governance	Corporate	Reporting	12.00	6.00
R.15.19	Governance	Corporate	Leadership	12.00	4.00
R.15.20	Governance	Corporate	Recognition	12.00	4.00
R.15.21	Governance	Corporate	Structure	16.00	6.00
R.15.28	Operations/Infrastructure	Human Resources	Delegation & approval process	12.00	6.00
R.15.36	Operations/Infrastructure	Infrastructure support	Pricing	9.00	6.00
R.15.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	12.00	8.00
R.15.49	Strategy and Planning	Strategy	Collaborations	9.00	4.00
R.16.6	Delivering on mission	HL-LHC	Installation	9.00	6.00
R.16.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	12.00	1.00
R.16.50	Strategy and Planning	Strategy	Collaborations enlargement	16.00	1.00
R.17.20	Governance	Corporate	Recognition	12.00	4.00
R.17.21	Governance	Corporate	Structure	9.00	6.00
R.17.45	Strategy and Planning	Corporate Responsibility & Sustainability	Waste reduction and elimination	12.00	6.00

TOP BURNING

Global ID	First Level	Second level	Risk	Matrix 2020	Matrix 2019	Matrix 2018
R.1.5	Delivering on mission	HL-LHC	Delivery	14.53	15.56	16.44
R.1.40	Operations/Infrastructure	Human Resources	Recruitment/Talent pipeline	13.08	11.75	11.00
R.1.64	Strategy and Planning	External Factors	Changes of applicable laws and regulations	13.08	7.00	6.10
R.1.66	Strategy and Planning	External Factors	Hazards/Catastrophic Loss	13.41	5.86	5.88
R.1.68	Strategy and Planning	External Factors	Macro-economic in-kind	15.41	8.44	9.14
R.1.74	Strategy and Planning	Planning	Project management	13.56	9.48	8.80
R.1.81	Strategy and Planning	Strategy	Dependency on external collaborations	15.50	14.69	15.11
R.1.84	Strategy and Planning	Strategy	Suppliers resilience and dependency	13.13	10.38	10.74
R.1.85	Strategy and Planning	Strategy	Technology diversification	13.28	9.78	9.48
R.2.4	Delivering on mission	HL-LHC	Commissioning	16.00	12.00	12.00
R.2.27	Operations/Infrastructure	Human Resources	Change management	16.00	16.00	12.00
R.3.13	Delivering on mission	HL-LHC	Product Design/ Quality	16.00	16.00	16.00
R.4.14	Delivering on mission	HL-LHC	Production	12.00	12.00	12.00
R.4.51	Strategy and Planning	Strategy	Dependency on external collaborations	12.00	12.00	12.00
R.5.49	Strategy and Planning	Strategy	Collaborations	16.00	12.00	1.00
R.6A.51	Strategy and Planning	Strategy	Dependency on external collaborations	12.00	9.00	1.00
R.6B.7	Delivering on mission	HL-LHC	Interface of components	12.00	12.00	12.00
R.6B.12	Delivering on mission	HL-LHC	Planning	16.00	6.00	9.00
R.6B.27	Operations/Infrastructure	Human Resources	Change management	12.00	4.00	4.00
R.6B.47	Strategy and Planning	Planning	Project management	16.00	9.00	9.00
R.7.25	Operations/Infrastructure	Finance	Accounting processes	12.00	12.00	12.00
R.8.2	Delivering on mission	Collaborations	Monitoring of collaborations	16.00	12.00	12.00
R.8.3	Delivering on mission	Collaborations	Scientific value	12.00	6.00	8.00
R.8.50	Strategy and Planning	Strategy	Collaborations enlargement	12.00	6.00	6.00
R.9.11	Delivering on mission	HL-LHC	Operation & Maintenance	16.00	16.00	1.00
R.9.36	Operations/Infrastructure	Infrastructure support	Pricing	12.00	12.00	1.00
R.10.25	Operations/Infrastructure	Finance	Accounting processes	12.00	1.00	1.00
R.10.34	Operations/Infrastructure	Infrastructure support	Assets management	12.00	9.00	4.00
R.12.14	Delivering on mission	HL-LHC	Production	12.00	6.00	4.00
R.12.50	Strategy and Planning	Strategy	Collaborations enlargement	12.00	1.00	1.00
R.12.53	Strategy and Planning	Strategy	Suppliers resilience and dependency	16.00	16.00	15.00

Global ID	First Level	Second level	Risk	Matrix 2020	Matrix 2019	Matrix 2018
R.13.14	Delivering on mission	HL-LHC	Production	12.00	12.00	4.00
R.13.25	Operations/Infrastructure	Finance	Accounting processes	12.00	12.00	12.00
R.13.36	Operations/Infrastructure	Infrastructure support	Pricing	12.00	12.00	12.00
R.13.53	Strategy and Planning	Strategy	Suppliers resilience and dependency	12.00	12.00	12.00
R.13.54	Strategy and Planning	Strategy	Technology diversification	12.00	12.00	12.00
R.15.15	Delivering on mission	HL-LHC	R&D	12.00	12.00	12.00
R.15.18	Governance	Corporate	Reporting	12.00	6.00	6.00
R.15.19	Governance	Corporate	Leadership	12.00	4.00	4.00
R.15.20	Governance	Corporate	Recognition	12.00	4.00	6.00
R.15.21	Governance	Corporate	Structure	16.00	6.00	9.00
R.15.28	Operations/Infrastructure	Human Resources	Delegation & approval process	12.00	6.00	10.00
R.15.30	Operations/Infrastructure	Human Resources	Recruitment/Talent pipeline	12.00	9.00	6.00
R.15.32	Operations/Infrastructure	Information Technology	Information & Comm Tech (ICT) architecture	12.00	12.00	16.00
R.15.33	Operations/Infrastructure	Information Technology	Technology Licensing	12.00	12.00	16.00
R.15.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	12.00	8.00	8.00
R.16.11	Delivering on mission	HL-LHC	Operation & Maintenance	16.00	9.00	9.00
R.16.25	Operations/Infrastructure	Finance	Accounting processes	16.00	9.00	9.00
R.16.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	12.00	1.00	1.00
R.16.50	Strategy and Planning	Strategy	Collaborations enlargement	16.00	1.00	1.00
R.17.20	Governance	Corporate	Recognition	12.00	4.00	4.00
R.17.23	Operations/Infrastructure	Corporate Image	Communication	12.00	12.00	12.00
R.17.25	Operations/Infrastructure	Finance	Accounting processes	12.00	12.00	12.00
R.17.36	Operations/Infrastructure	Infrastructure support	Pricing	12.00	12.00	6.00
R.17.44	Strategy and Planning	Corporate Responsibility & Sustainability	Short term impact on the environment	12.00	9.00	9.00
R.17.45	Strategy and Planning	Corporate Responsibility & Sustainability	Waste reduction and elimination	12.00	6.00	6.00
R.17.46	Strategy and Planning	External Factors	Changes of applicable laws and regulations	20.00	9.00	9.00
R.17.52	Strategy and Planning	Strategy	Strategy for outsourcing	12.00	12.00	1.00
R.17.53	Strategy and Planning	Strategy	Suppliers resilience and dependency	12.00	12.00	12.00

TOP DECREASE

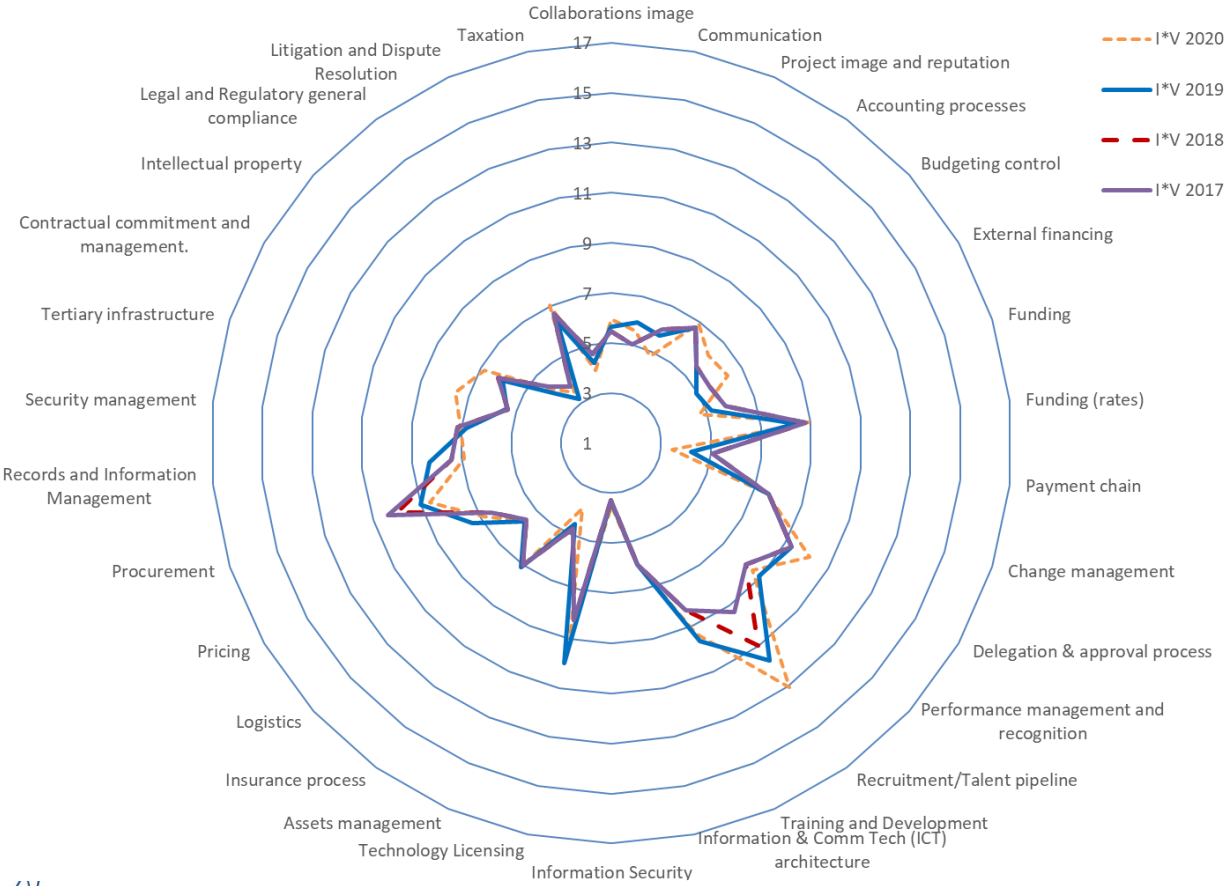
Second level	Risk	
Collaborations	Knowledge transfer	1
Collaborations	R&D	2
HL-LHC	Installation	1
HL-LHC	Interface of components	1
HL-LHC	Interface with LHC	2
HL-LHC	Delivery	1
HL-LHC	Planning	1
HL-LHC	Product Design/ Quality	2
HL-LHC	Production	2
HL-LHC	Obsolescence	1
HL-LHC	Aging	1
Knowledge transfer and training	Knowledge and technology transfer	1
Corporate	Leadership	1
Corporate	Recognition	1
Finance	Accounting processes	2
Finance	Budgeting control	1
Human Resources	Change management	1
Human Resources	Performance management and recognition	1
Human Resources	Recruitment/Talent pipeline	2
Information Technology	Information & Comm Tech (ICT) architecture	1
Infrastructure support	Assets management	1
Infrastructure support	Logistics	1
Infrastructure support	Pricing	1
Infrastructure support	Records and Information Management	1
Planning	Project management	1
Strategy	Technology diversification	1
Strategy	Dependency on external collaborations	1
Strategy	Suppliers resilience and dependency	1

TOP INCREASE

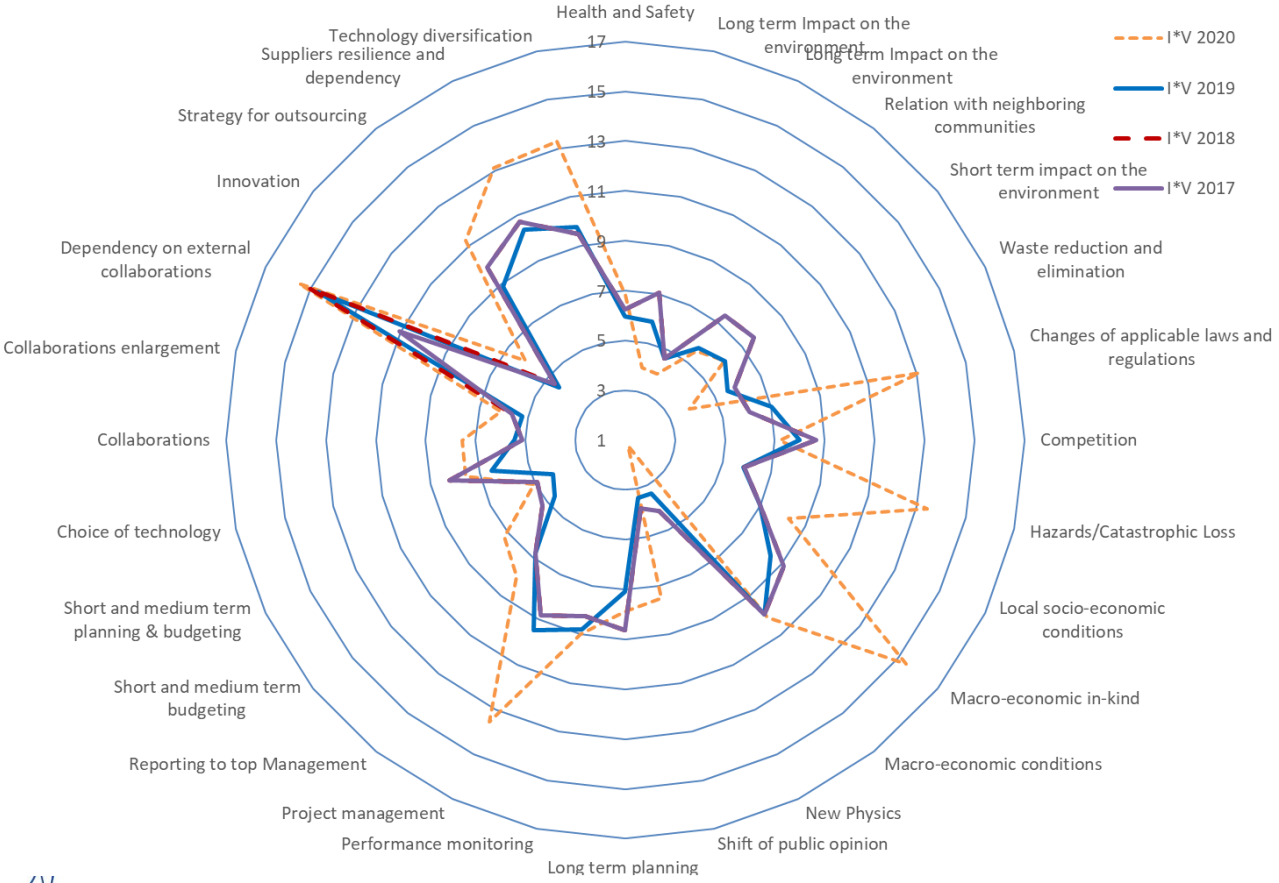
Second level	Risk	
Knowledge transfer and training	Scientific publications	1
Collaborations	Monitoring of collaborations	2
Collaborations	Knowledge transfer	2
Collaborations	Scientific value	2
HL-LHC	Planning	2
HL-LHC	Commissioning	3
HL-LHC	Installation	2
HL-LHC	Operation & Maintenance	2
HL-LHC	Product Design/ Quality	1
HL-LHC	Production	2
HL-LHC	Delivery	1
HL-LHC	Aging	1
Corporate	Leadership	1
Corporate	Recognition	2
Corporate	Structure	3
Corporate	Reporting	2
Corporate	Communication with Executive Management	1
Finance	Budgeting control	1
Finance	Accounting processes	3
Human Resources	Change management	2
Human Resources	Delegation & approval process	3
Human Resources	Recruitment/Talent pipeline	3
Human Resources	Training and Development	1
Infrastructure support	Assets management	2
Infrastructure support	Records and Information Management	1
Infrastructure support	Pricing	2
Infrastructure support	Tertiary infrastructure	2
Corporate Responsibility & Sustainability	Short term impact on the environment	1
Corporate Responsibility & Sustainability	Waste reduction and elimination	1
External factors	Changes of applicable laws and regulations	11
External Factors	Hazards/Catastrophic Loss	1
External Factors	Macro-economic in-kind	1
External Factors	Shift of public opinion	1
Planning	Project management	4
Strategy	Choice of technology	1
Strategy	Technology diversification	1
Strategy	Collaborations	5
Strategy	Collaborations enlargement	4
Strategy	Dependency on external collaborations	4
Strategy	Strategy for outsourcing	2
Strategy	Suppliers resilience and dependency	1

Delivery on mission & Governance

Operations/Infrastructure



Strategy and Planning



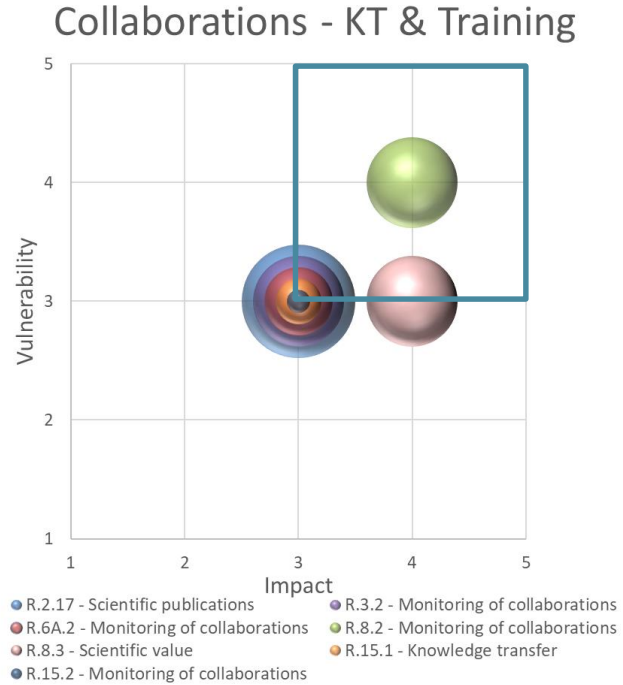
Our Top Ten WP2-18 and WP1

WP2-18
Interface of components
Product Design/ Quality
Production
Accounting processes
Recruitment/Talent pipeline
Pricing
Changes of applicable laws and regulations
Project management
Collaborations
Suppliers resilience and dependency

WP1
Delivery
Expectations from Member States
Recruitment/Talent pipeline
Changes of applicable laws and regulations
Hazards/Catastrophic Loss
Macro-economic in-kind
Project management
Dependency on external collaborations
Suppliers resilience and dependency
Technology diversification

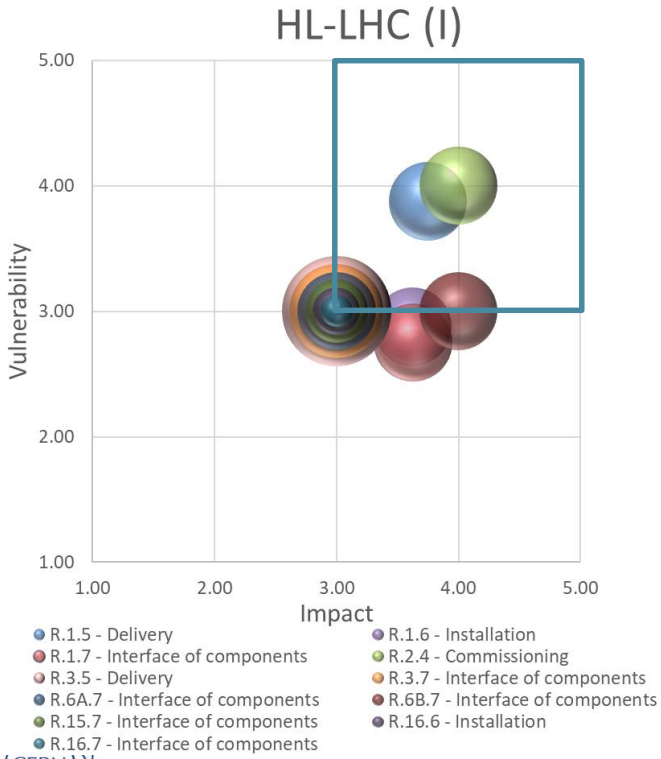
TOP RISKS

MARCI – TOP RISKS DELIVERY ON MISSION



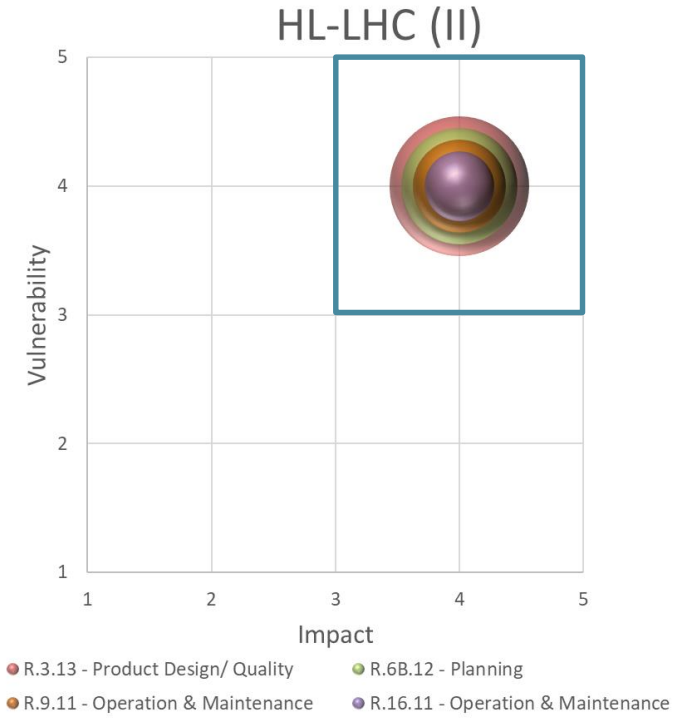
- Increasing feeling of need to have efficient ways to monitor the collaborations
- Awareness of the need of a good knowledge transfer before starting work on a collaboration
- Concerns about the scientific value to attract collaborations

MARCI – TOP RISKS DELIVERY ON MISSION



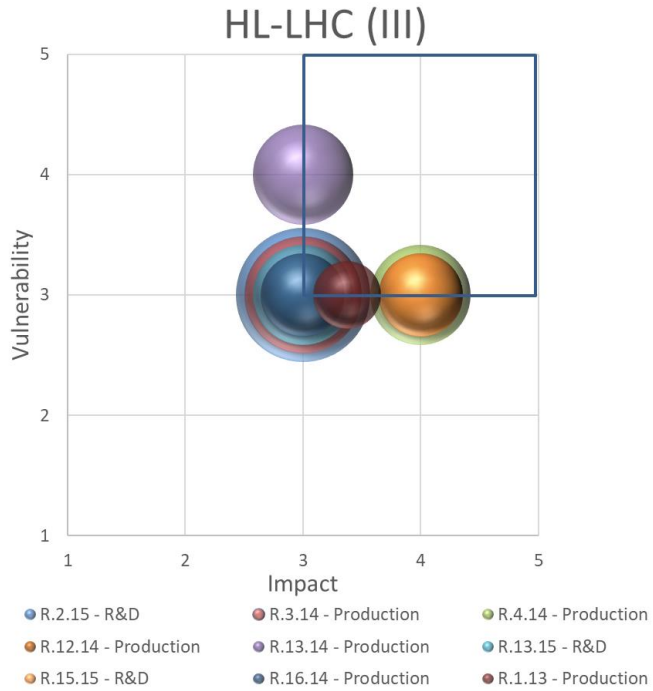
- The extra year in the schedule caused several WPs to revaluate the Delivery risk decreasing the impact
- Although there was important progress in the integration work, the remaining work has impeded the reduction of the Interface of components risk

MARCI – TOP RISKS DELIVERY ON MISSION



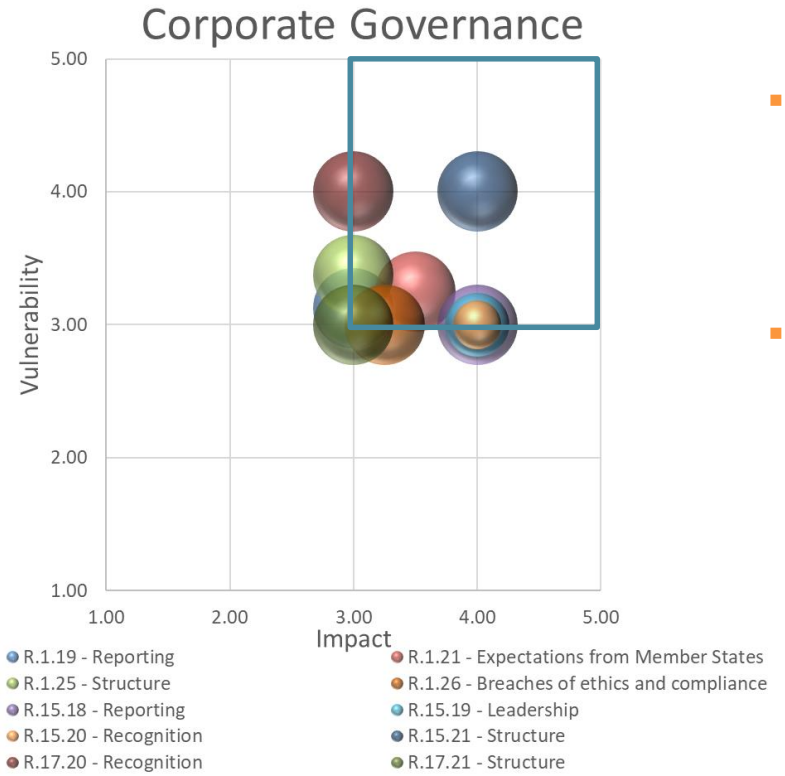
- Operation and maintenance comes back as the extra year implies that several infrastructures will have to be operated during one extra year
- Product Design/quality decreases for those that have finished the LS2 production. Vulnerability has increased for those that have found that some design choices make the production more difficult

MARCI – TOP RISKS DELIVERY ON MISSION



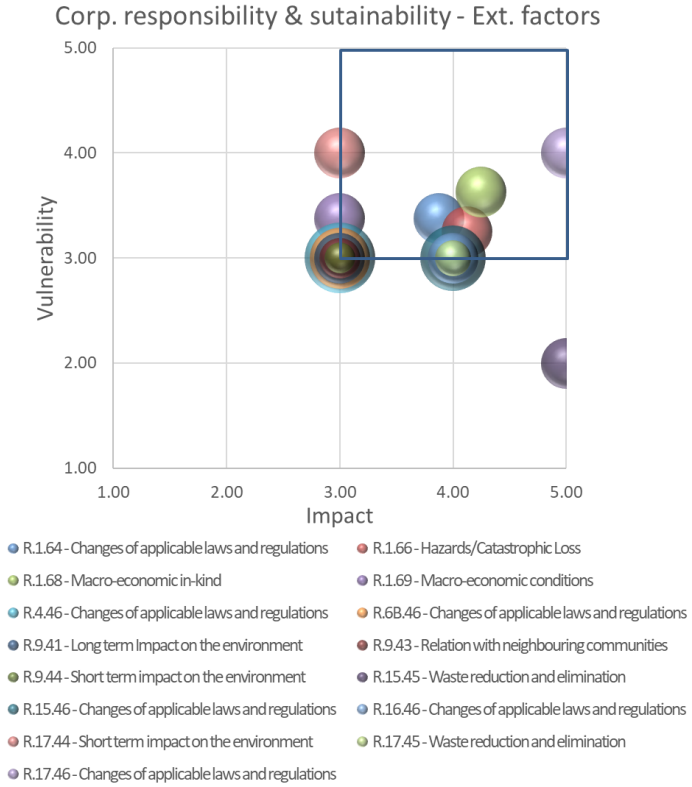
- Mixed feelings on Production. While being always in our top ten risks values it is frequently under evaluated before start production
- The Production risk has remained stable throughout the WPs
- R&D has decreased for most WPs as this phase is now completed

MARCI – TOP RISKS GOVERNANCE



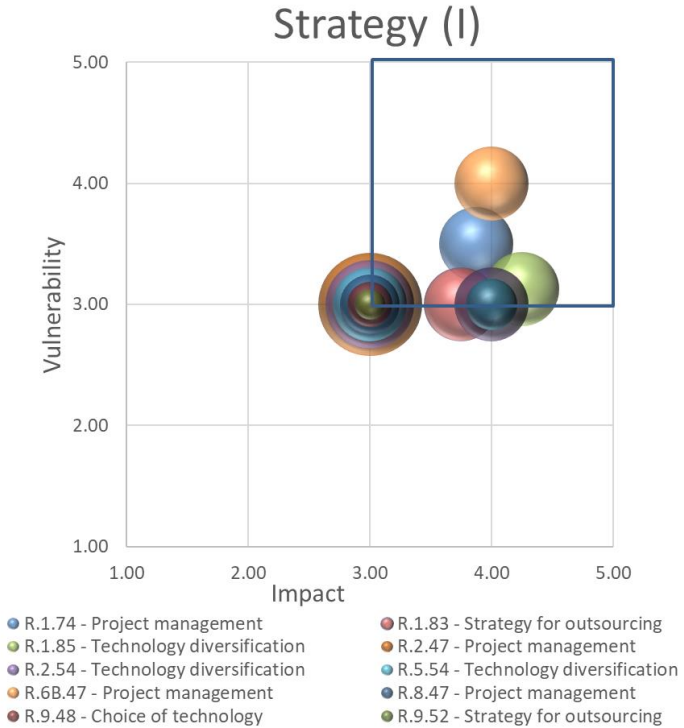
- Increase in risks related to Structure and Recognition due to the reorganisation of groups and project structure that took place
- General decrease of all risks linked to leadership. Possible effect of the maturity of the project

MARCI – TOP RISKS STRATEGY AND PLANNING



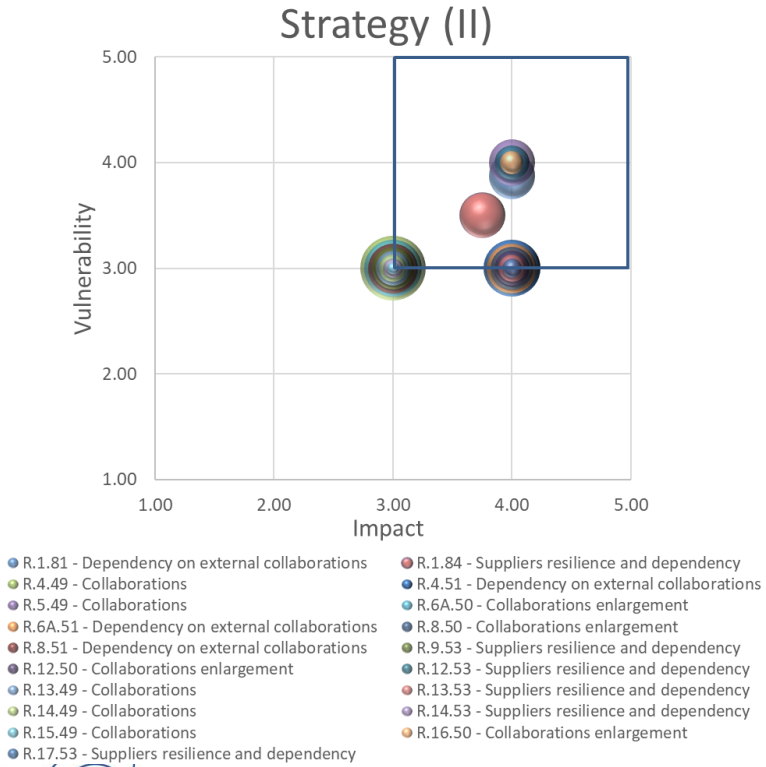
- Noticeable increase in the risk Changes of applicable laws and regulations caused by the new restrictions caused by COVID
- Increase in Waste reduction and elimination risk after an adverse event
- Still risks linked to cooling systems and noise, important for the Relation with neighbouring communities risk
- There is a global awareness of the need of an organized plan for the elimination /reconditioning of components dismantled during LS3

MARCI – TOP RISKS
STRATEGY AND PLANNING



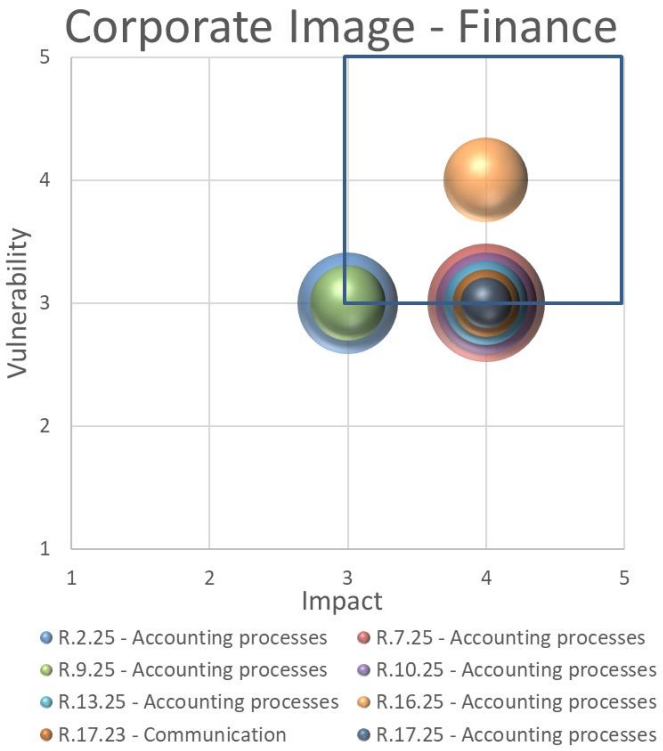
- Project management continues being on average in the top ten this year. For some WPs the impact has decreased because their management team has been reinforced but in general there is fear that the resources may not be sufficient to manage the new collaborations
- The risk on technology diversification are strongly linked to the ones of R&D, which only remain for certain WPs.

MARCI – TOP RISKS STRATEGY AND PLANNING



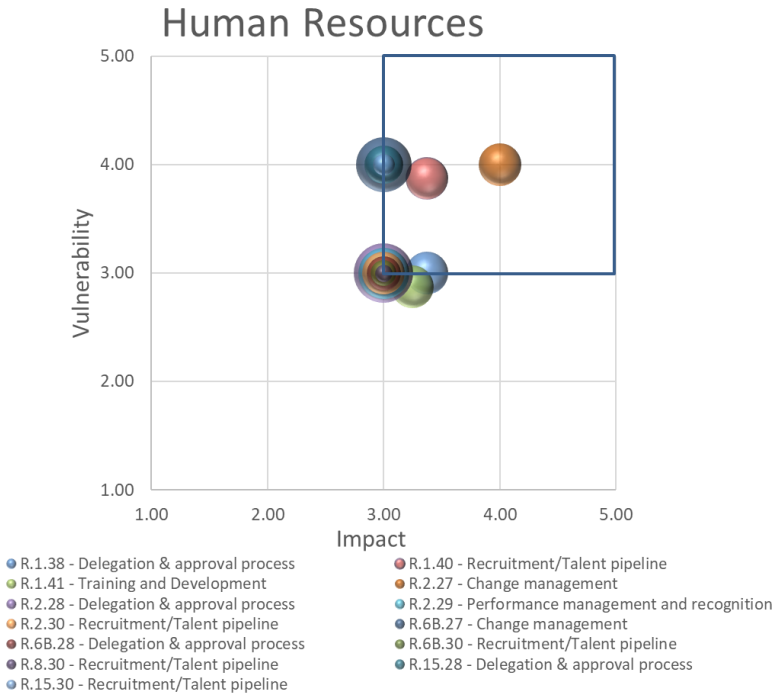
- The Collaborations and Collaborations enlargement risks have increased significantly due to the new collaborations and those that have not been signed yet
- There is an increased awareness of our vulnerability to single suppliers as the Suppliers resilience and dependence remains stable in the top risks
- Dependency on external collaborations increases due to the Russian collaboration

MARCI – TOP RISKS OPERATIONS/INFRASTRUCTURE



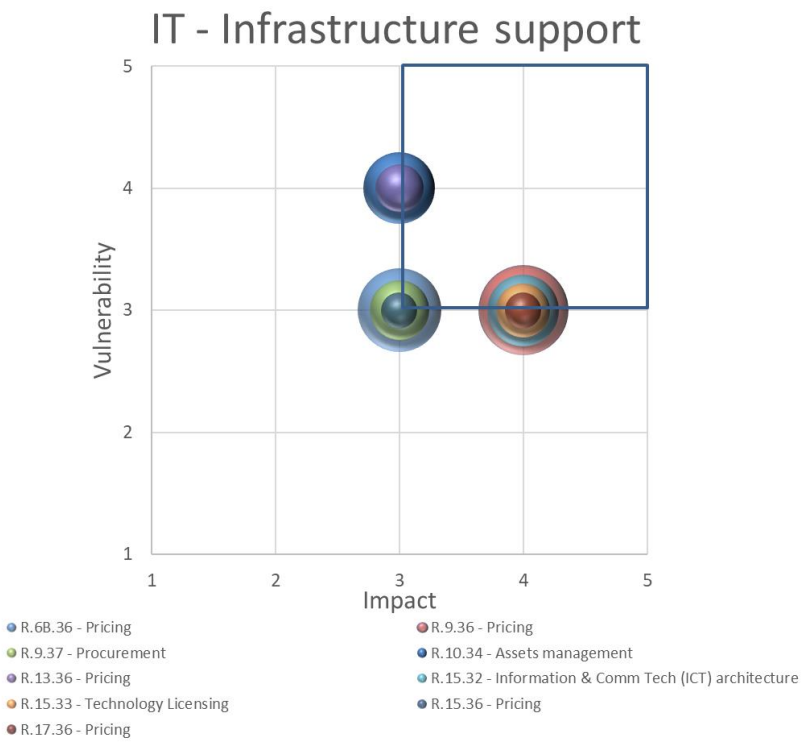
- Accounting processes has been historically our top risk. Some of the increased values are due to the last rebaselining exercise
- In general the WPs feel more comfortable with the budget allocated for each one of their deliverables
- The impression is that they feel more vulnerable on the MPA budget than on the material budget

MARCI – TOP RISKS OPERATIONS/INFRASTRUCTURE



- The restructuring that took place has increased the Change management risk
- Recruitment/Talent pipeline continues in the top 5 and increasing with the foreseen end of the PJAS program
- Performance management and recognition has grown along the years, a factor to be monitored
- The Delegation & approval process risk has increased due to the workload that it puts on the WPs

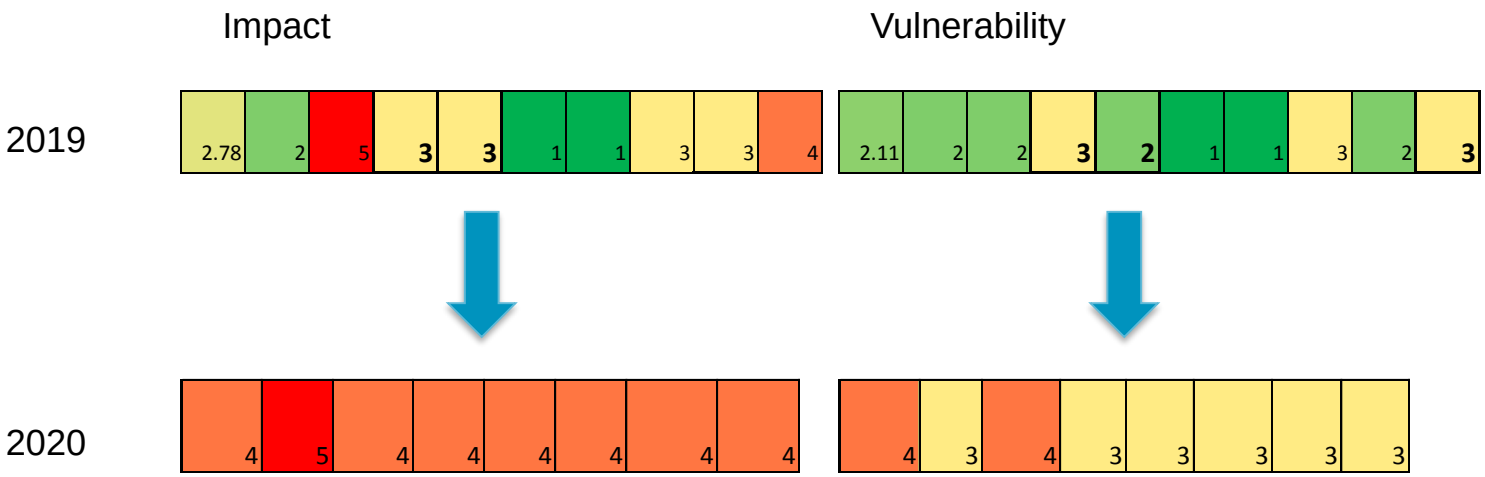
MARCI – TOP RISKS OPERATIONS/INFRASTRUCTURE



- Pricing is increasing for WPs that are approaching new big tenders. It is one risk that is systematically under evaluated
- ITC risks, linked to SmartTeam, Fluka and MALT, have decreased as there is less uncertainty.

How has the perception of pandemic risk changed?

External Factors	Hazards/Catastrophic Loss	Risk that might result from a seism, epidemic disease, terrorism, etc. CERN's ability to react to and recover from



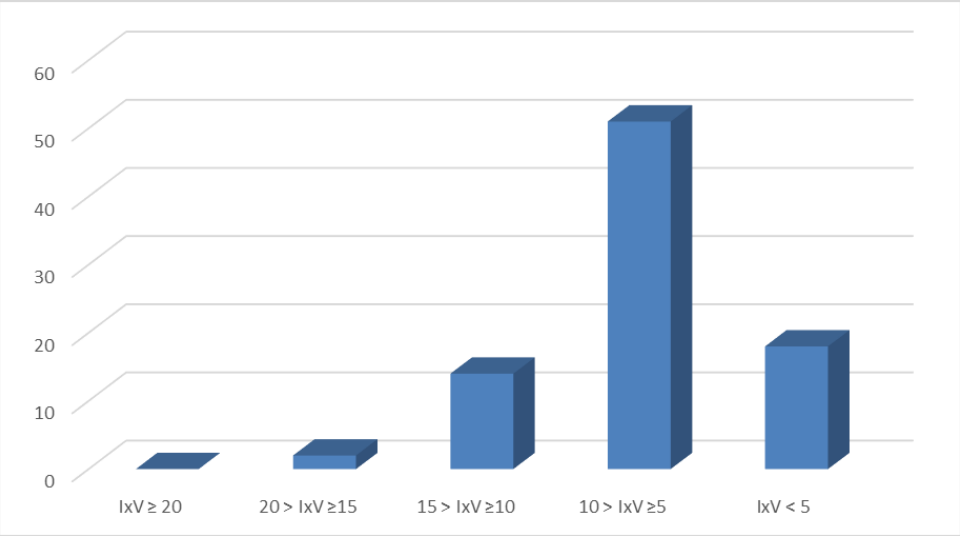
Present status by WP

Evolution risks, vulnerability and impact

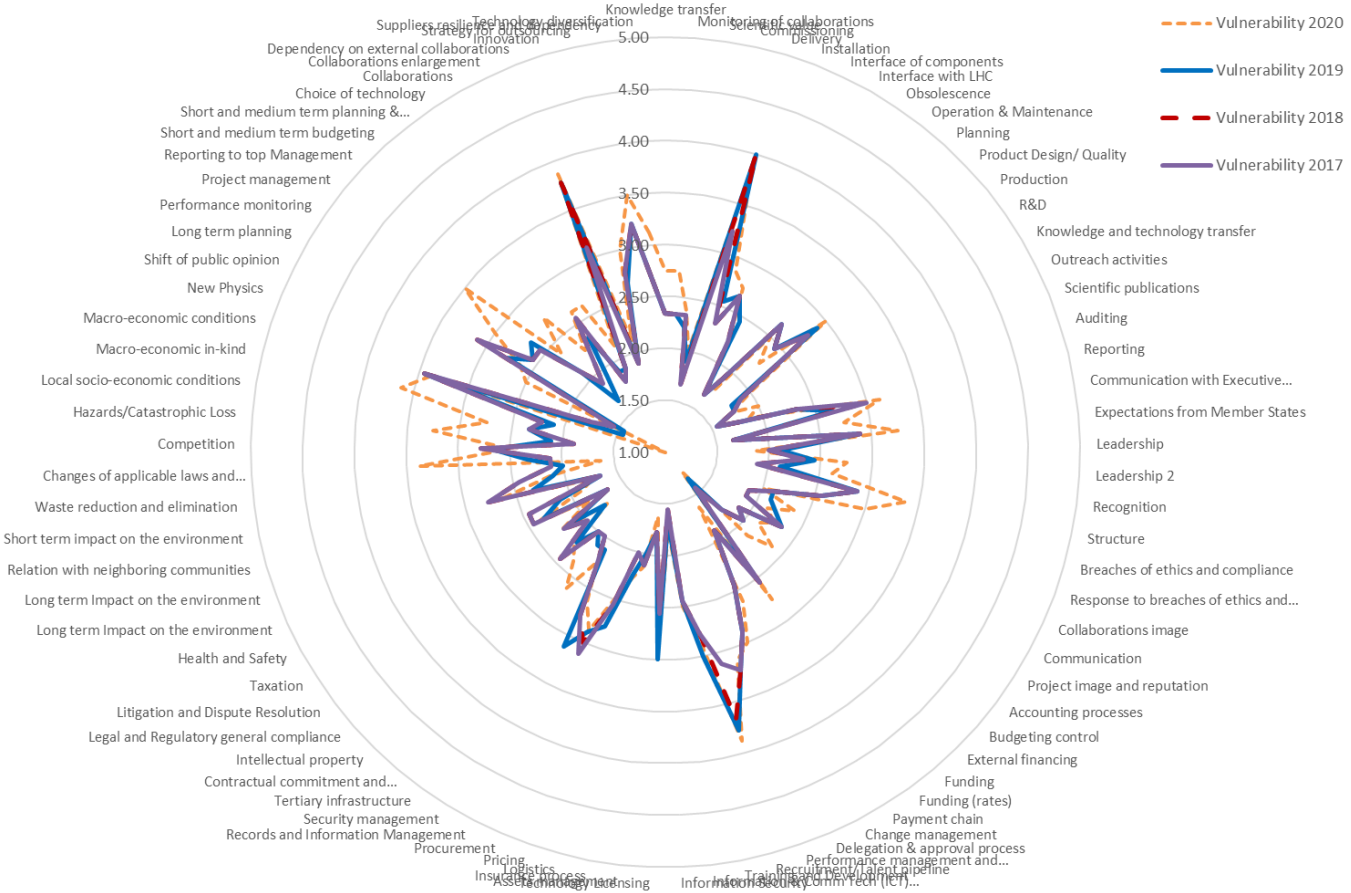
Main actions

WP1

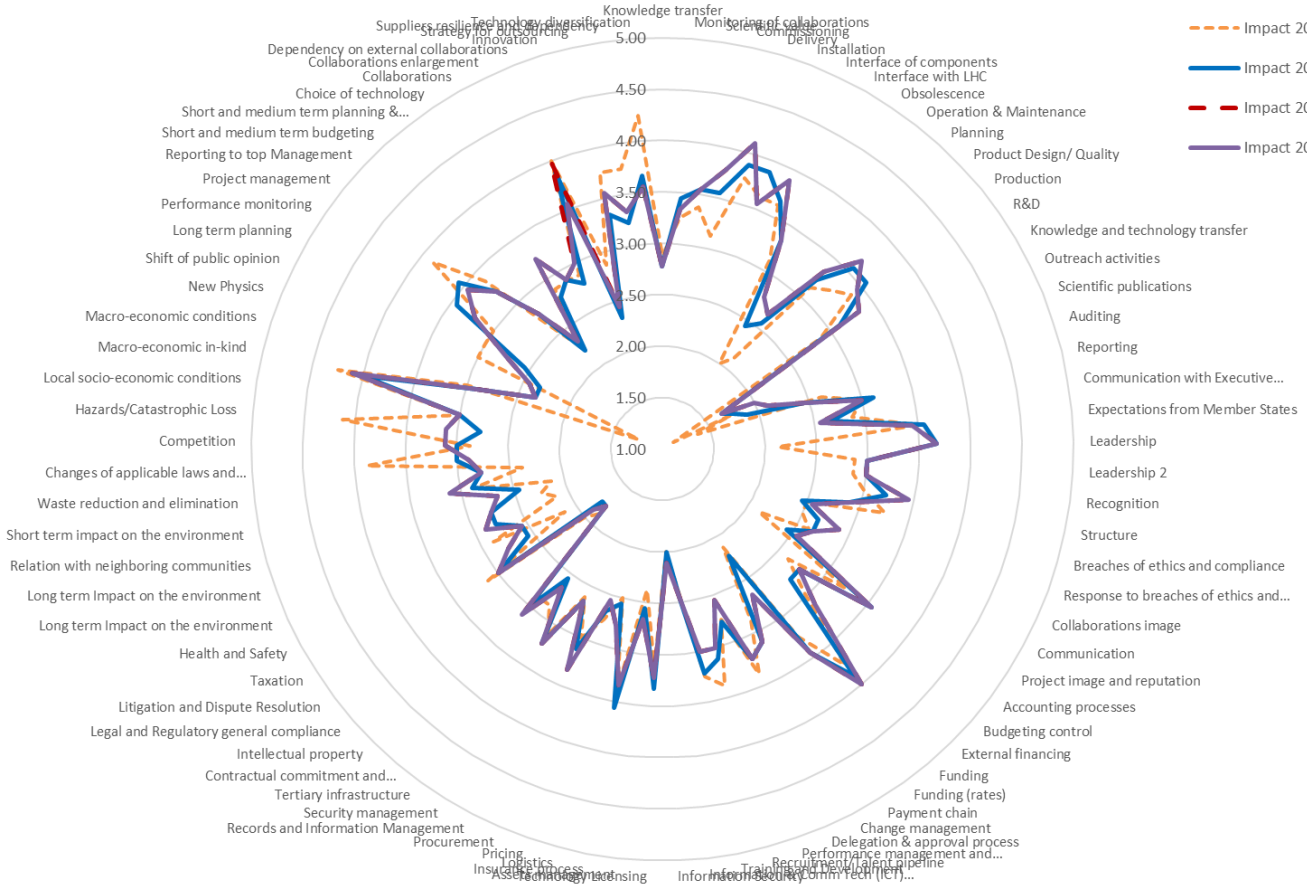
IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP1	0	2	14	51	18



WP1


Vulnerability 2020
Vulnerability 2019
Vulnerability 2018
Vulnerability 2017
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
Knowledge transfer
Monitoring of collaborations
Commissioning
Delivery
Installation
Interface of components
Interface with LHC
Obsolescence
Operation & Maintenance
Planning
Product Design/ Quality
Production
R&D
Knowledge and technology transfer
Outreach activities
Scientific publications
Auditing
Reporting
Communication with Executive...
Expectations from Member States
Leadership
Leadership 2
Recognition
Structure
Breaches of ethics and compliance
Response to breaches of ethics and...
Collaborations image
Communication
Project image and reputation
Accounting processes
Budgeting control
External financing
Funding
Funding (rates)
Payment chain
Change management
Delegation & approval process
Performance management and...
Recruitment/Talent pipeline
Training/Learning/Development
Information Security
Technology licensing
Asset management
Insurance
Logistics
Pricing
Procurement
Records and Information Management
Security management
Tertiary infrastructure
Contractual commitment and...
Intellectual property
Legal and Regulatory general compliance
Litigation and Dispute Resolution
Taxation
Health and Safety
Long term Impact on the environment
Long term Impact on the environment
Relation with neighboring communities
Short term impact on the environment
Waste reduction and elimination
Changes of applicable laws and...
Competition
Hazards/Catastrophic Loss
Local socio-economic conditions
Macro-economic in-kind
Macro-economic conditions
New Physics
Shift of public opinion
Long term planning
Performance monitoring
Project management
Reporting to top Management
Short and medium term budgeting
Short and medium term planning &...
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external collaborations
Innovation
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification

WP1


Impact 2020
Impact 2019
Impact 2018
Impact 2017
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
Knowledge transfer
Monitoring of collaborations
Selection
Commissioning
Delivery
Installation
Interface of components
Interface with LHC
Obsolescence
Operation & Maintenance
Planning
Product Design/ Quality
Production
R&D
Knowledge and technology transfer
Outreach activities
Scientific publications
Auditing
Reporting
Communication with Executive...
Expectations from Member States
Leadership
Leadership 2
Recognition
Structure
Breaches of ethics and compliance
Response to breaches of ethics and...
Collaborations image
Communication
Project image and reputation
Accounting processes
Budgeting control
External financing
Funding
Funding (rates)
Payment chain
Change management
Delegation & approval process
Performance management and...
Recruitment/Talent pipeline
Training/Learning/Development
Comm Tech (ICT)...
Information security
Technology licensing
Asset management
Logistics
Pricing
Procurement
Records and Information Management
Security management
Tertiary infrastructure
Contractual commitment and...
Intellectual property
Legal and Regulatory general compliance
Litigation and Dispute Resolution
Taxation
Health and Safety
Long term Impact on the environment
Long term Impact on the environment
Relation with neighboring communities
Short term impact on the environment
Waste reduction and elimination
Changes of applicable laws and...
Competition
Hazards/Catastrophic Loss
Local socio-economic conditions
Macro-economic in-kind
Macro-economic conditions
New Physics
Shift of public opinion
Long term planning
Performance monitoring
Project management
Reporting to top Management
Short and medium term budgeting
Short and medium term planning &...
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external collaborations
Innovation
Strategy for outsourcing
Technology diversification
Supplies resilience and dependency

WP1 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 15.6 to **14.5**	5	Delivery	The late delivery of components from the collaborations and the industry is considered a major risk. A great effort will be made to synchronize the arrival of both of them. In particular those for the IT string. Elaborate a planning that allows to identify the real margins that exist for the components (not only procurement but also production). Refine the installation schedule to be inside the 2.5-year window
From 14.7 to **15.5**	81	Dependency on external collaborations	Continue the close contact with the collaborators. The biggest risk comes from the uncertainty of the Russian collaboration and that Japan may not continue contributing
From 11.8 to **13.1**	40	Recruitment/Talent pipeline	Discuss with the new management which is the preferred solution (not cost neutral)
From10.4 to **13.1**	84	Suppliers resilience and dependence	Keep going with the actions (early procurement, payment for prototypes, identify second suppliers …). Continue having internal capability to produce the components in case of the failure of the contractors. Discussion with the Sector about how to maintain the interest from the industry for some technologies/materials. Consider a central support from CERN and not from the project.
From 9.8 to **10.0**	7	Interface of components	Keep the pressure on the creation of the ECRs (Technical ECRs to be discussed in the TCC, managerial aspects to be discussed on the PSM). Issue Conceptual specifications for new Baseline components including discussions of WPs/Groups. Ensure that the WPs are coordinated before the preparation of ECRs. Complete the interface specifications of all WPs
From 9 to **8.6**	49	Procurement	Keep an eye on the new structure.
From 10.0 to **10.1**	69	Macro-economic conditions	This risk is out of the control of the project. A preparedness action has been set: The action is to continue to report to the executive committee in a clear and transparent manner and to ask to be informed if a delay may affect the schedule and resources of the machine.
From 10.3 to **11.4**	21	Expectations from Member States	Clear reporting of the risks of the collaborations and of having contracts with companies that are not fully qualified but from poorly returned countries
From 9.3 to **10.1**	25	Structure	Ensure that close contact is maintained with the new management.
From 10.3 to **10.1**	13	Production	Reinforce PRRs and MRs (including interfaces with other WPs). Distribute the plan of PRRs and MRs to the GLs.
From 9.8 to **13.3**	85	Technology diversification	Ensure correct documentation on the technological choices, in particular for the technologies for which we do not have an alternative. Decision on the production of the MQXFB .
From 9.3 to **10.1**	38	Delegation & approval process	Rediscuss with GLs and WPs the delegation of authority for those WPs with new interfaces. Clarify the role of the HSE link and operational safety coordinator.
From 10.0 to **9**	44	Technology Licensing	Follow up of the implementation of ARAS (replacement of SmarTeam). Evaluate potential changes in the software for financing reporting (EVM).
From 9.9 to **10.4**	6	Installation	The lessons learnt from LS2 shall be integrated. Identify installation contact points for all the components added to the Baseline and complete the list of people responsible for installation. Continue with the installation studies.
From 9.7 to **9.3**	41	Training and Development	Continue the training of the companies in the usage of MTF and EDMS. Continue the training on EVM.
From 9.5 to **13.6**	74	Project management	Identification of resources needed during 2021 for discussion with new management.

WP1 – MAIN NEW ACTIONS

IxV	ID	Risk	Actions
From 8.9 to **11.3**	83	Strategy for outsourcing	Once more suggest GLs to reinforce contract supervision. Every contract should have two people following it and one has to be a Staff. Use the PSM to discuss this need with the GLs. Reinforce the message to the new management.
From 8.4 to **15.4**	68	Macro-economic in-kind	Under the responsibility of CERN management.
From 5.9 to **13.4**	66	Hazards/Catastrophic Loss	Global actions come from CERN management. Maintain actions for COVID as established for the 1st wave.
From 7 to **13.1**	64	Changes of applicable laws and regulations	Maintain actions for COVID as established for the 1st wave (visits to the companies through video, …).
From 7.4 to **9.8**	26	Breaches of ethics and compliance	Keep close contract with the top management for the plan to replace the PJAS.
From 8.3 to **9.4**	19	Reporting	Agree the structure of the project office and of the project in general in relation with the structure of the sector (including committees).
From 8.8 to **9**	73	Performance monitoring	Increase the number of check points in the schedule (granularity in EVM included).
From 8 to **8.9**	2	Monitoring of collaborations	Maintain the present reporting. Ensure that there is a “presential” annual meeting in 2021.
From 8.4 to **8.9**	35	Funding (rates)	We have no way to compensate in case it is needed (no contingency).

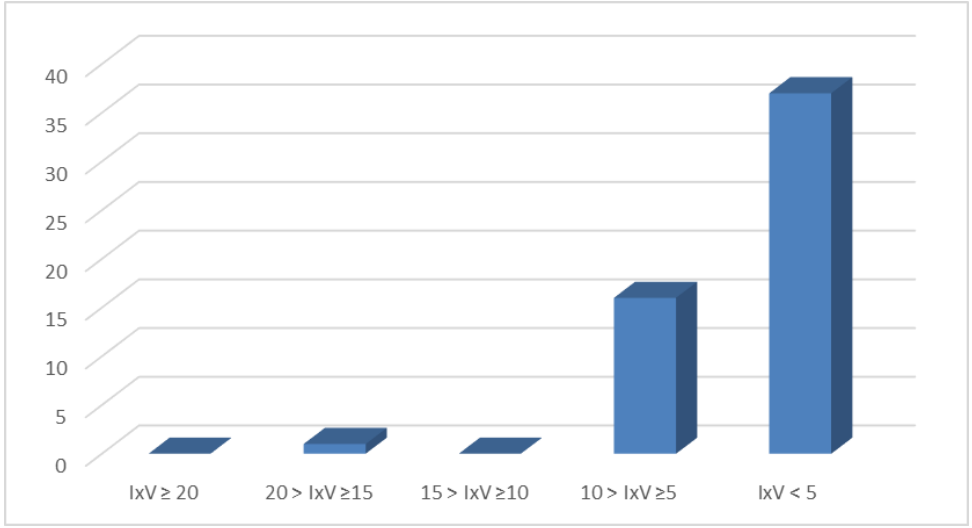
WP3 and WP4 – Mature WPs with well established Collaborations and in full production mode

Main risks: Monitoring of the very large collaborations involved and follow up of the production of the big amount of deliverables required.

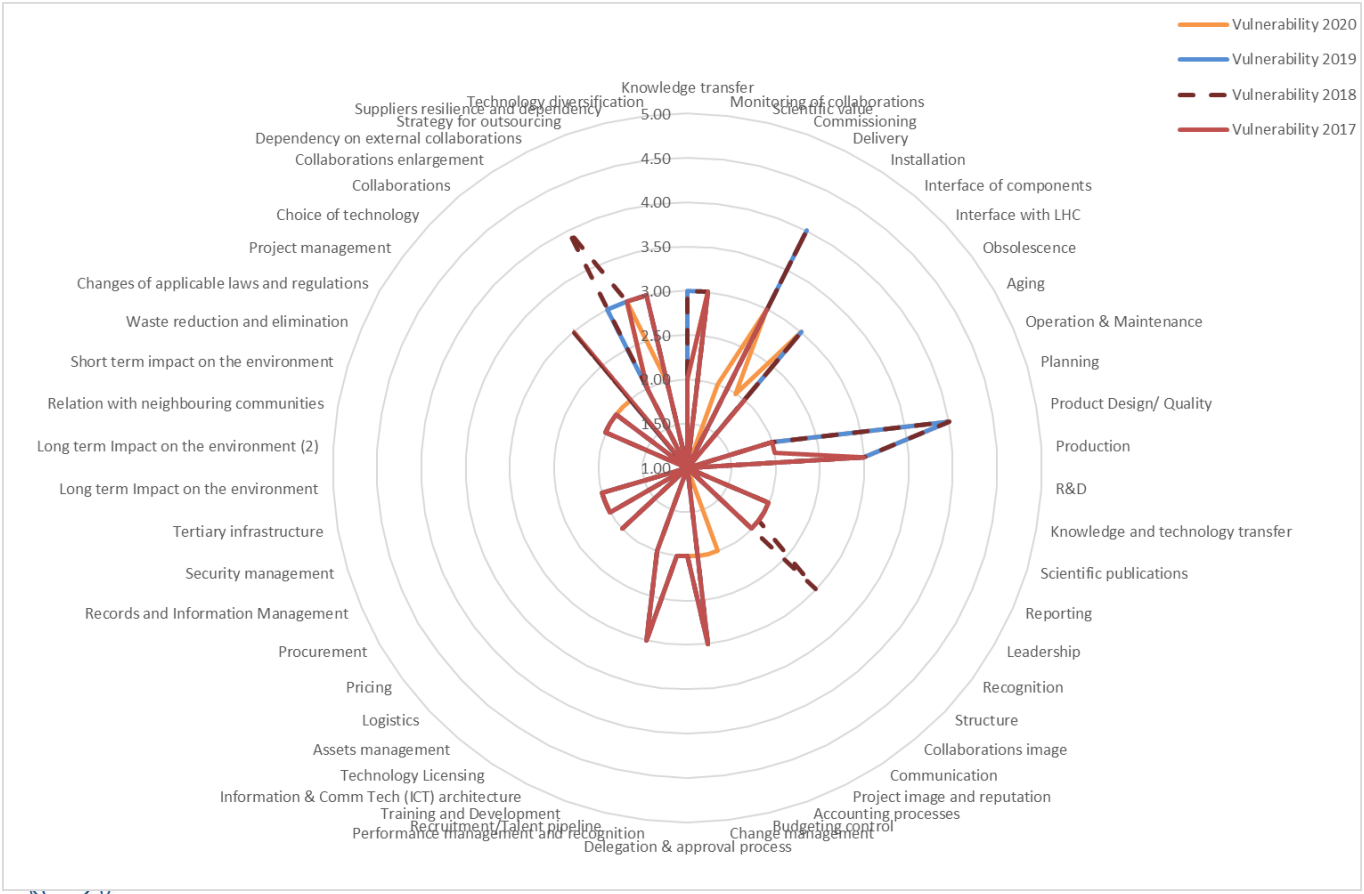
Average I*V → 4.15

WP3

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP3	0	1	0	16	37



WP3


Vulnerability 2020
Vulnerability 2019
Vulnerability 2018
Vulnerability 2017
Knowledge transfer
Monitoring of collaborations
Scientific value
Commissioning
Delivery
Installation
Interface of components
Interface with LHC
Obsolescence
Aging
Operation & Maintenance
Planning
Product Design/ Quality
Production
R&D
Knowledge and technology transfer
Scientific publications
Reporting
Leadership
Recognition
Structure
Collaborations image
Communication
Project image and reputation
Accounting processes
Budgeting control
Change management
Delegation & approval process
Performance management and recognition
Recruitment/Talent pipeline
Training and Development
Information & Comm Tech (ICT) architecture
Technology Licensing
Assets management
Logistics
Pricing
Procurement
Records and Information Management
Security management
Tertiary infrastructure
Long term Impact on the environment
Long term Impact on the environment (2)
Relation with neighbouring communities
Short term impact on the environment
Waste reduction and elimination
Changes of applicable laws and regulations
Project management
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external collaborations
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification
5.00
4.50
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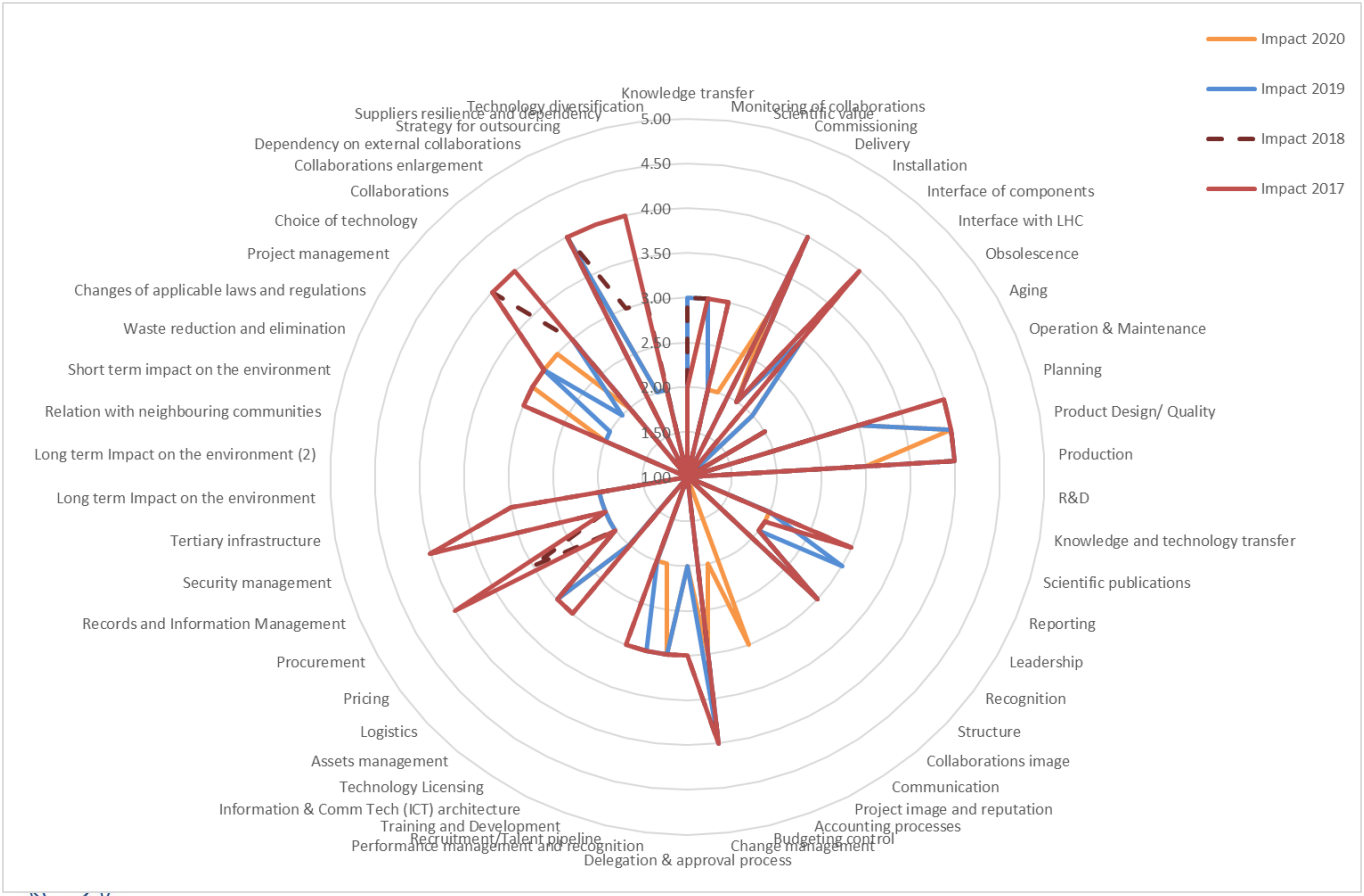
2.50
2.00
1.50
1.00

WP3


Impact 2020
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Commissioning
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Collaborations
Collaborations enlargement
Dependency on external collaborations
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification
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1.50
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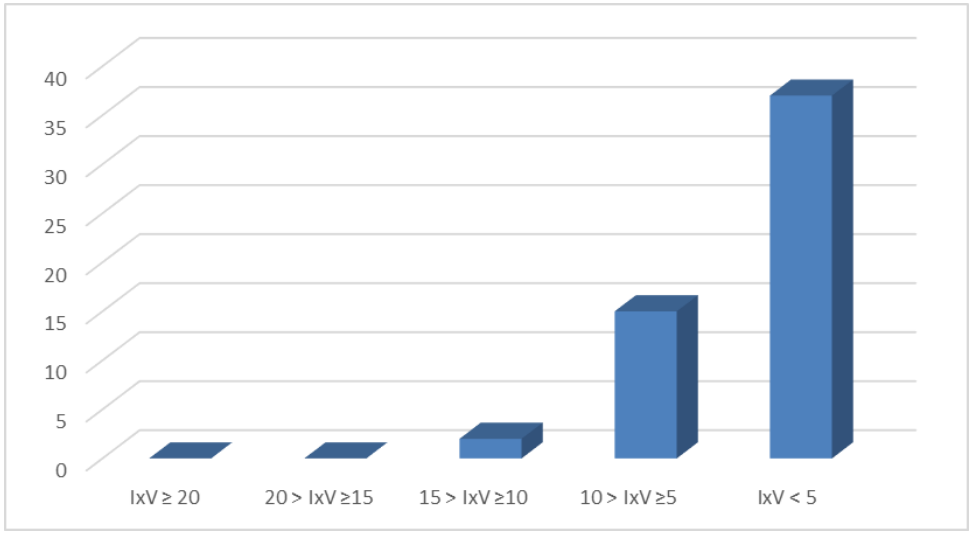
WP3 – MAIN ACTIONS

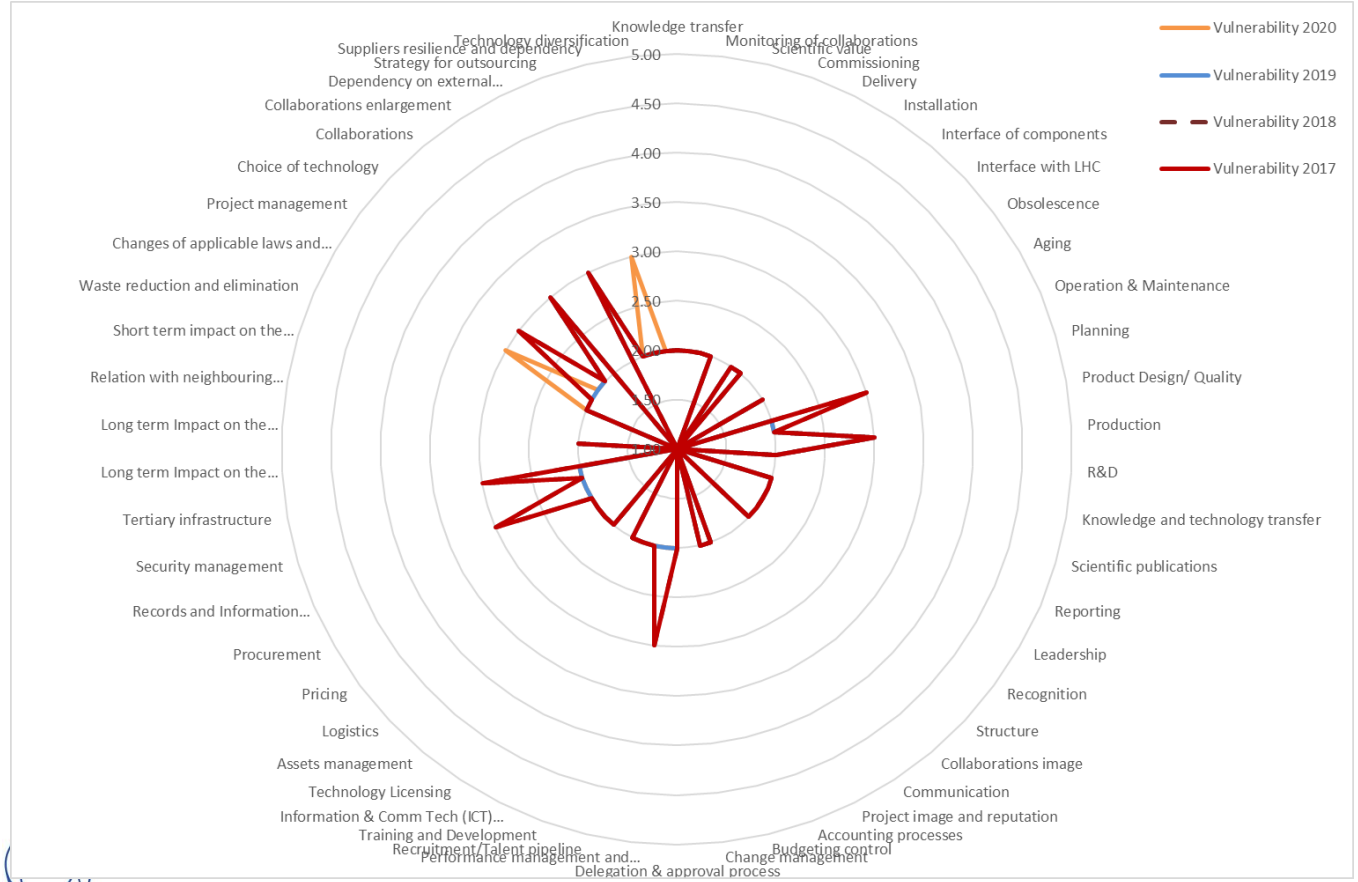
IxV	ID	Risk	Actions
From 16 to **9**	5	Delivery	Monitoring of the schedule including those of the collaborations
From 12 to **9**	14	Production	Maintain the monitoring of the nonconformities and the cross-pollination with the other teams
From 16 to **16**	13	Product Design/ Quality	Prototype for Q2. Two magnets will be tested in 2021 to assess performance of MQXFB.
From 9 to **9**	7	Interface of components	Finalise the interface specifications next year
From 9 to **9**	2	Monitoring of collaborations	Tight follow-up of the collaborations with visits on key moments of the production/testing phases

WP4

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP4	0	0	2	15	37



WP4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Knowledge transfer
Monitoring of collaborations
Scientific value
Commissioning
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Installation
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Production
R&D
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Scientific publications
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Leadership
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Change management
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Performance management and...
Recruitment/Talent pipeline
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Records and Information...
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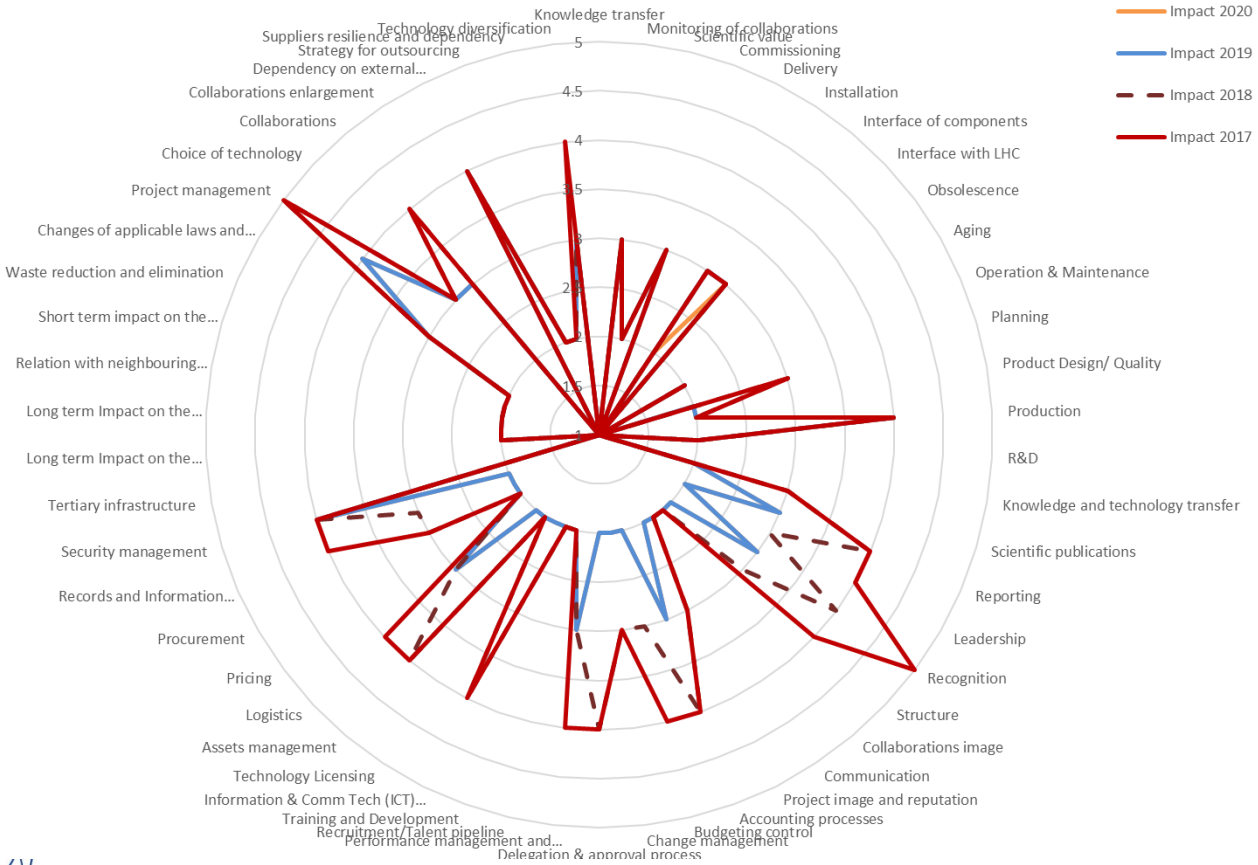
Long term Impact on the...
Long term Impact on the...
Relation with neighbouring...
Short term impact on the...
Waste reduction and elimination
Changes of applicable laws and...
Project management
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external...
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification

WP4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Changes of applicable laws and...
Project management
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external...
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification
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WP4 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 12 to **12**	14	Production	Continue the close follow-up and ensure the follow-up of the HL-LHC Quality plan (MTF level)
From 9 to **9**	49	Collaborations	If there is a change of scope, CERN can act as a backup to retake the production.
From 12 to **12**	51	Dependency on external collaborations	If there is a change of scope, CERN can act as a backup to retake the production.

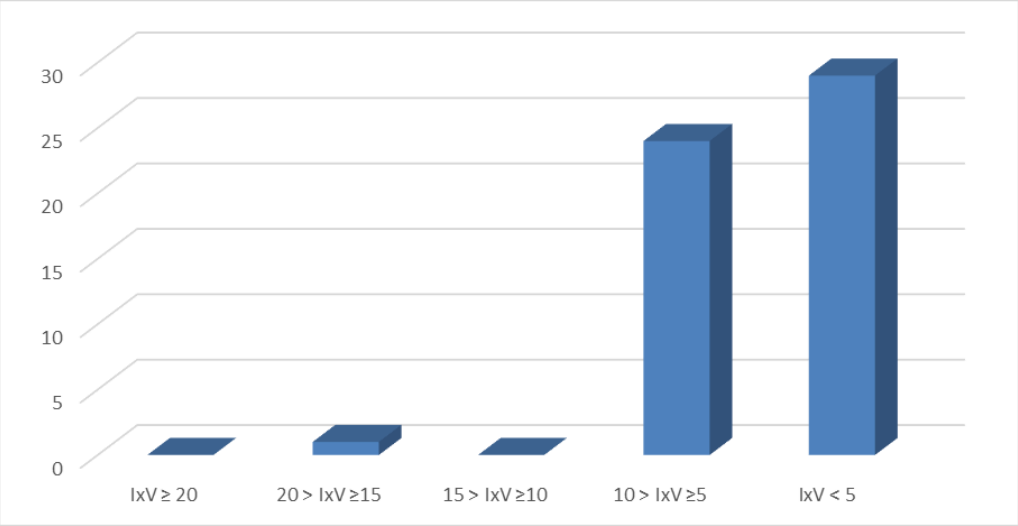
WP5 and WP8 – WPs with most of the LS3 Hardware coming from New Collaborations

Main risks: Collaboration enlargement (specially with the present restrictions in travel) and their monitoring in the initial phases.

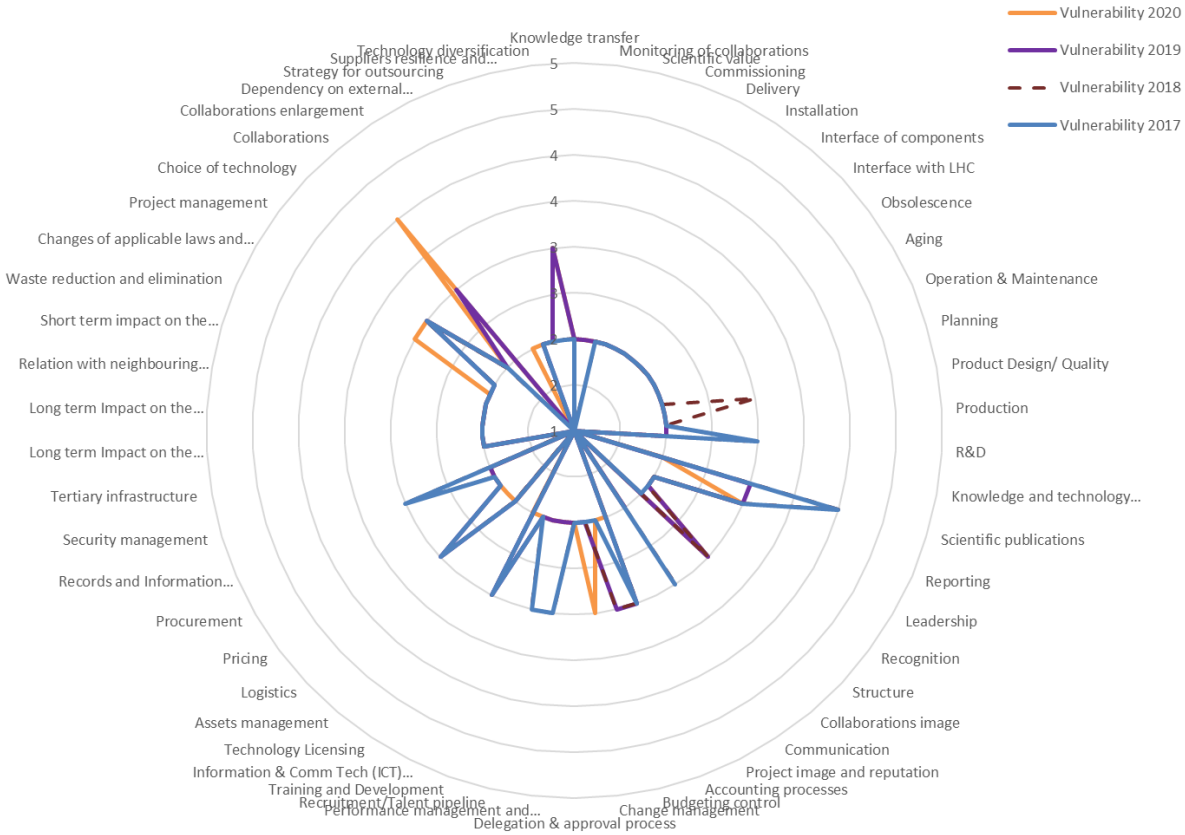
Average I*V → 4.42

WP5

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP5	0	1	0	24	29



WP5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Technology diversification
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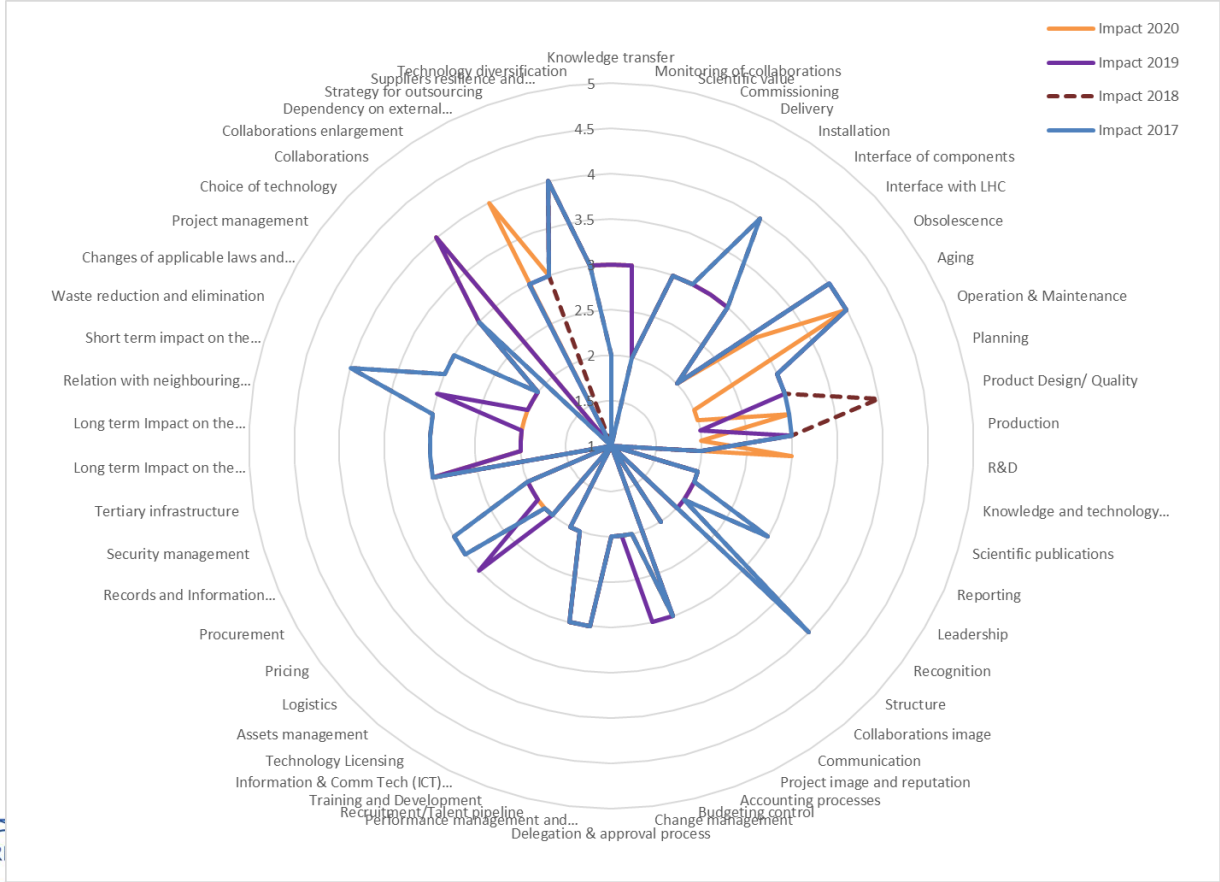
WP5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Choice of technology
Collaborations
Collaborations enlargement
Dependency on external...
Strategy for outsourcing
Supplier's resilience and...
Technology diversification
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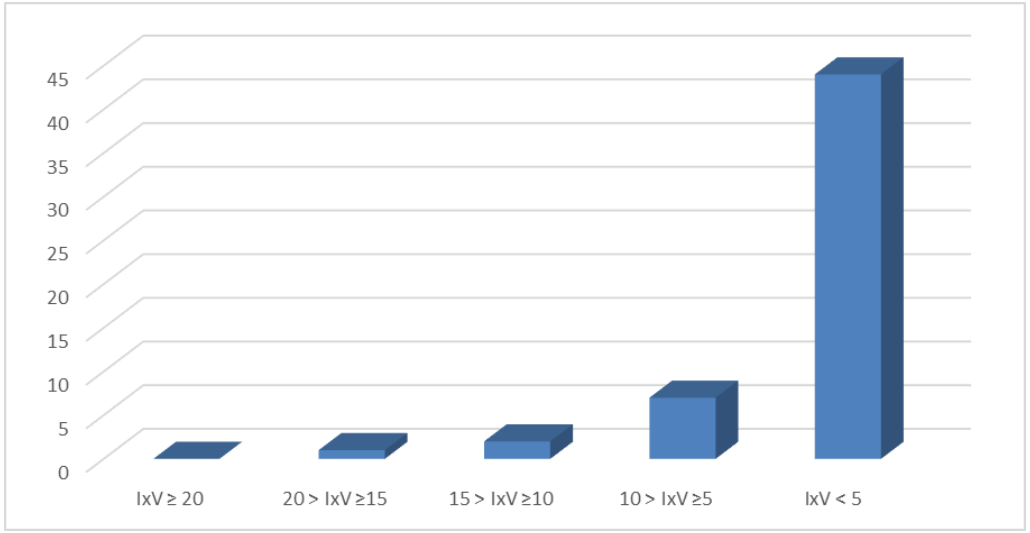
WP5 – MAIN ACTIONS

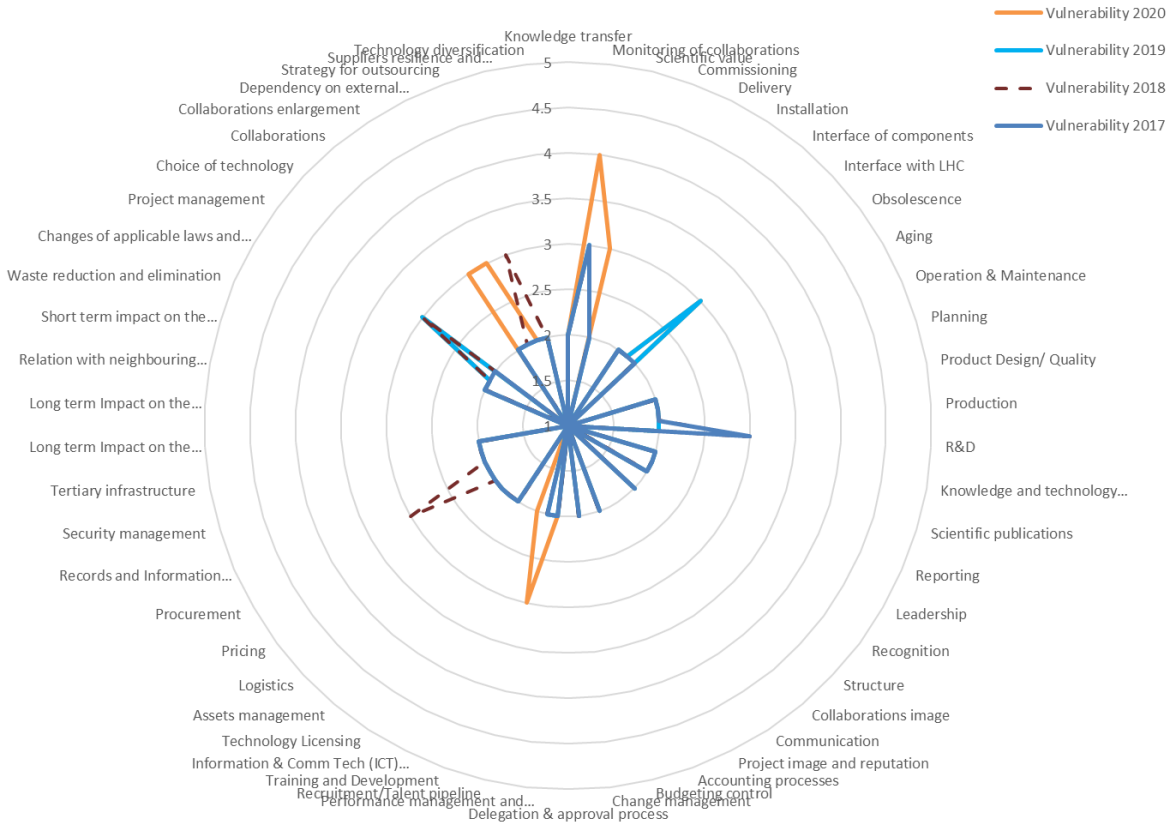
IxV	ID	Risk	Actions
From 12 to **16**	49	Collaborations	On WP1. Managerial follow up to obtain commitment that Russia will deliver on time. Timeline including the deadline (end of 2021) for a validated jaw.
From 9 to **9**	54	Technology diversification	WP1 must follow up this risk with Russia
From 4 to **6**	27	Change management	Follow up that they work on the transition and knowledge from the group.

WP8

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP8	0	1	2	7	44



WP8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Technology diversification
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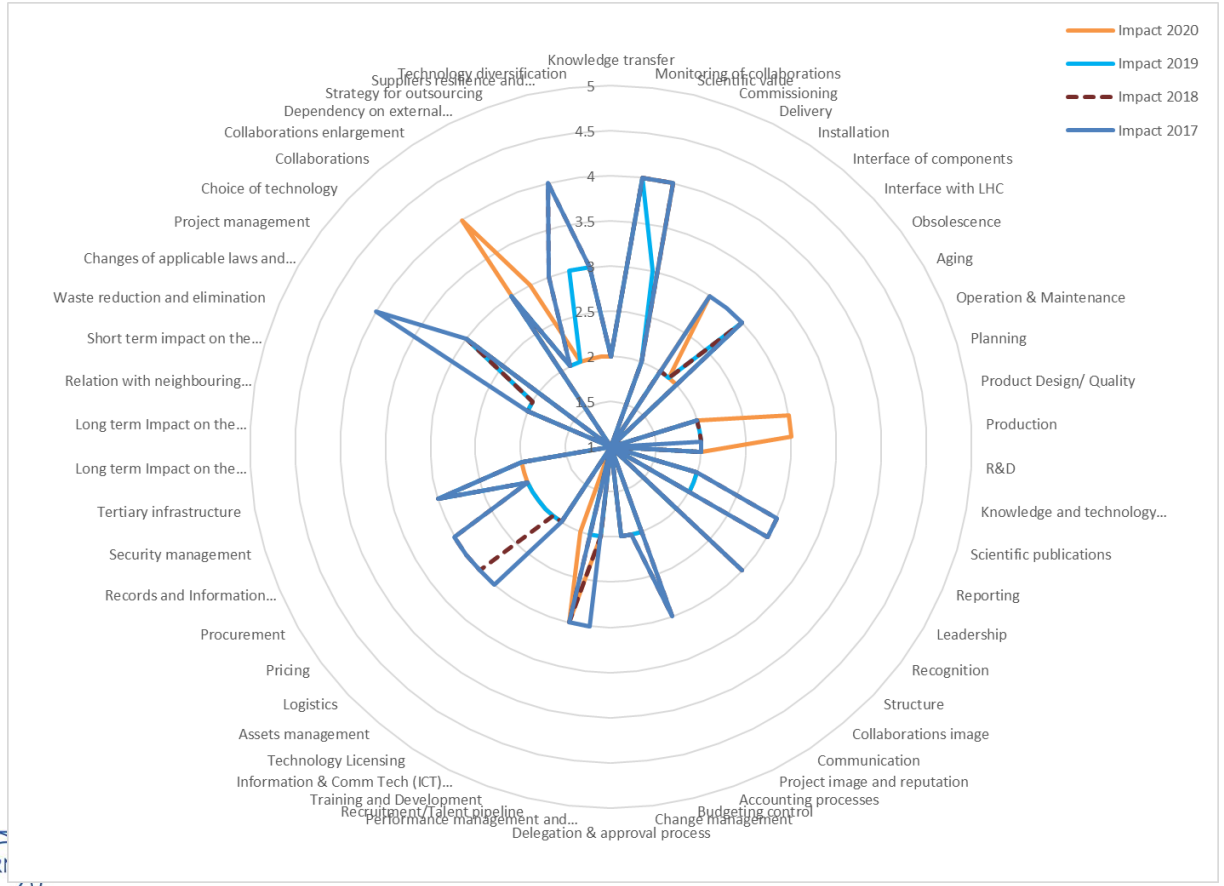
WP8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Collaborations enlargement
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Strategy for outsourcing
Suppliers resilience and...
Technology diversification
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WP8 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 12 to **16**	2	Monitoring of collaborations	Follow up the collaboration with Russia (BINP). Starting with the QP and a clear schedule and milestones.
From 9 to **9**	47	Project management	On the 26th November, the plan to create a mock-up of the TAXN – Q1 region will be presented in the TCC. This mock-up will ensure that the operation is feasible and will show any problem that has to be solved in advance. The discussions with the experiments will continue during 2021
From 6 to **12**	50	Collaborations enlargement	Call for more frequent Technical meetings. In case of failure will have to look for an alternative producer. The value of the collaboration is 2 MCHF and potentially the point of no return is in December 2021.
From 4 to **9**	51	Dependency on external collaborations	See previous action. An alternative plan exists in case it is not done by the Russian collaboration but will imply extra cost for the project
From 4 to **9**	30	Recruitment / Talent pipeline	Request in PSM that the money allocated for the PJAS is used for the recruitment of a fellow in the May committee
From 6 to **12**	3	Scientific value	Same action as for Risk 2

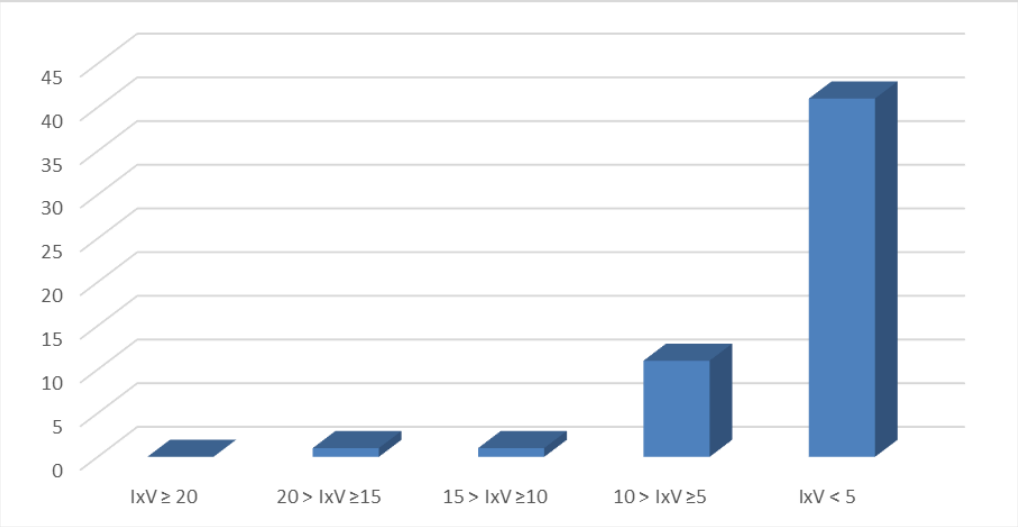
WP9 and WP17 – WPs with important LS3 Workload (but no Collaborations involved)

Main risks: Strategy for outsourcing, accounting processes and Pricing as there is a lot of upcoming procurement work; Suppliers resilience and dependence due to the large contracts that are involved, and Impact on the environment caused by the civil works required .

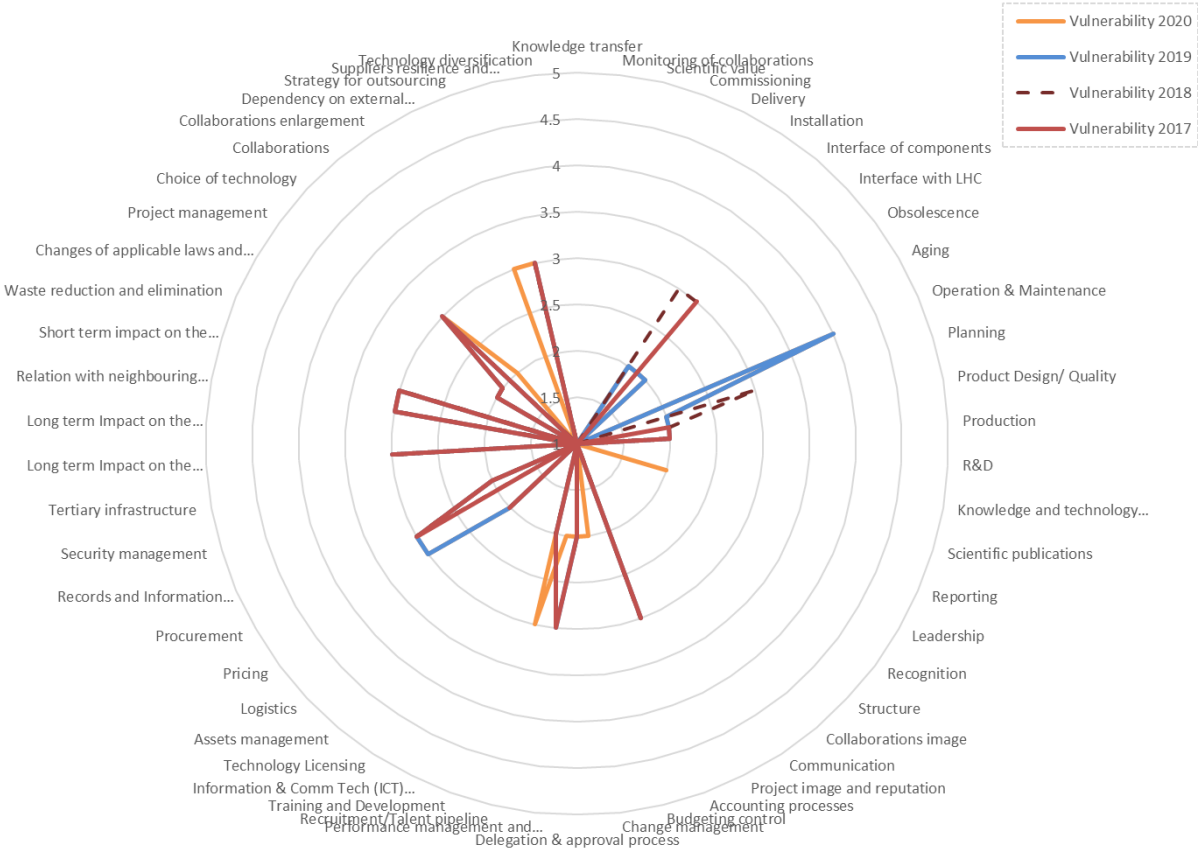
Average I*V → 4.36

WP9

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP9	0	1	1	11	41



WP9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Short term impact on the...
Waste reduction and elimination
Changes of applicable laws and...
Project management
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external...
Strategy for outsourcing
Suppliers resilience and...
Technology diversification
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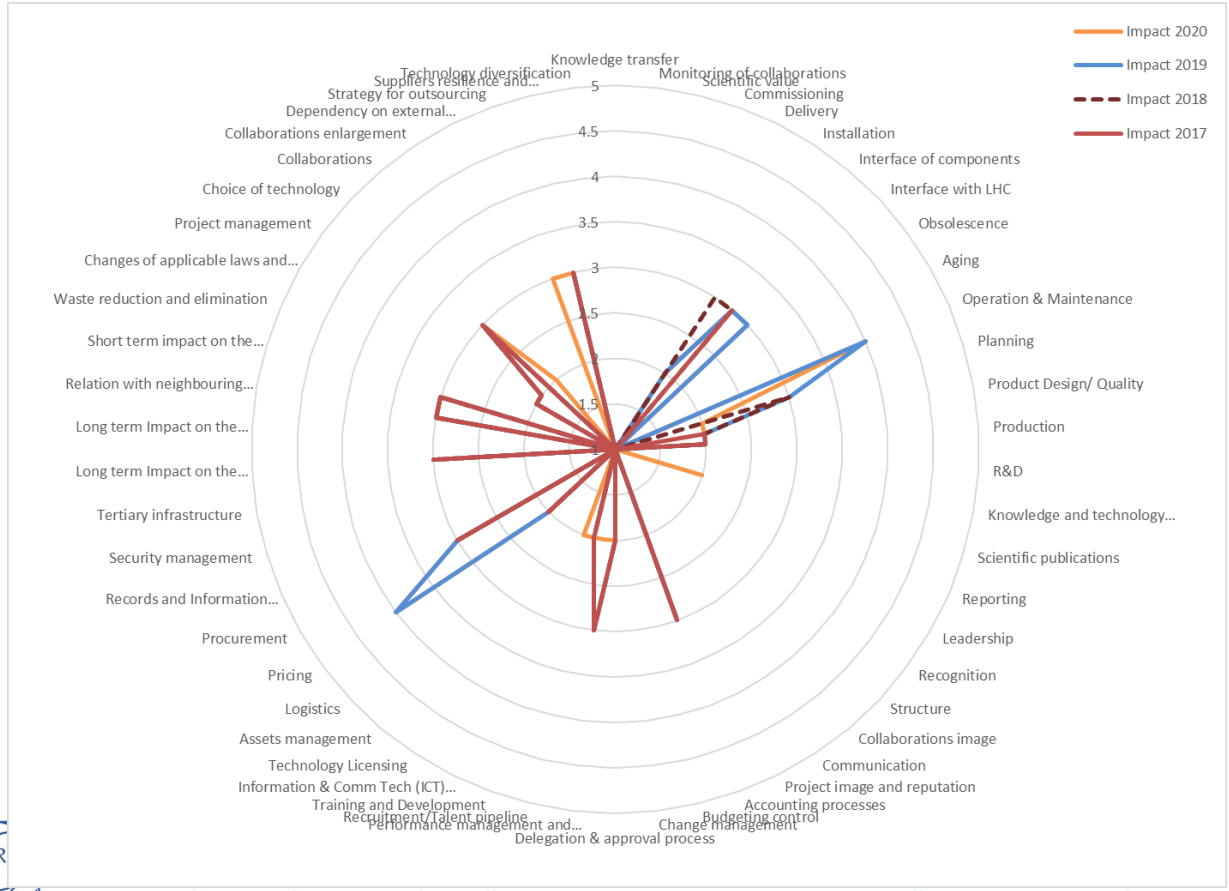
WP9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Collaborations enlargement
Dependency on external...
Strategy for outsourcing
Supplier's resilience and...
Technology diversification
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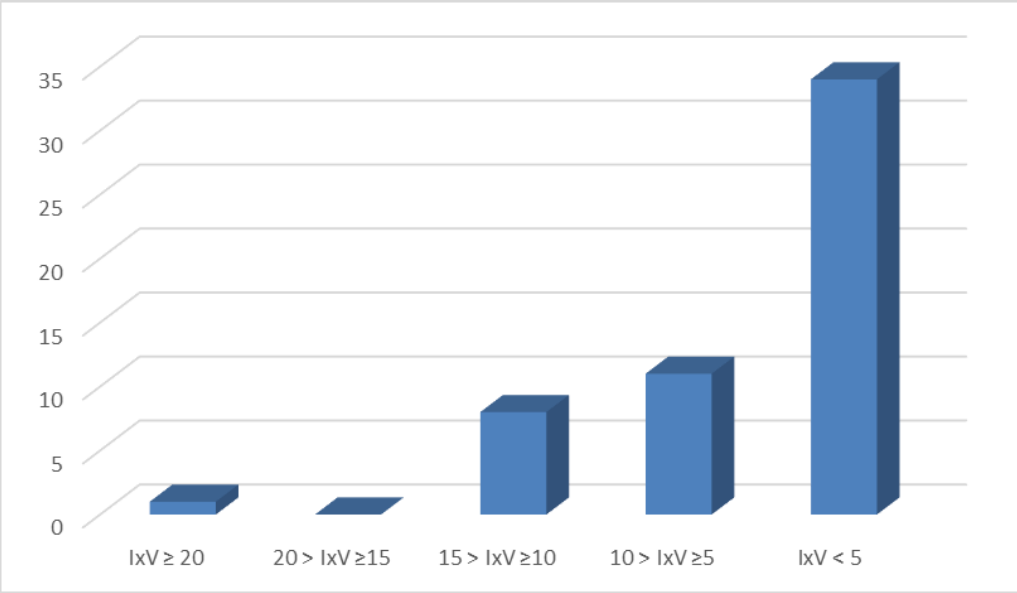
WP9 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 9 to **9**	25	Accounting processes	Similar point will be done before the tendering
From 9 to **9**	37	Procurement	Clarify the Specification committee objectives and methods. This risk is transferred to WP1
From 9 to **9**	41	Long term Impact on the environment	Already discussed with SMB for calculation of cost of possible palliative solutions. Maybe information during the open days
From 9 to **9**	43	Relation with neighbouring communities	Maintain vigilance on noise
From 9 to **9**	44	Short term impact on the environment	Action on WP17.3 for SHM building. Continue studies on cool down.
From 9 to **9**	48	Choice of technology	The cold compressors will be treated with a feasibility study.
From 9 to **9**	53	Suppliers resilience and dependency	Maintain the open option for the Indian companies if they get the correct experience and validation of their work in ITER
From12 to **12**	36	Pricing	Not delaying the tendering so that we have the possibility of retendering if prices do not correspond to what it is expected. WP9 will launch studies with industry to minimise risk of misunderstanding
From 16 to **16**	11	Operation & maintenance	Waiting for the Working group to give an alternative solution for the cooling of adjacent sectors. The risk is maintained until a solution is agreed.
From 1 to **9**	52	Strategy for outsourcing	Market survey criteria. Possibility to reissue a new MS

WP17

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP17	1	0	8	11	34



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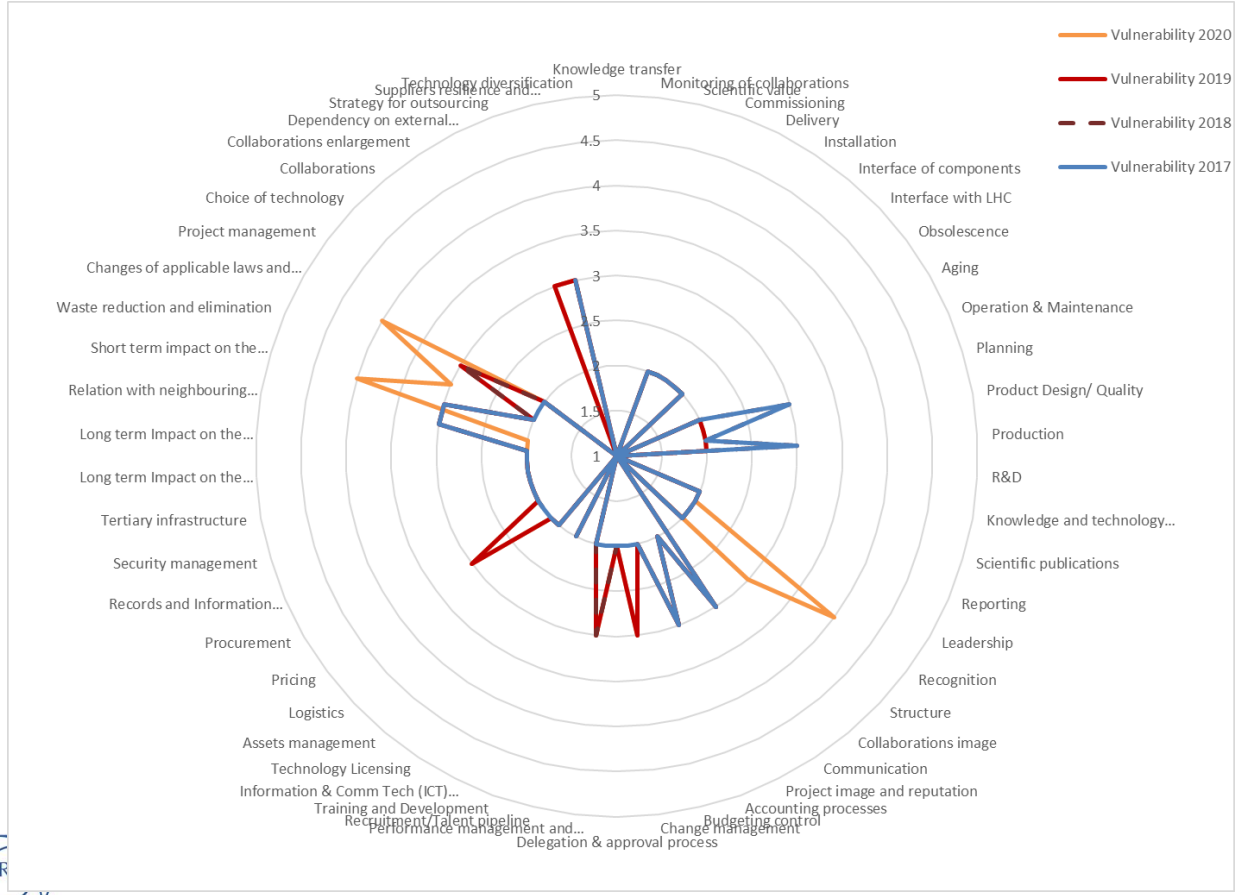
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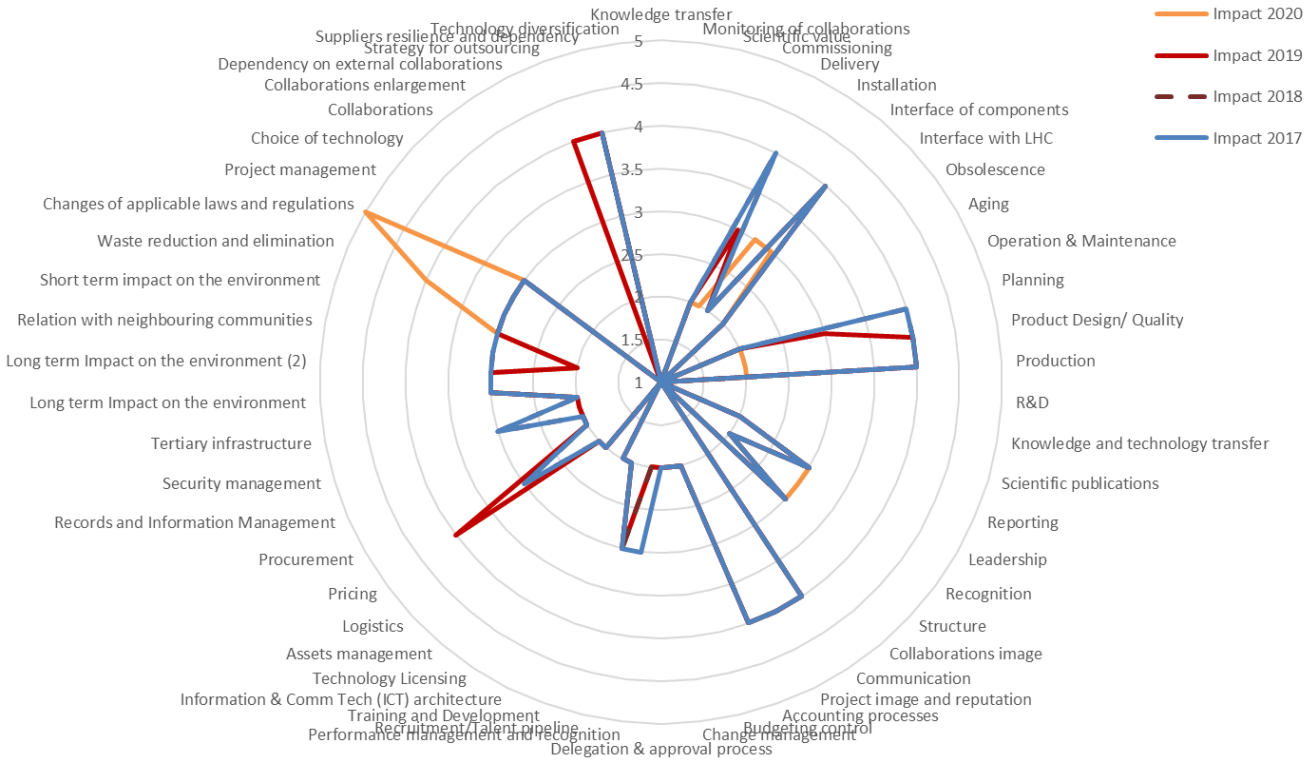
WP17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WP17 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 12 to **12**	23	Communication	The main risk concerning communication is during any crisis that could happen during an accident/incident. This will be covered by the emergency reaction sheets to be prepared for the "crisis management cell"
From 12 to **12**	25	Accounting processes	Continue the usage of SMRs. Next year when the design of the buildings is finished, it will be strongly reduced. From the end of the design a new methodology will be used (rolling SMRs).
From 12 to **12**	53	Suppliers resilience and dependency	Maintain monitoring of the invitation to tender for CV to make sure that the strategy does not have a cost impact. Monitoring of the framework contracts of EL with special HL work volume packages
From 9 to **12**	44	Short term impact on the environment	Continue analysing the incident and increase the noise detection system threshold.
From 9 to **20**	46	Changes of applicable laws	No action required now, follow-up closely
From 12 to **12**	36	Pricing	Active campaign to motivate companies to answer MS. More information for ILOs to reach more companies
From 12 to **12**	52	Strategy for outsourcing	See 53
From 4 to **12**	20	Recognition	Identify with SCE the new allocation/repartition of 4 FTEs needed for the next year
From 6 to **9**	21	Structure	Monitor the delays and revaluate the risk
From 6 to **12**	45	Waste reduction and elimination	As the level of pollution is small, define and negotiate with the Contractor a new category of spoil which can reduce the cost impact.

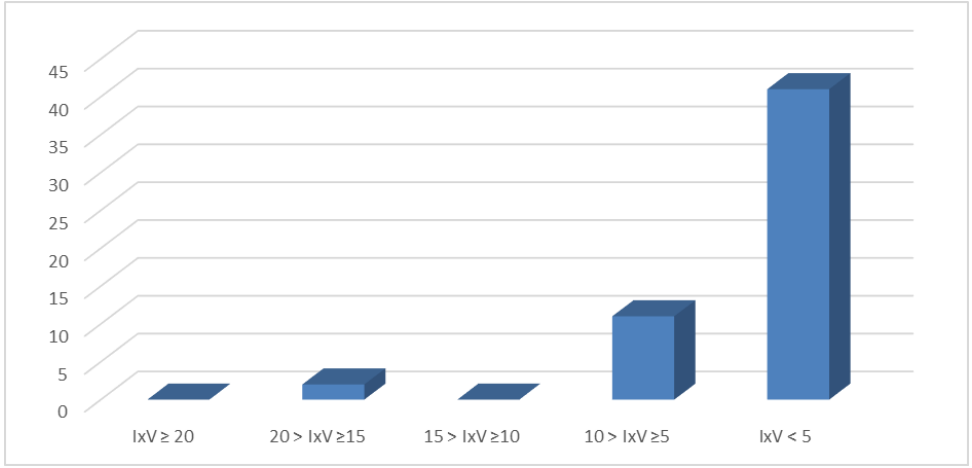
WP2 and WP10 – WPs with mainly Manpower (No Hardware)

Main risks: Accounting processes since the resources for R&D projects are not completely guaranteed. Other noticeable risks are related to Recruitment as personnel are the basis of these WPs, and Scientific publications, which constitute a very important outcome.

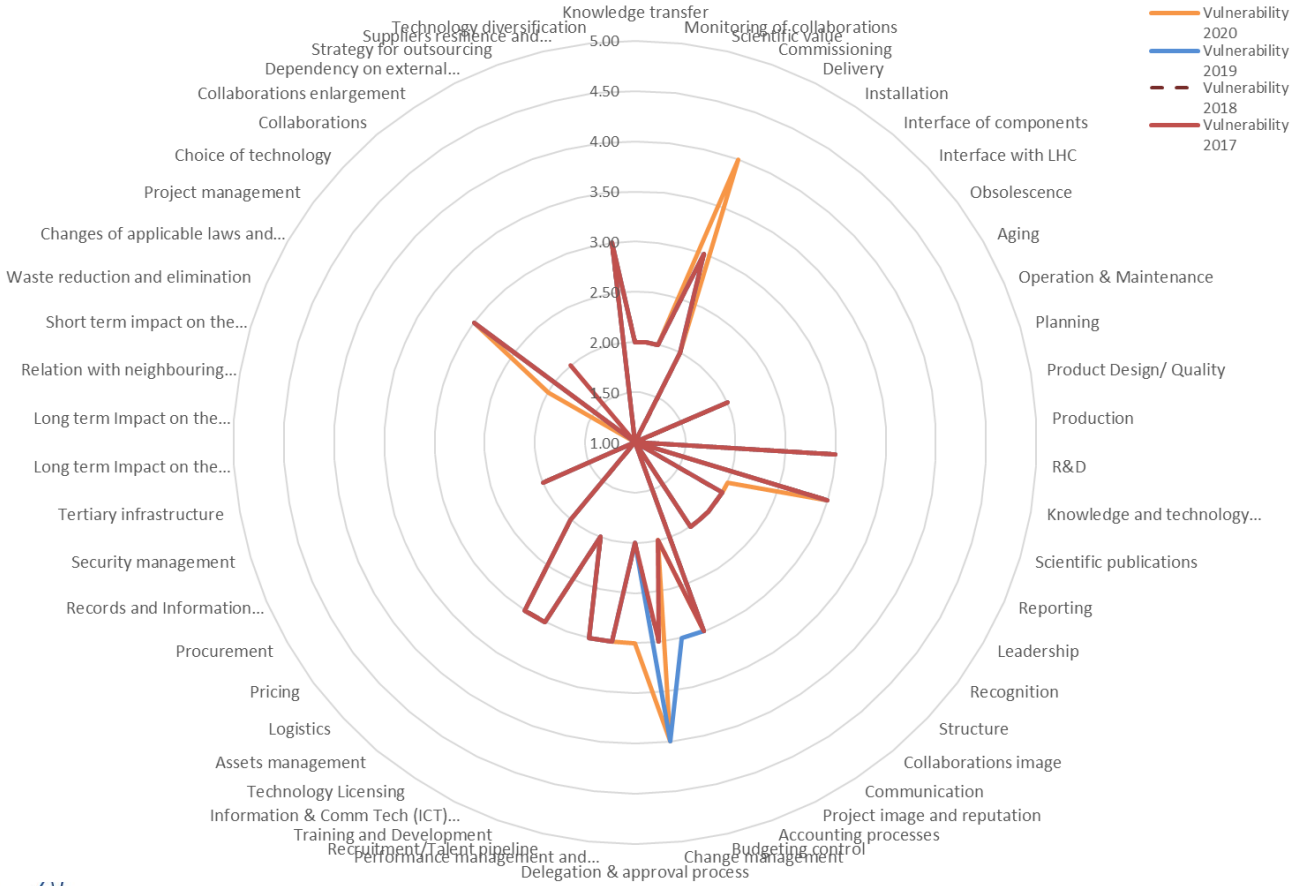
Average I*V → 2.87

WP2

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP2	0	2	0	11	41



WP2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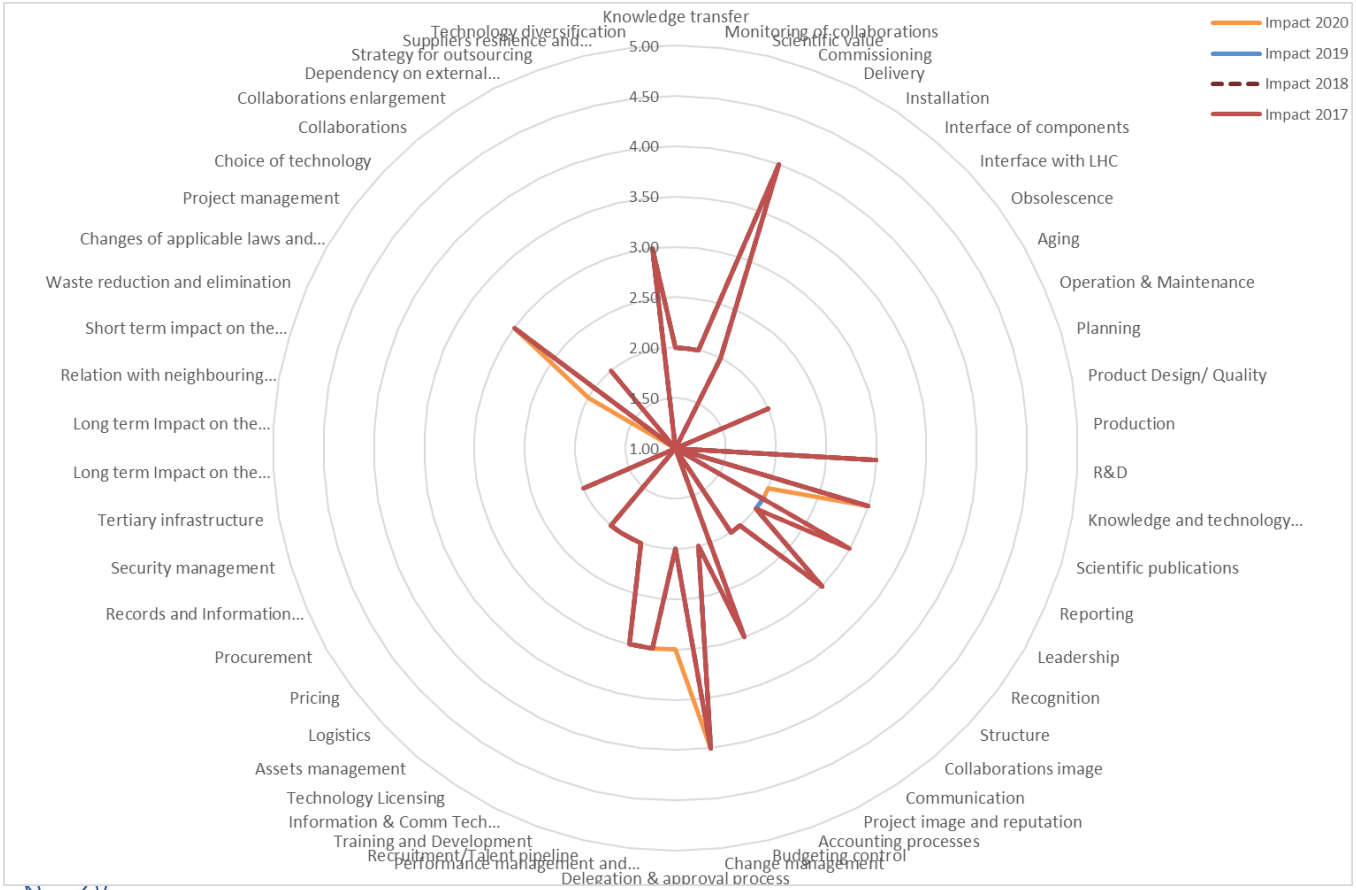
WP2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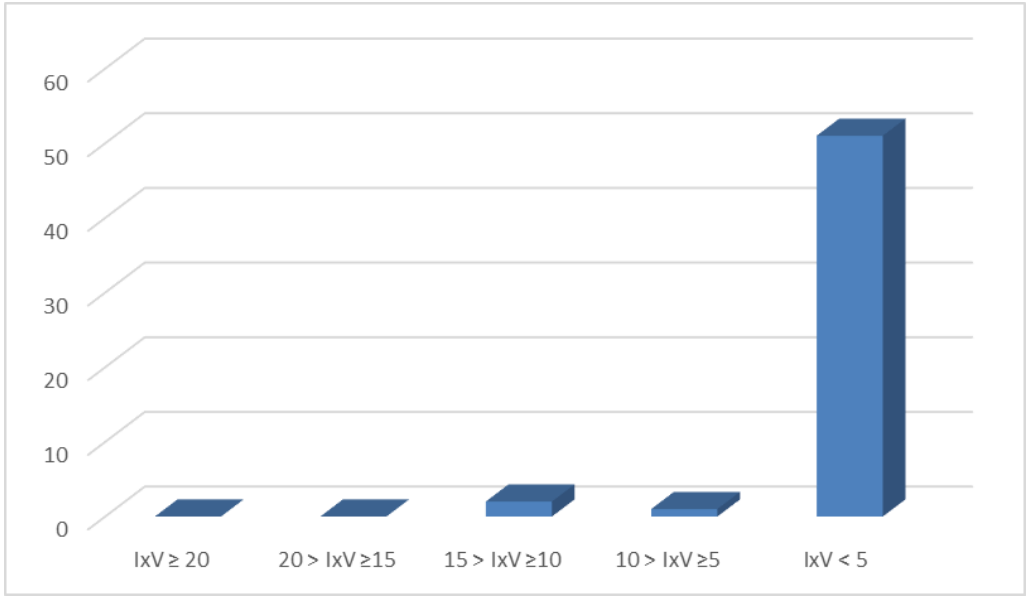
WP2 – MAIN ACTIONS

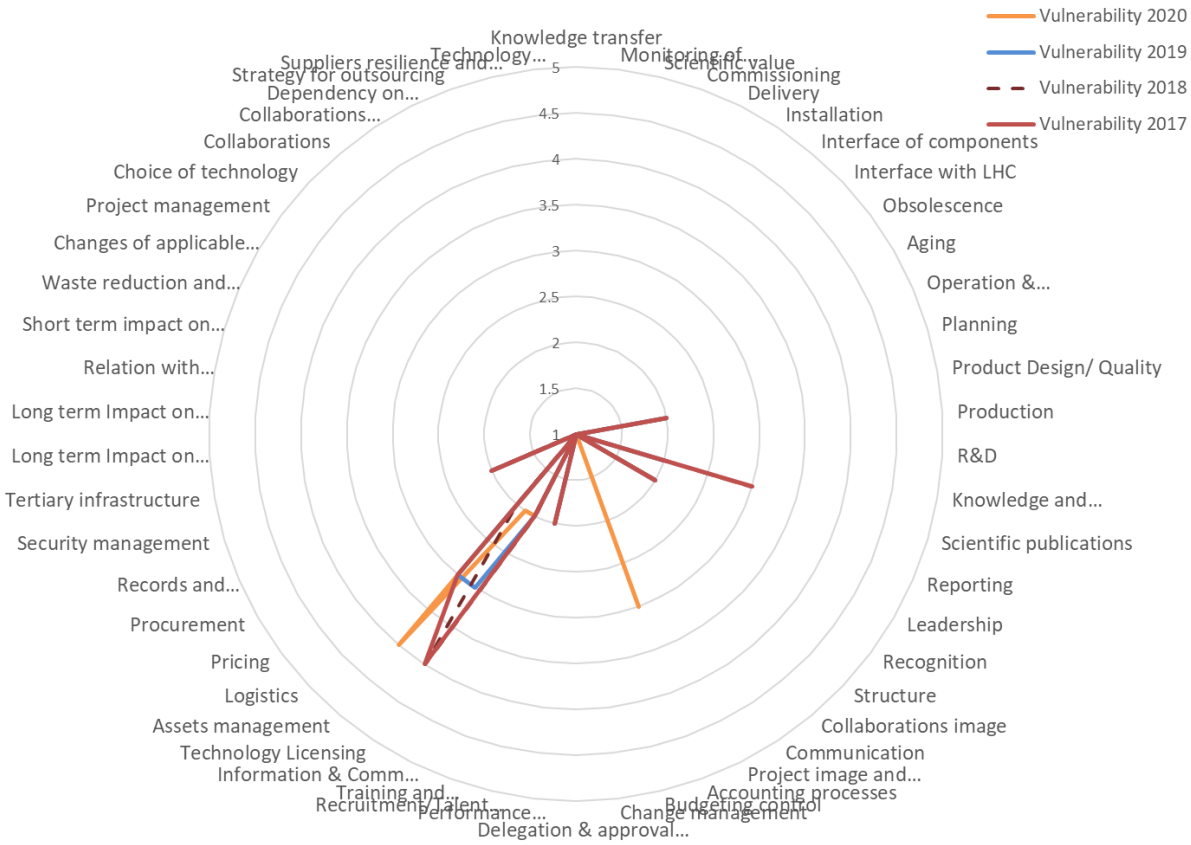
IxV	ID	Risk	Actions
From 12 to **16**	4	Commissioning	Discussion with PL and with new DH.
From 9 to **9**	15	R&D	Still no resources beyond baseline. Moved to WP1
From 9 to **9**	17	Scientific publications	Adequate time and resource allocation for documentation and validation. Definition of distribution list of KEY approvers (avoid large approval lists) and responsible for approval. The approval of the document should be conditional to the approval of these key people. Will be rediscussed with former WPL.
From 9 to **9**	25	Accounting processes	Continue defending the 1/3 contribution from the department.
From 16 to **16**	27	Change management	Discussion with the new PL and with the new DH and DDH to obtain the budget again
From 9 to **9**	29	Performance management and recognition	Reduce number of projects and studies and focus effort.
From 9 to **9**	30	Recruitment/Talent pipeline	Try to obtain a new EU grant/Swiss grant to increase attractiveness (mobility and extra resources). Make contact with Serbian community. Possible PhD from University in applied mathematics.
From 9 to **9**	47	Project management	Review of WP1 of all the potential options still open so that we can "close" them or give a deadline before the end of the year.
From 9 to **9**	54	Technology diversification	See Risk 47
From 4 to **9**	28	Delegation & approval process	Explore some automatic control tools

WP10

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP10	0	0	2	1	51



WP10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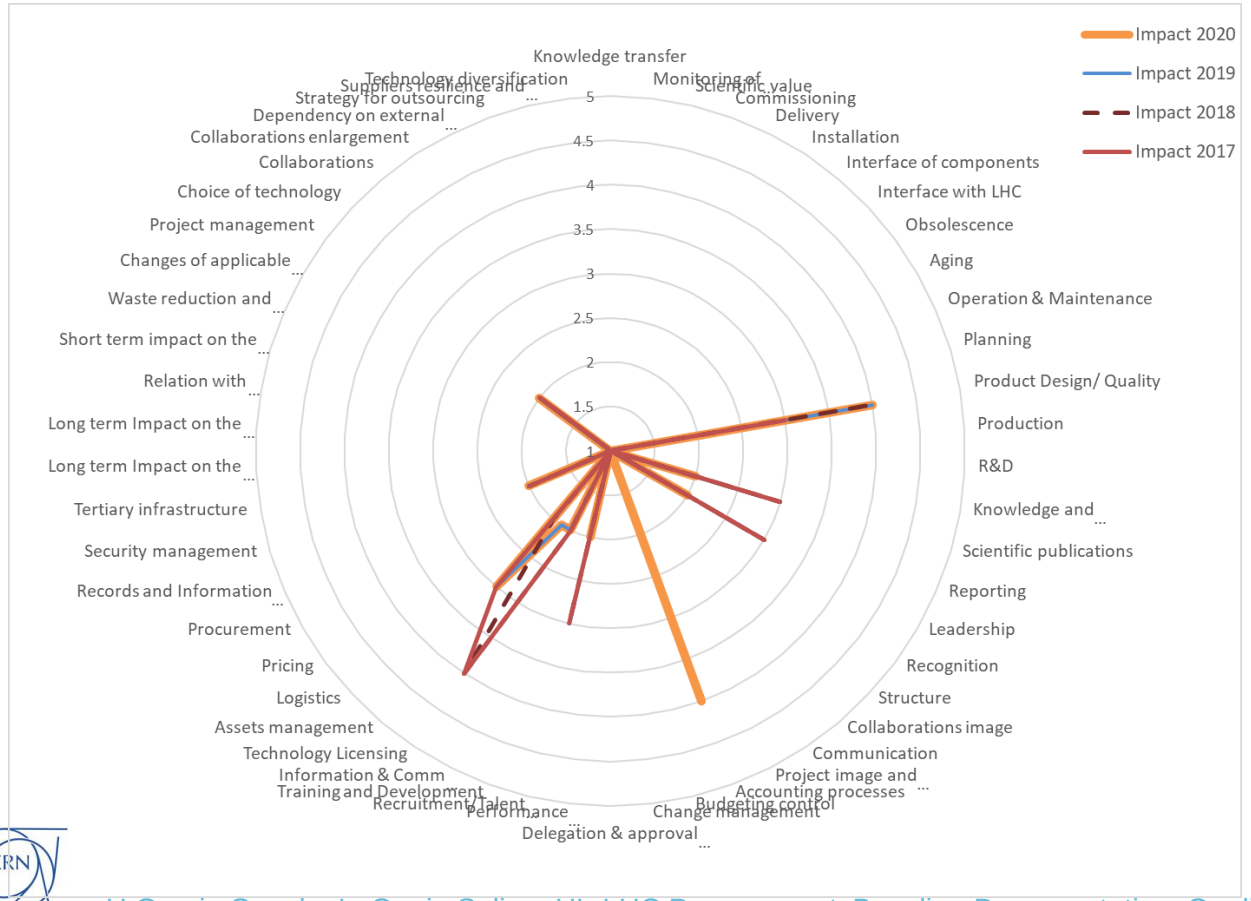
WP10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Technology diversification
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WP10 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 9 to **12**	34	Assets management	Acceptance that there will be no testing in 2021
From 1 to **12**	25	Accounting process	Transferred to WP1. HL PL has to actively support that the R2E project is extended
From 8 to **8**	13	Product Design/ Quality	Guideline on how the radiation tolerant systems should be qualified and quality controlled. Involvement of WP10 in the engineering review of critical systems with active electronics exposed to radiation (e.g. WP6B, WP7, WP13, WP18)

Since 2019

Quantitative approach added to the qualitative approach

The difficulty of quantifying risks

- Literature is very rich on risks quantification methodologies. A lot of them address one objective (insurance, liability, contingency definition, ….). Some of them are based on a list of foreseen adverse events, other in general risk topologies
- HL-LHC is a project without contingency and therefore risk management has been always considered as a tool to increase resilience and to anticipate and minimize the effect of adverse events.
- First approach: to use our present Risk register based on the risk map to obtain a “topological risk”
- In a later stage for each risk with an action to explore its fault tree and quantify if its consequences are covered by the general exercise or if an addition “over cost” has to be considered.

From qualitative to quantitative: Impact on cost

Impact assessment	Catastrophic Extreme	Major	Moderate	Minor	Negligible
Assessment scale	5	4	3	2	1

Impact	Minimum	Most likely	Maximum
5	30%	50%	60%
4	15%	20%	40%
3	0%	10%	20%
2	-5%	5%	15%
1	-10%	0%	10%

Financial loss	Reputation	Legal/ Regulatory	Safety	Environment	Objectives

From qualitative to quantitative: Vulnerability - Probability

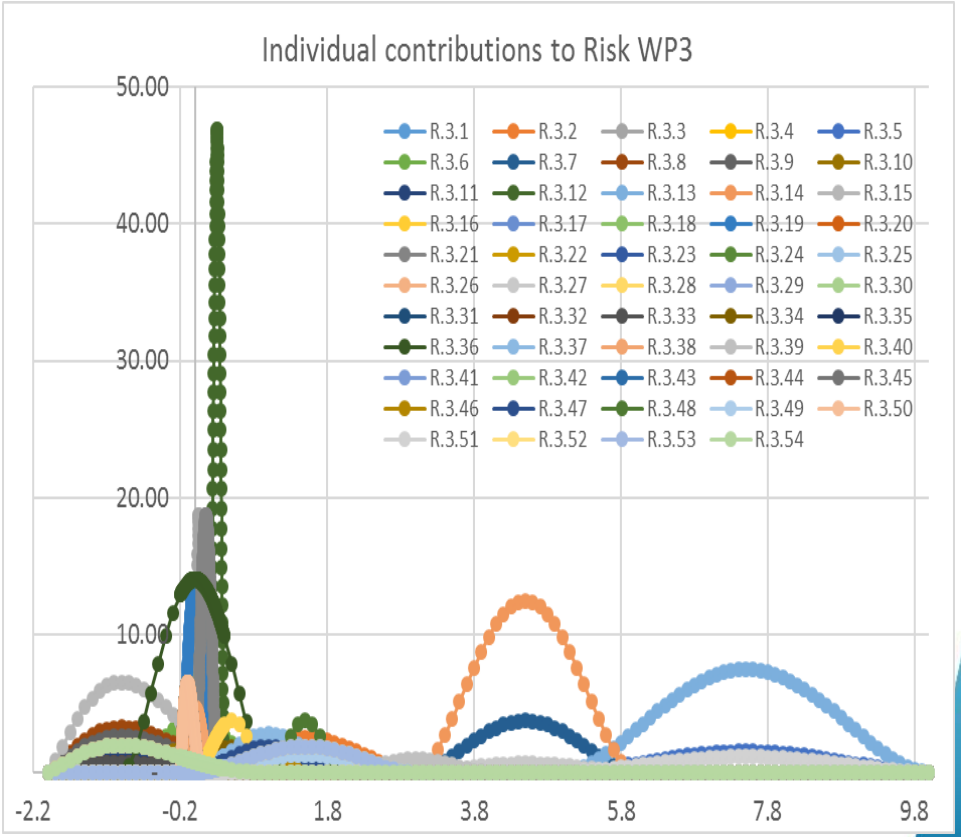
Vulnerability assessment	Severe vulnerability	High vulnerability	Moderate vulnerability	Mild vulnerability	No evidence of vulnerability
Assessment scale	5	4	3	2	1

Vulnerability	Probability
5	100 %
4	80 %
3	50 %
2	50 %
1	50 %

INTERNAL CONTROL	PREVIOUS RISK EXPERIENCE	CAPABILITY	RATE OF CHANGE

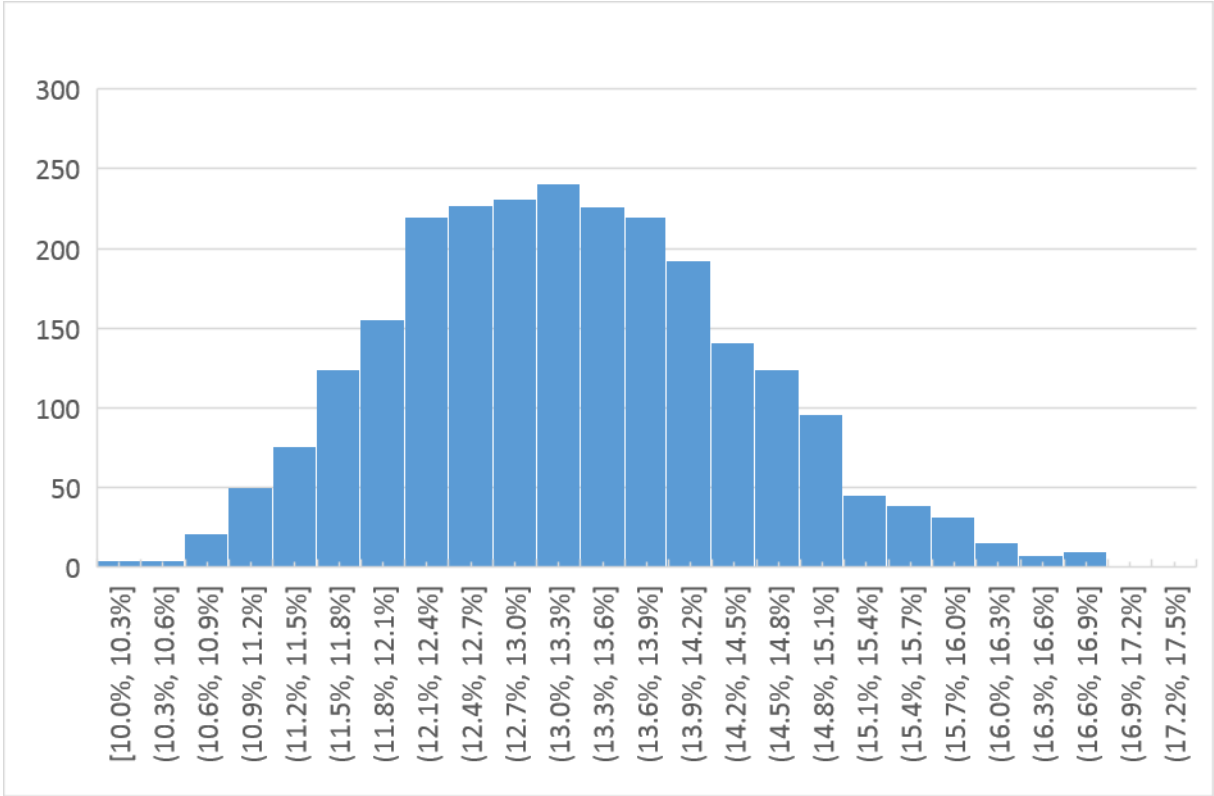
Distribution of the Risk

- The risk pattern will take in consideration the impact profile (PERT distribution based on the most likely, minimum and maximum)
- The probability that the event happens based on the vulnerability of the event
- The relative weight of each family of risks (ex. Production risk for WP3 will have 200 times more weight than the risks on lack of scientific publications)



Distribution of the Risk

- Then all is normalized so that the final value is expressed in percentage of residual value.
- There is a Monte Carlo simulation for each one of the risks and a global computation for all the risks together



Next step

- The Montecarlo will be run again in 2021 before the next cost and schedule review
- As proposed, a few WPs will be identified to make an “adverse event” list.
- For the Risks with the biggest Cost or Schedule impact a list of “what can go wrong” and the consequences will be done. This will allow the preparation of more detailed actions and will modulate the results of the Montecarlo analysis

Outline

1. Risk assessment. Main approach
2. Methodology
3. Risk Register – How is it done?
4. Main Outcomes from last exercise
5. **Conclusions**

Main conclusions

- Risk is very subjective and the values given by WPLs are linked to their risk appetite
- With more than 50% of our budget already engaged and most of big procurements launched, our risk is every time less linked to the maturity level/pricing and more to production nonconformities, contract/collaboration management and non detected design problems.
- If there are time delays those can create extra costs
- We have not added yet the result of analysing the impact of the worst adverse events
- The perception of the risk from the collaborations is indirect and while they do not have “direct cost” (full in-kind contributions) impact they can have an strong indirect impact (retake the activities, procurement of components, rework if nonconformities, delay on other activities, transport, storage, …)
- The restructuring has caused some uncertainty and the need for adaptation but will hopefully be a temporary risk.
- The situation due to COVID has had important effects on a lot of WPs, mainly complicating the monitoring of collaborations and production due to restricted travelling, as well as requiring adaptations to the work in-house.
- The Project has already put in place Mitigation Actions based on the risk assessment: Production of equipment in-house to mitigate Delays in industrial/collaborations production, extension of Collaboration agreements due to COVID-19, Feasibility studies before the Call for Tender, etc…

Many Thanks for your attention
Any Question?

Creating a risk-conscious culture within an organization is the first step to protect the organization against the risks consequences

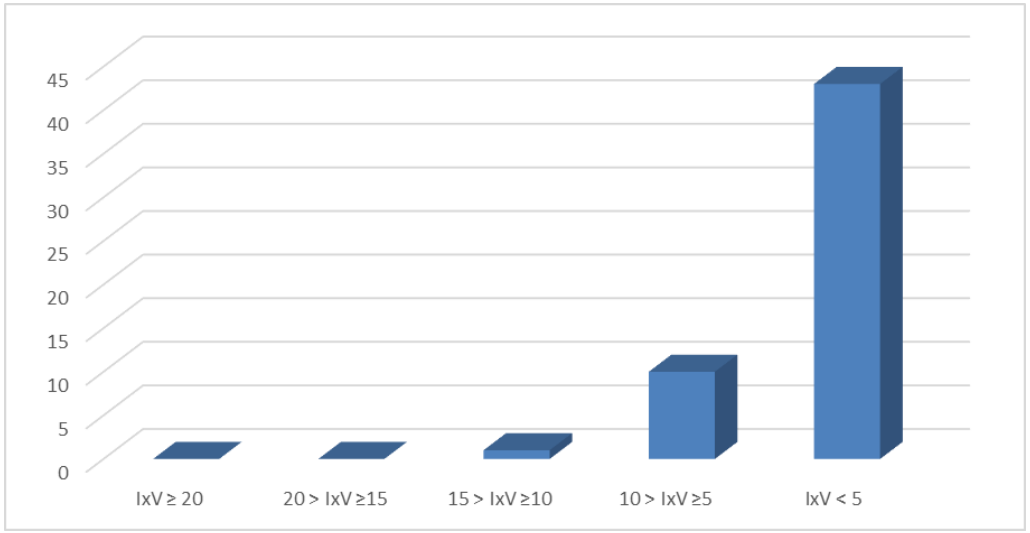
Many Thanks to Isabel Bejar who has put in place the risk assessment in the Project and has been carrying-out and monitoring this non-negligible activity up to now.

Spare Slides

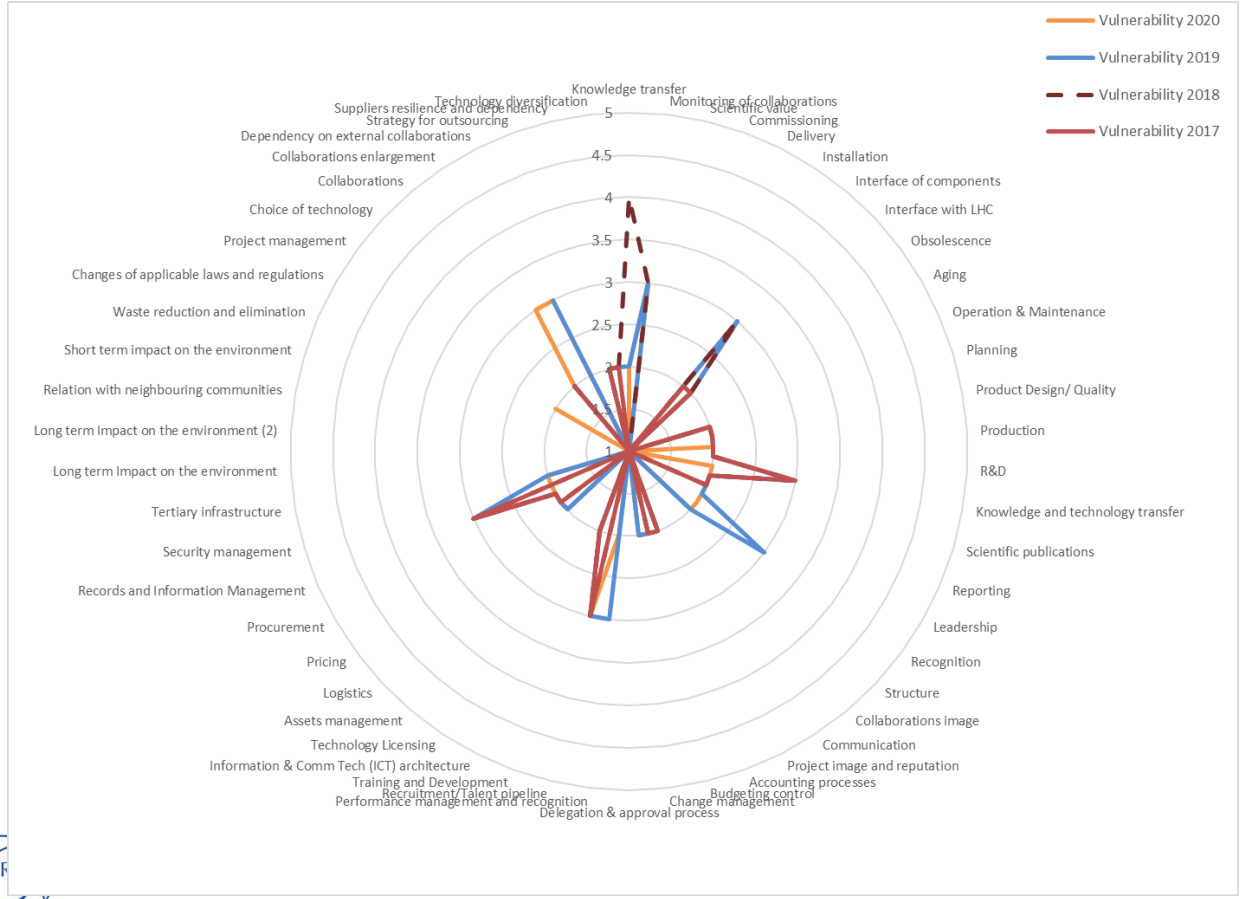
Rest of WPs

WP6A

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP6A	0	0	1	10	43



WP6A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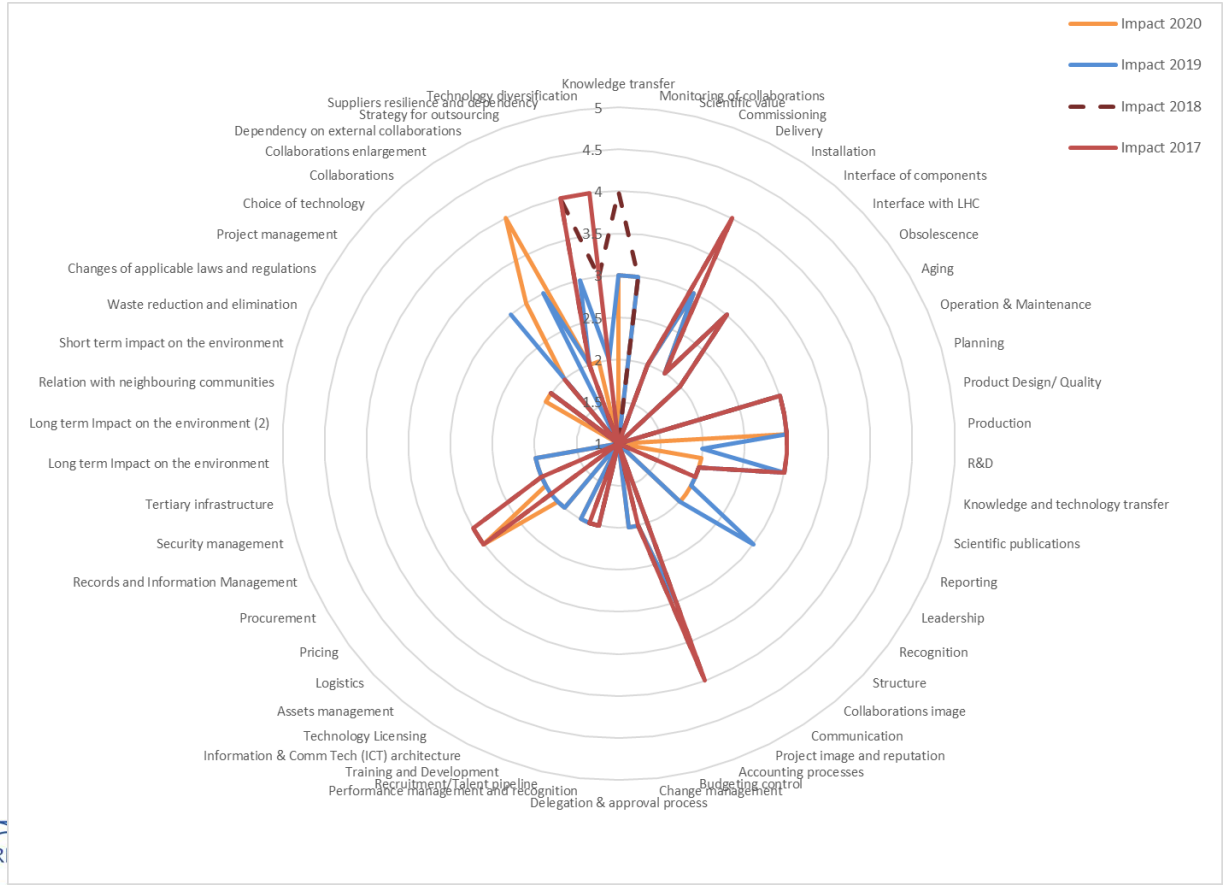
WP6A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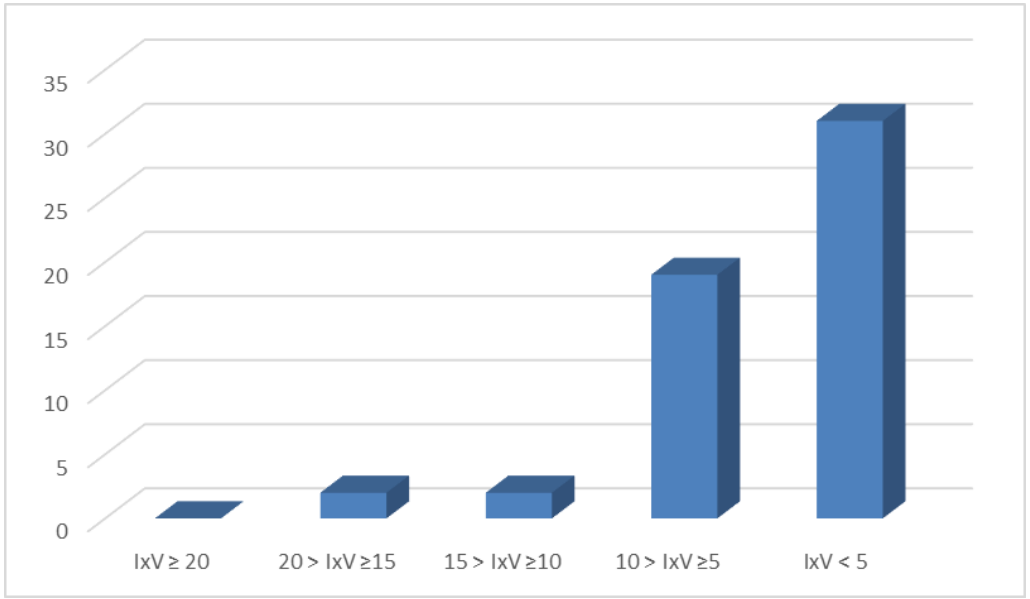
WP6A – MAIN ACTIONS

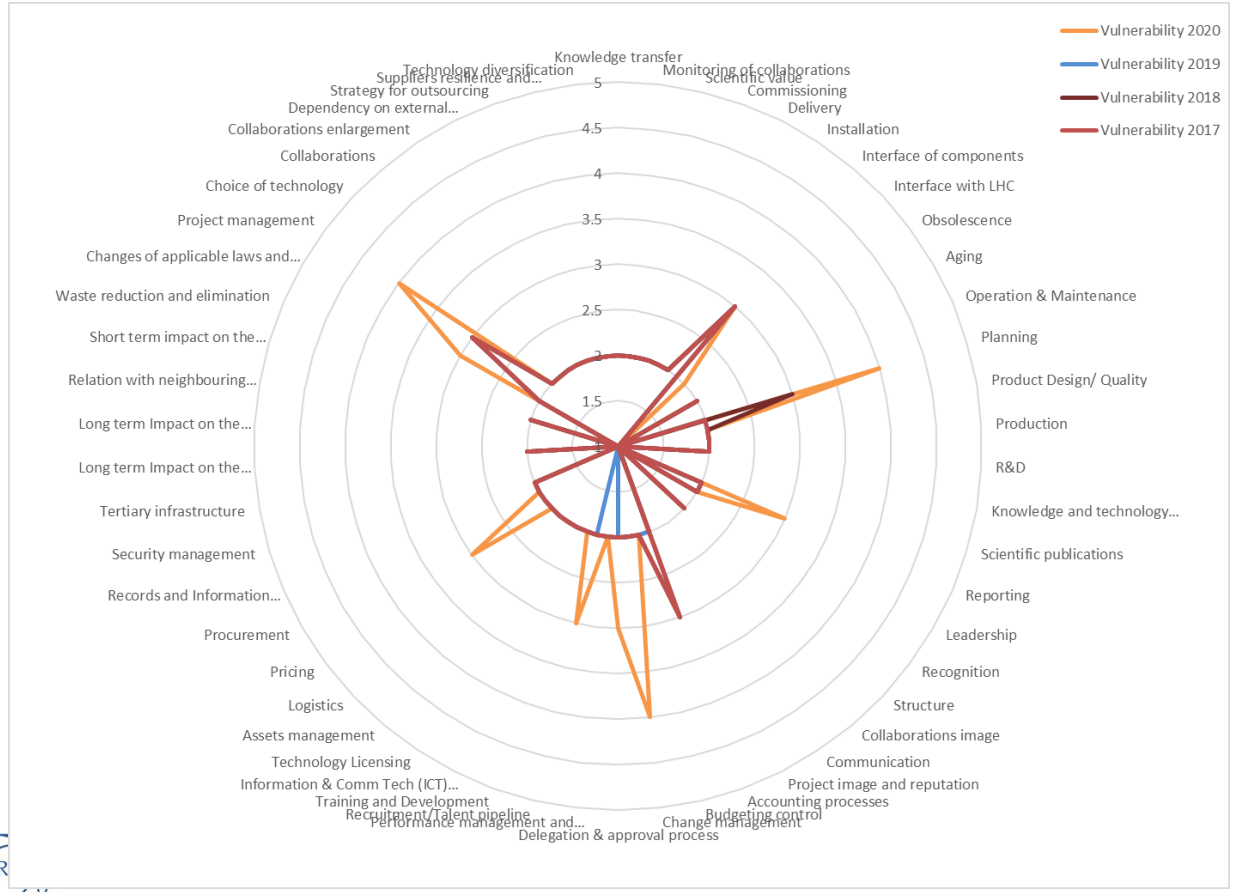
IxV	ID	Risk	Actions
From 9 to **4**	16	Knowledge and technology transfer	Finalise the investigation
From 9 to **9**	2	Monitoring of collaborations	Maintain the actions and revaluate once the work with the Russian collaboration begins.
From 9 to **9**	7	Interface of components	Work to be done on the integration of the link in the DD and tunnel
From 9 to **12**	51	Dependency on external collaborations	Maintain close monitoring. Action escalated to WP1 to push for the start of manufacturing in Russia.
From 1 to **9**	50	Collaborations enlargement	Revaluate when the collaborations are defined.

WP6B

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP6B	0	2	2	19	31



WP6B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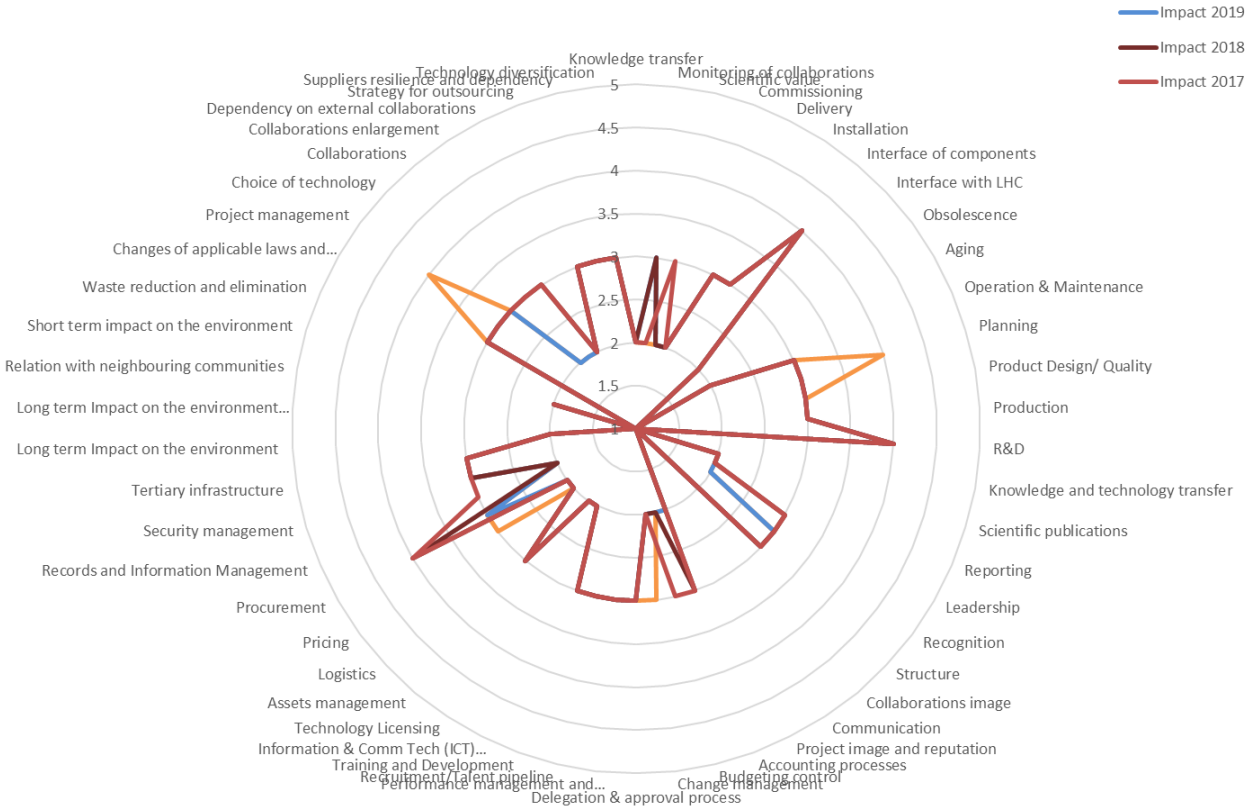
WP6B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Technology diversification
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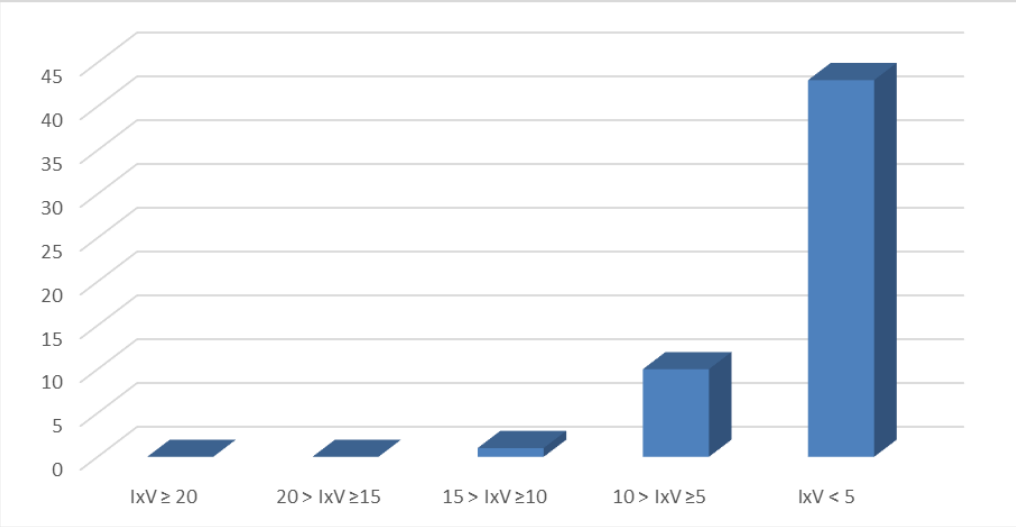
WP6B – MAIN ACTIONS

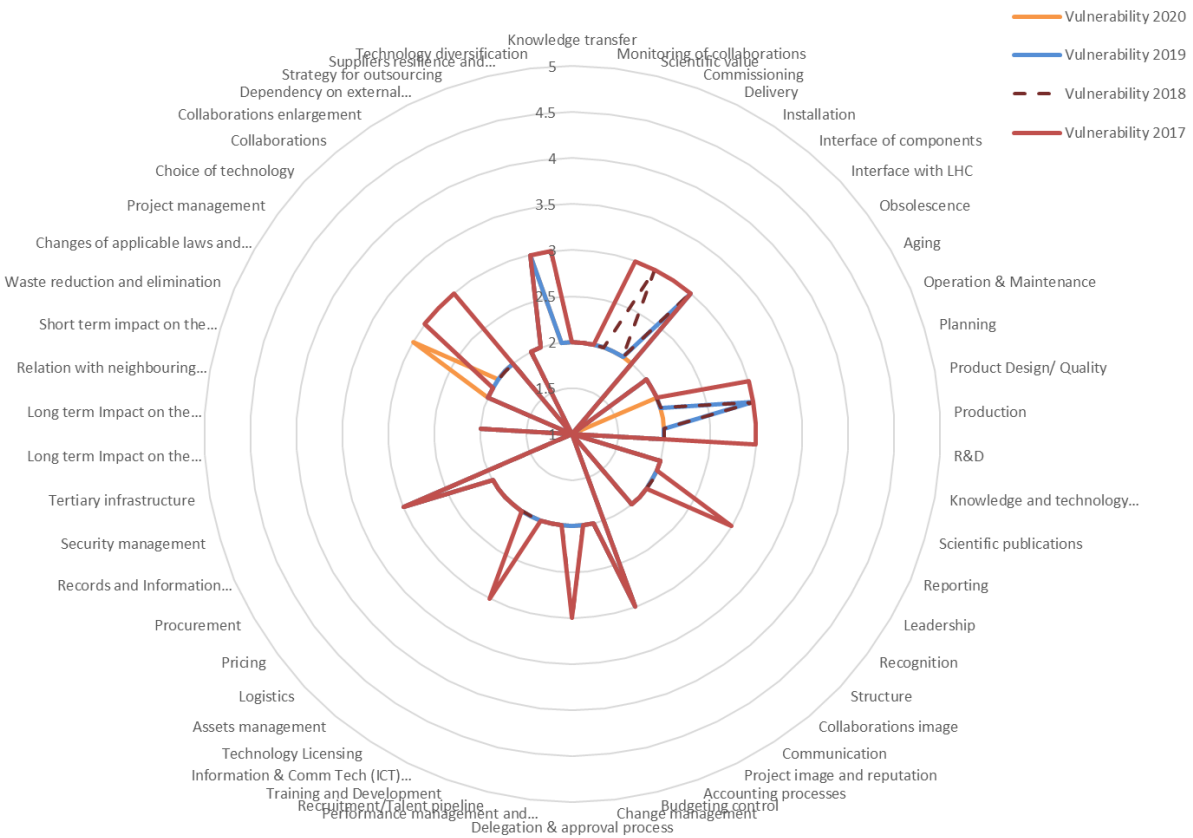
IxV	ID	Risk	Actions
From 12 to **12**	7	Interface of components	Action required at WP1 level to obtain answers and ease the approval process. Continue the Interface meetings
From 9 to **16**	47	Project management	A new staff has to be hired even though the new engineer will most likely not be able to help with project management
From 9 to **16**	12	Planning	The new GL/DGL will have to rearrange the work to fill the gap in the short term.
From 4 to **12**	27	Change management	The new GL/DGL will have to rearrange the work to fill the gap in the short term.
From 6 to **9**	28	Delegation & approval process	Request support from the Project Office to handle the approval process
From 6 to **9**	30	Recruitment/Talent pipeline	Anticipate recruitment process to be able to relaunch the process if no candidates are found
From 4 to **9**	36	Pricing	Improve industry/market knowledge and perhaps launch tendering early enough to allow retendering if the price is far from the budget allocated
From 6 to **9**	46	Changes of applicable laws and regulations	Action transferred to WP1

WP7

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP7	0	0	1	10	43



WP7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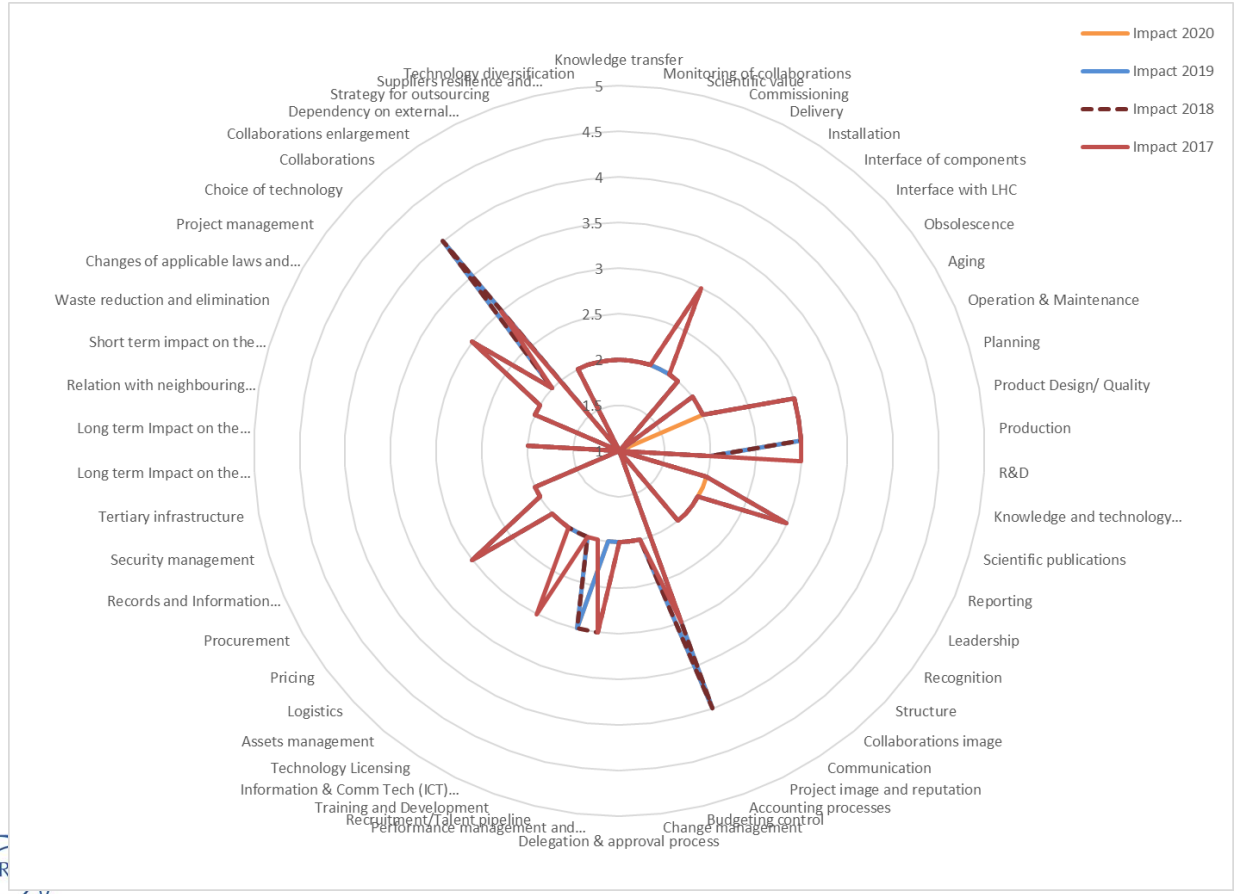
WP7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WP7 – MAIN ACTIONS

IxV	ID	Risk	Actions
From 12 to **12**	25	Accounting processes	Finalise the EL cost assessment. The tenders for CLIQ and EE system pre-series production will further reduce the uncertainty of the unit price for the different systems

WP11

- The risk exercise was not carried out with WP11 in 2020 as it was considered completed. The data shown hereafter corresponds to the previous exercise.

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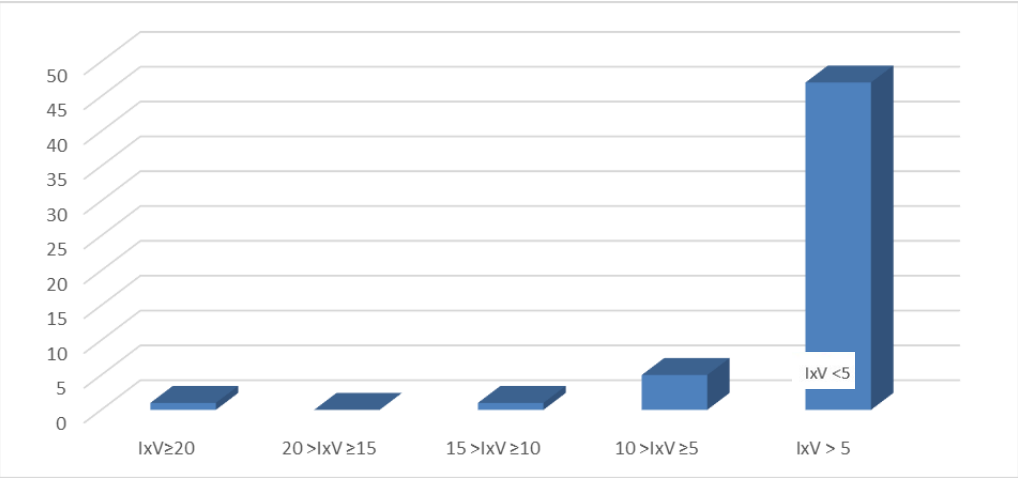
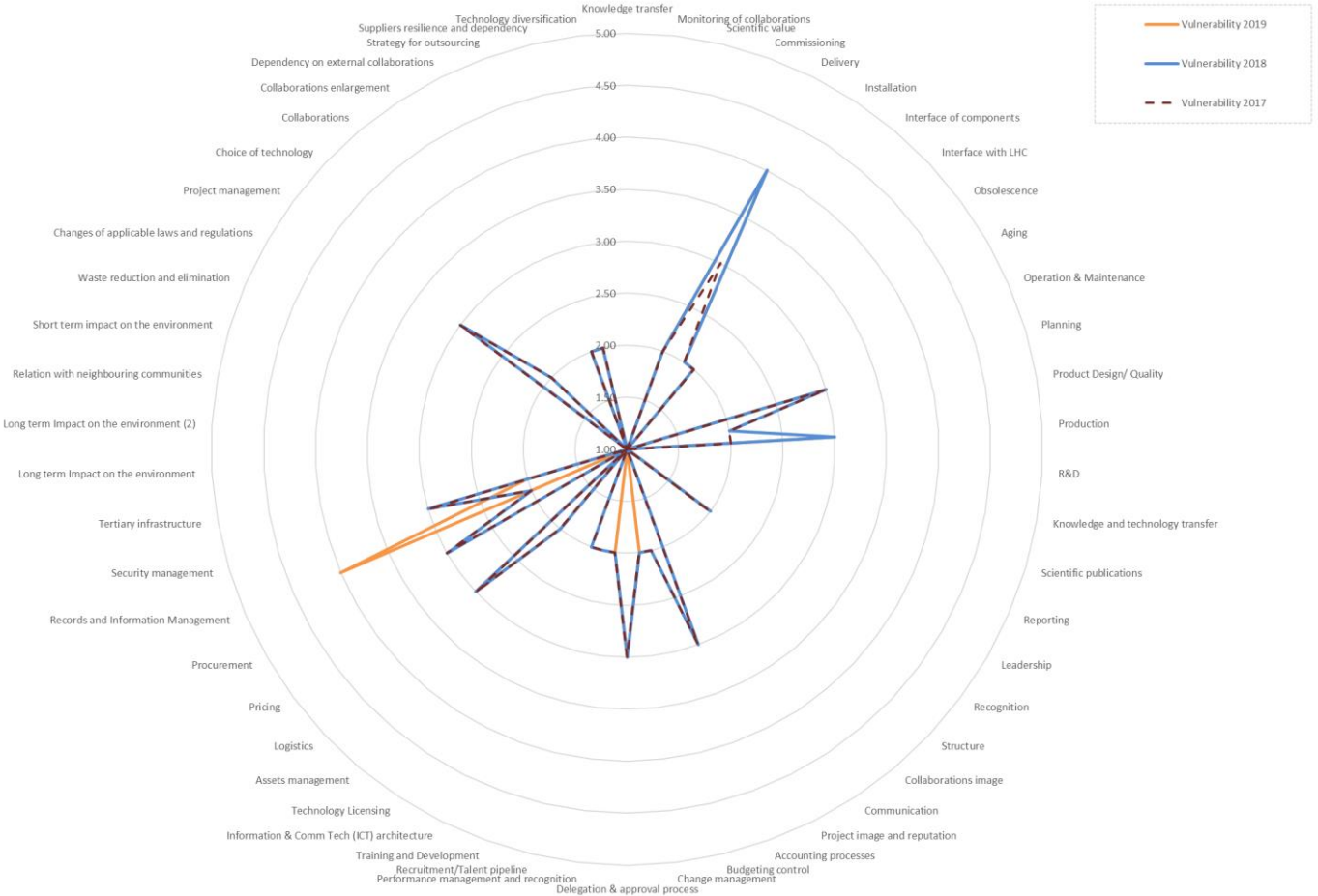
WP11	1	0	1	5	47

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Tertiary infrastructure
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Long term Impact on the environment (2)
Relation with neighbouring communities
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Waste reduction and elimination
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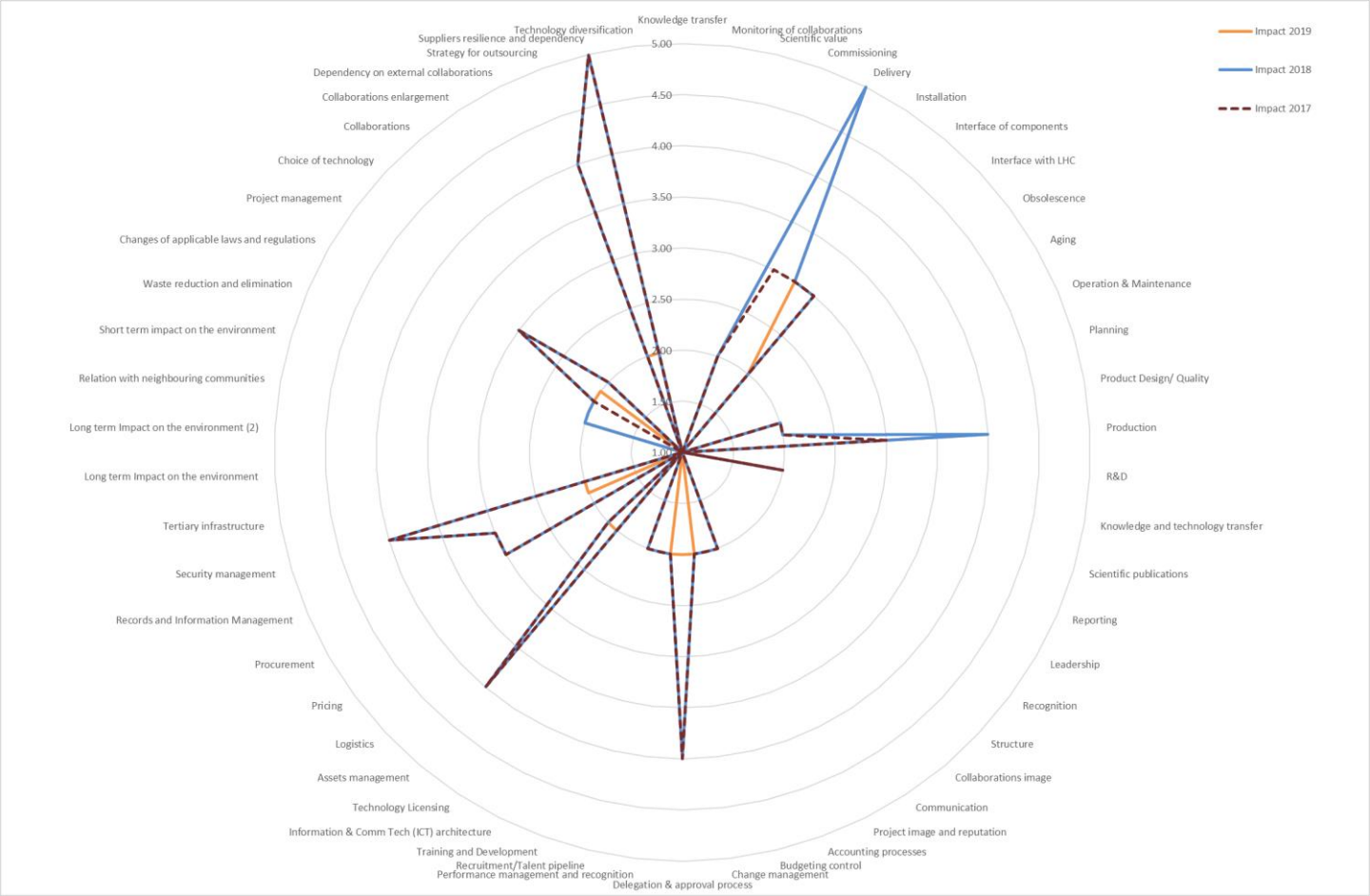
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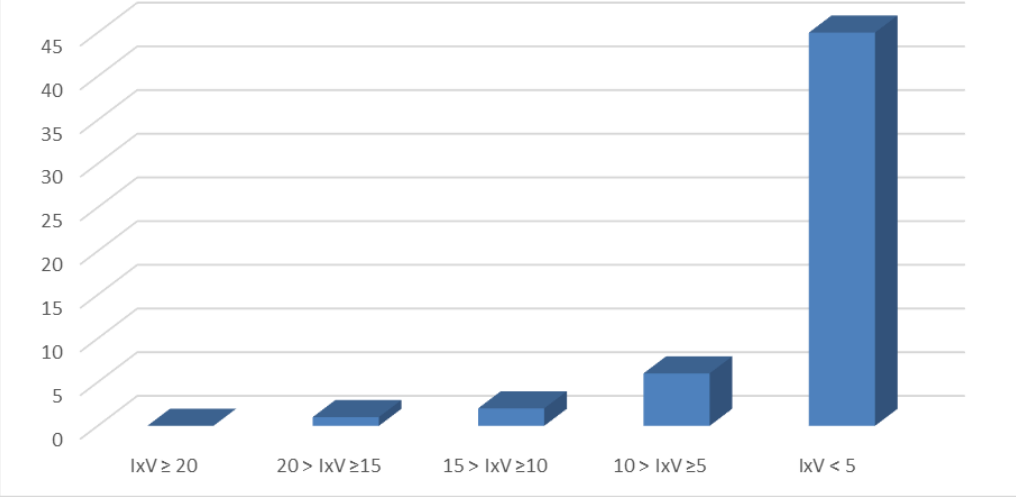
Collaborations
Collaborations enlargement
Dependency on external collaborations
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification

WP11 – MAIN ACTIONS

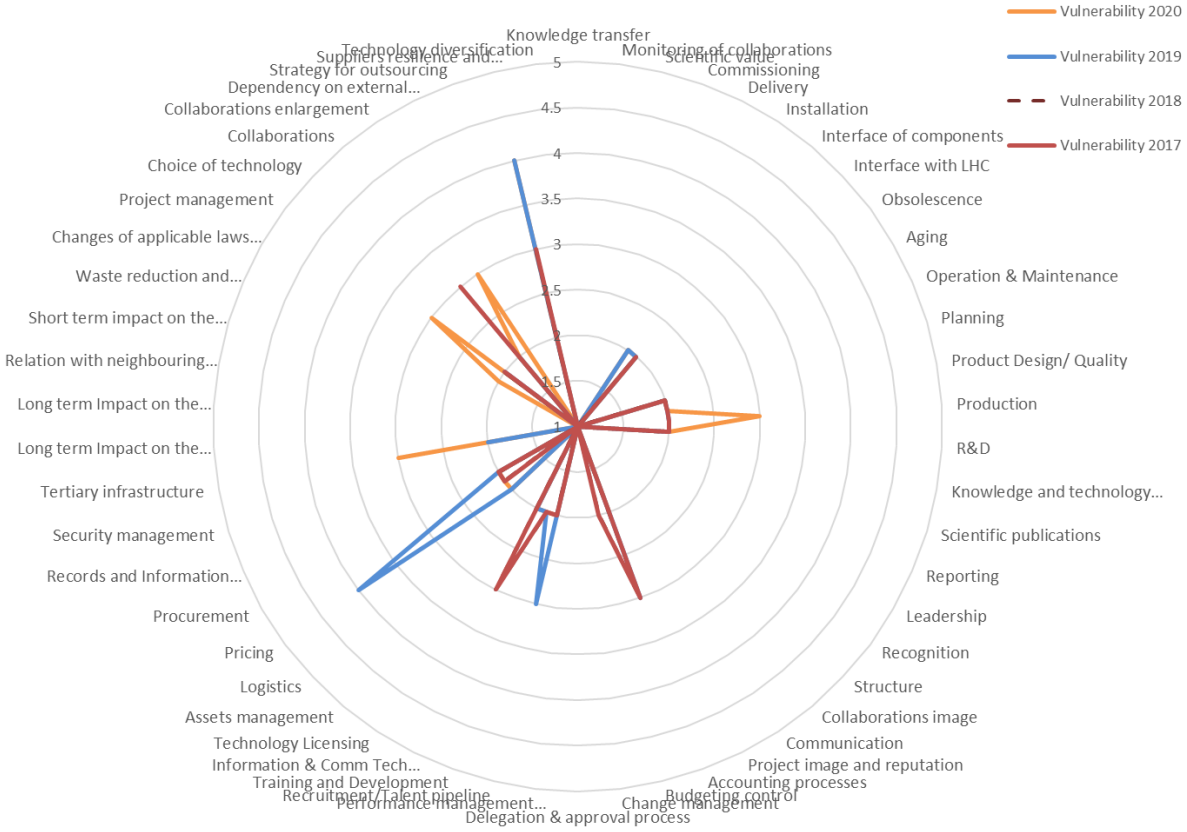
IxV	Risk ID	Risk	Actions
From 20 to **20**	5	Delivery	The production and installation schedule of the 11T dipole magnets for LS2 is under control, however with very little margin, hence it needs strict monitoring. In case of delays implying impossibility to install the magnets during LS2, these could be installed during an extended technical stop after LS2
From 12 to **4**	39	Security management	Actions are not required any more
From 10 to **4**	53	Suppliers resilience and dependency	Actions are not required any more
From 9 to **1**	37	Procurement	Actions are not required any more
From 9 to **4**	47	Project management	Actions are not required any more
From 12 to **12**	14	Production	The production and installation schedule of the 11T dipole magnets for LS2 is under control, however with very little margin, hence it needs strict monitoring. In case of delays implying impossibility to install the magnets during LS2, these could be installed during an extended technical stop after LS2 Maintain strict control on the activities. The risk is mainly on the unknown.

WP12

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP12	0	1	2	6	45



WP12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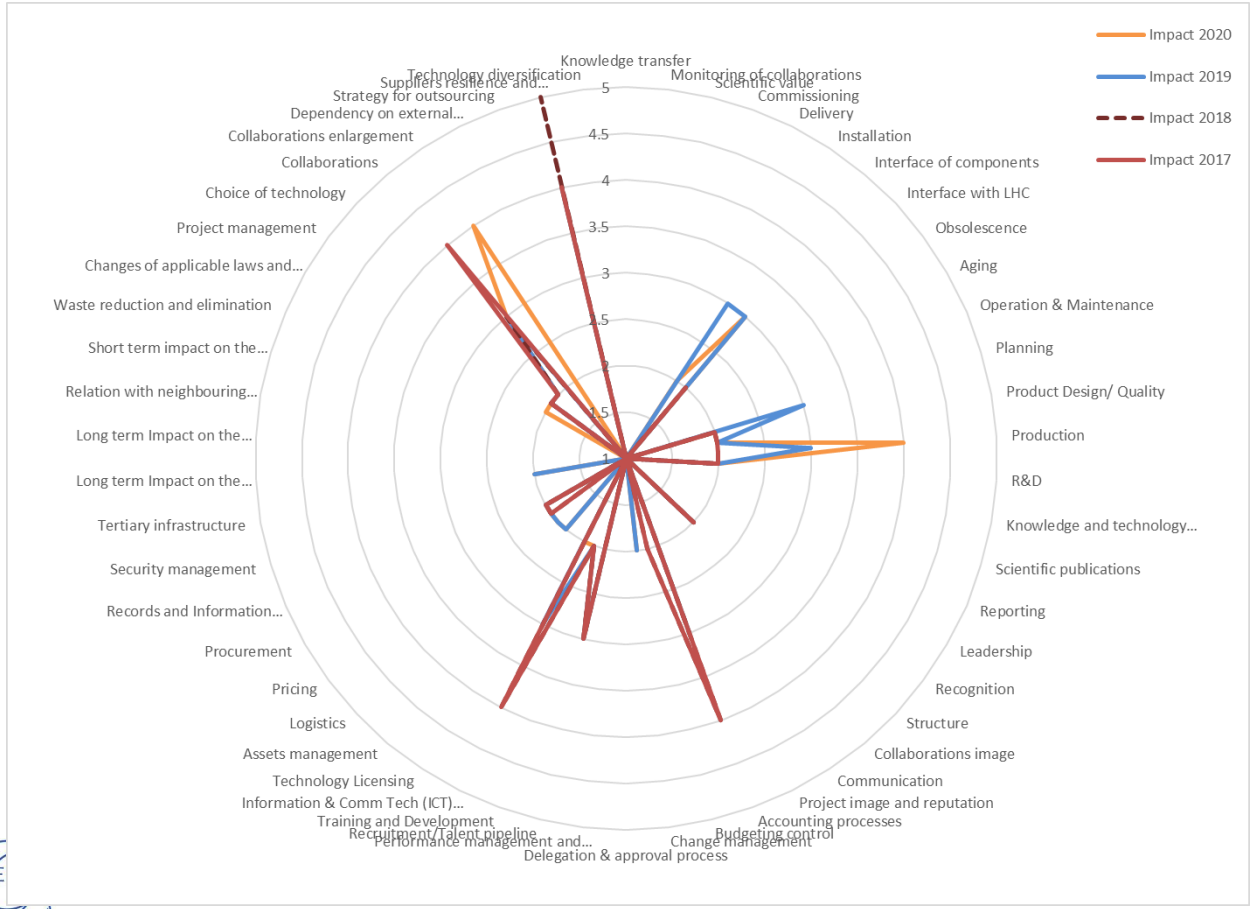
WP12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Suppliers resilience and...
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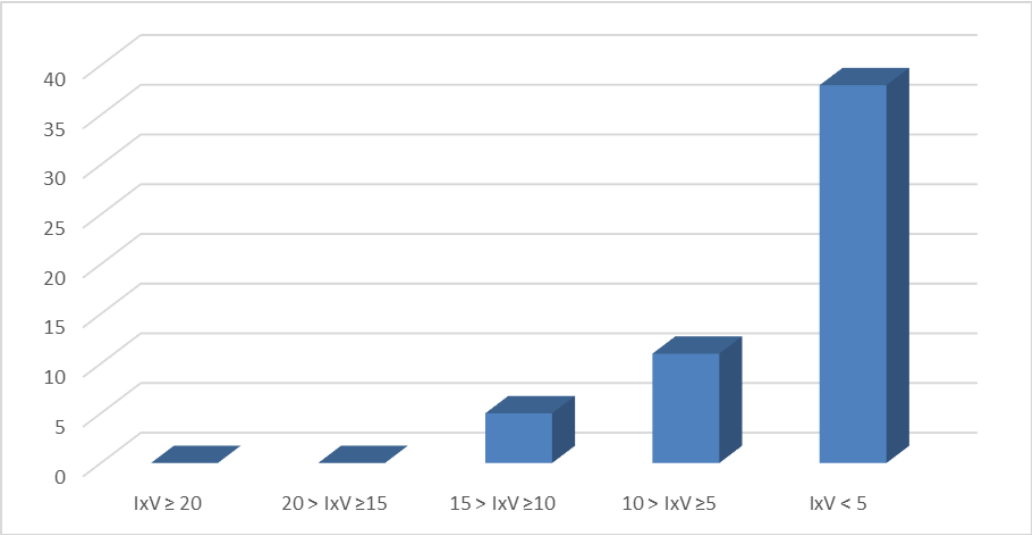
WP12 – MAIN ACTIONS

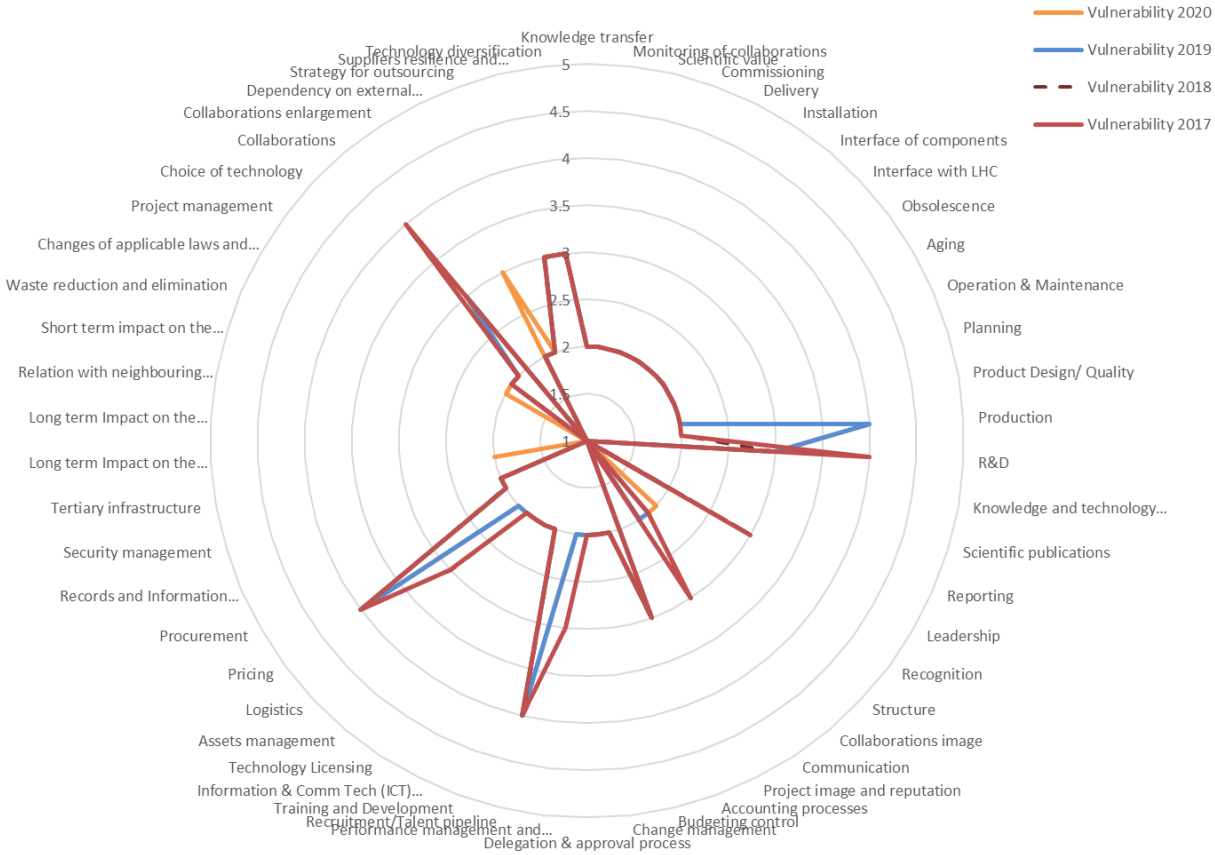
IxV	ID	Risk	Actions
From 16 to **16**	53	Suppliers resilience and dependency	Relax the specification, anticipate the production of raw material. Moved to WP1. Concern transferred during last PSM.
From 9 to **6**	25	Accounting processes	AL43 will be renewed and the new tender will be done only in 2 years. No more actions required
From 9 to **6**	30	Recruitment/Talent pipeline	The needs in terms of personnel should be anticipated as much as possible to allow us to do the announcements to the Institutes with enough time. In parallel, training of CERN staff on specific HL-LHC competencies is going on when possible.
From 1 to **12**	50	Collaborations enlargement	Produce the thermal links at CERN and look for an alternative for the interconnect (around 400k CHF)
From 9 to **12**	14	Production	Find a producer or a plan B for the bellows

WP13

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP13	0	0	5	11	38



WP13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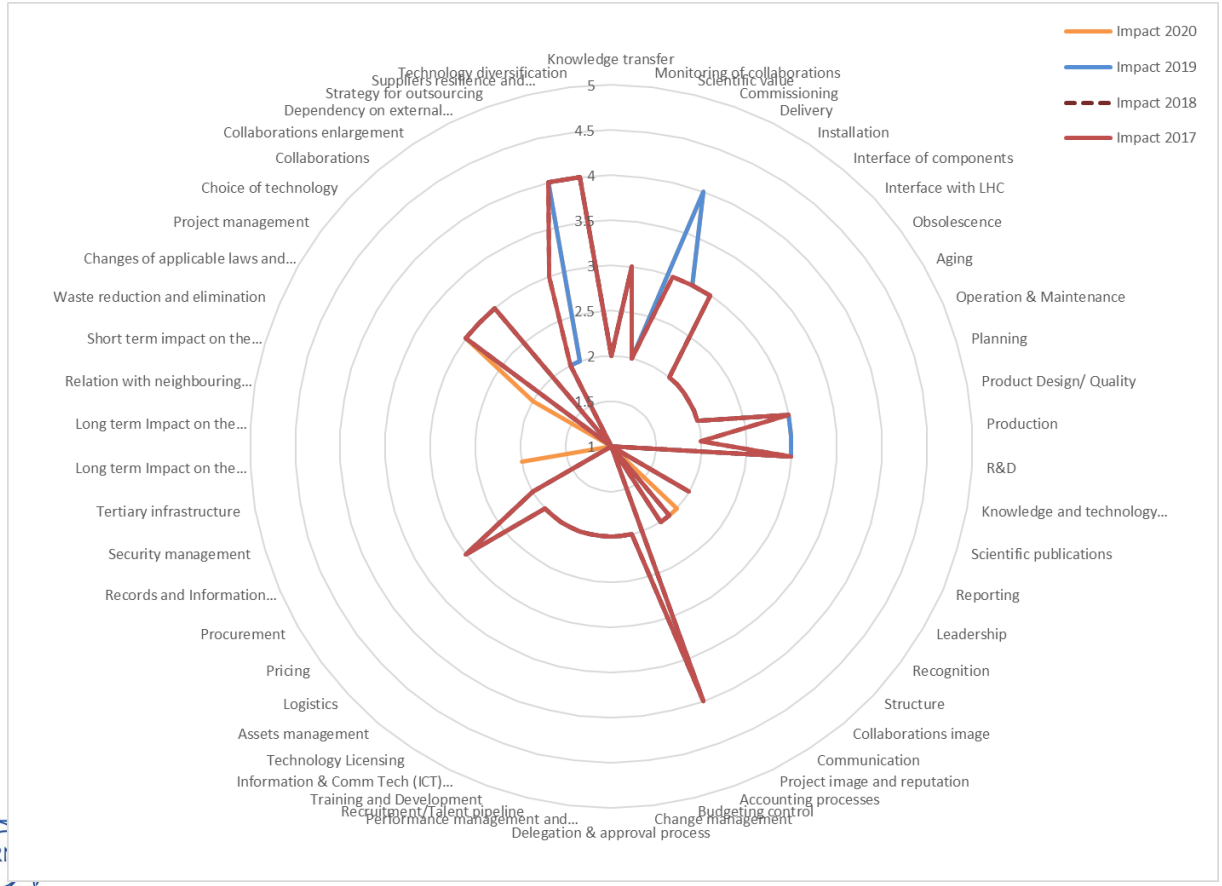
WP13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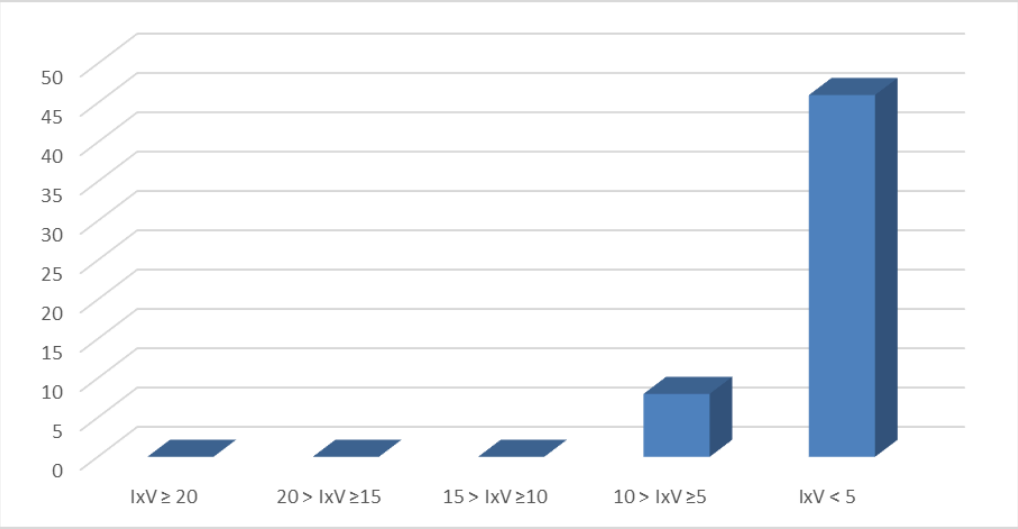
WP13 – MAIN ACTIONS

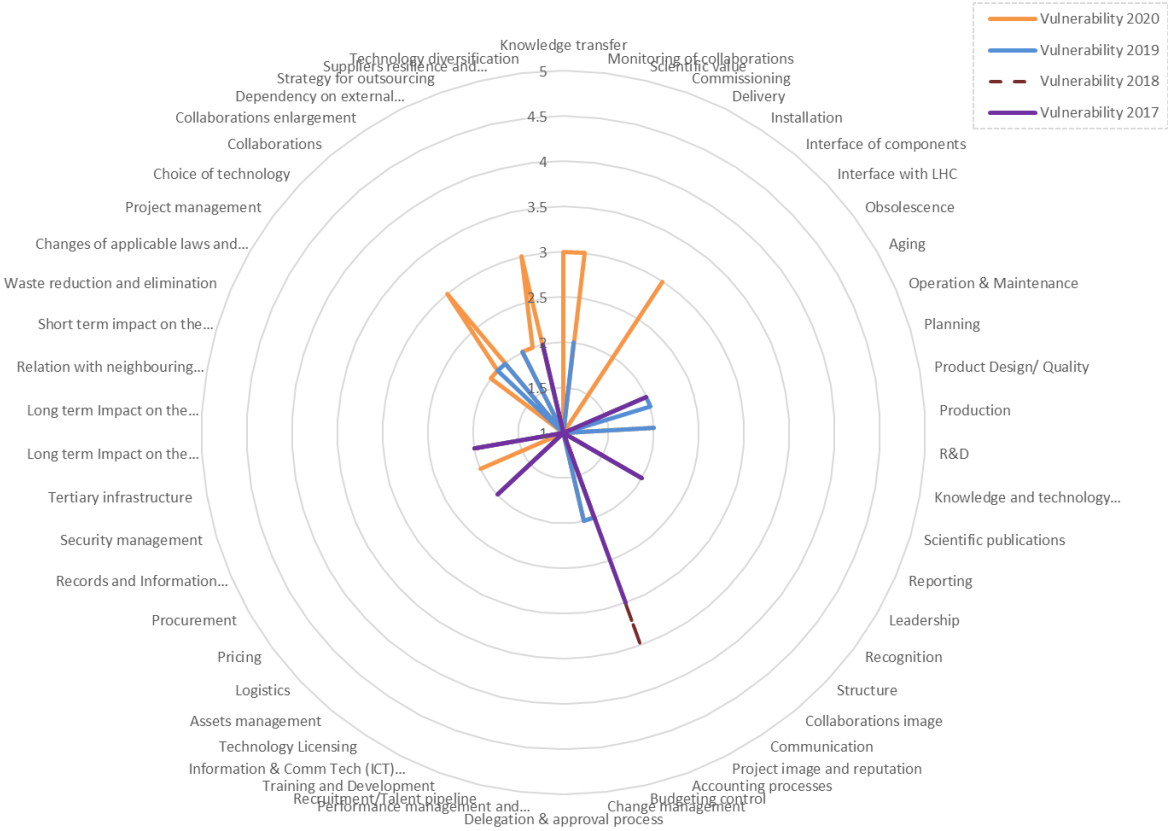
IxV	ID	Risk	Actions
From 12 to **12**	25	Accounting processes	Main risk is associated with the cost of the final solution as there is uncertainty related to the cost forecast. There is a clear monitoring of the feasibility of the R&D via prototypes and optimization of the cost of the prototypes
From 12 to **12**	36	Pricing	Maintain and study in particular the “decabling” and “recabling” cost for old equipment that will remain operational for HL-LHC.
From 9 to **9**	49	Collaborations	Periodic meetings at high level to ensure that the commitment of the collaboration is maintained with Russia
From 12 to **12**	53	Suppliers resilience and dependency	Continue for all equipment and maintain actions such as asking for prototypes to qualify alternative suppliers.
From 12 to **12**	54	Technology diversification	See Risk 53 and 15
From 9 to **9**	15	R&D	Maintain the action. There is the impression that with the maturity of the existing collaborations their risk has reduced. But the overall level is maintained due to the addition of the new Russian collaboration.
From 12 to **12**	14	Production	Early qualification of suppliers for critical components. Investigation of alternative technologies for critical components. Collaboration with European industry to widen the choice of companies available to manufacture critical components.

WP14

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP14	0	0	0	8	46



WP14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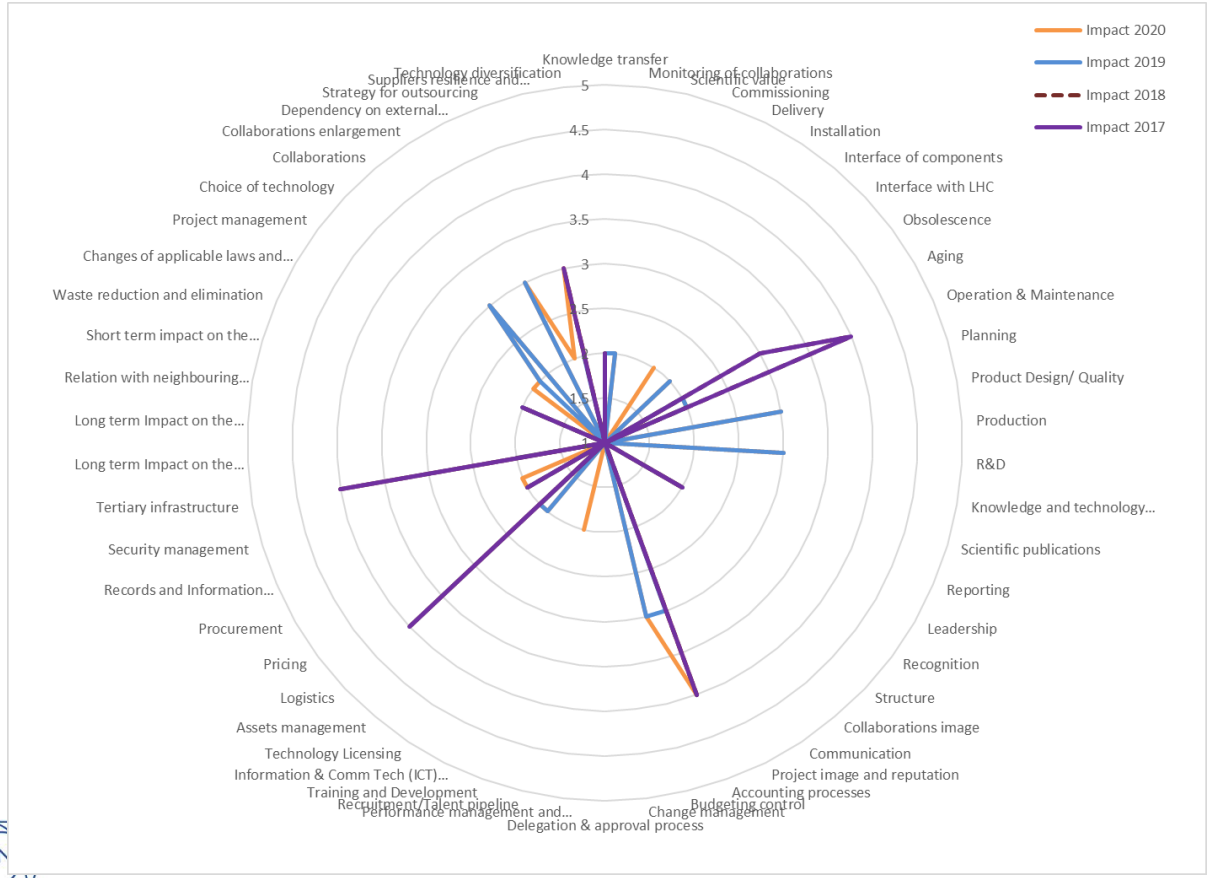
Suppliers resilience and...
Technology diversification

WP14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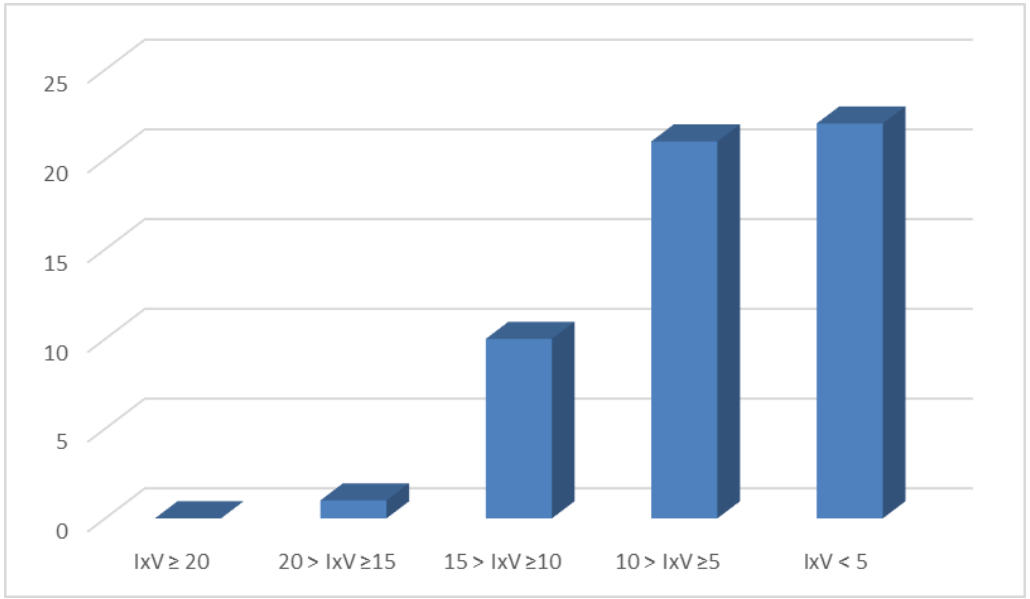
WP14 – MAIN ACTIONS

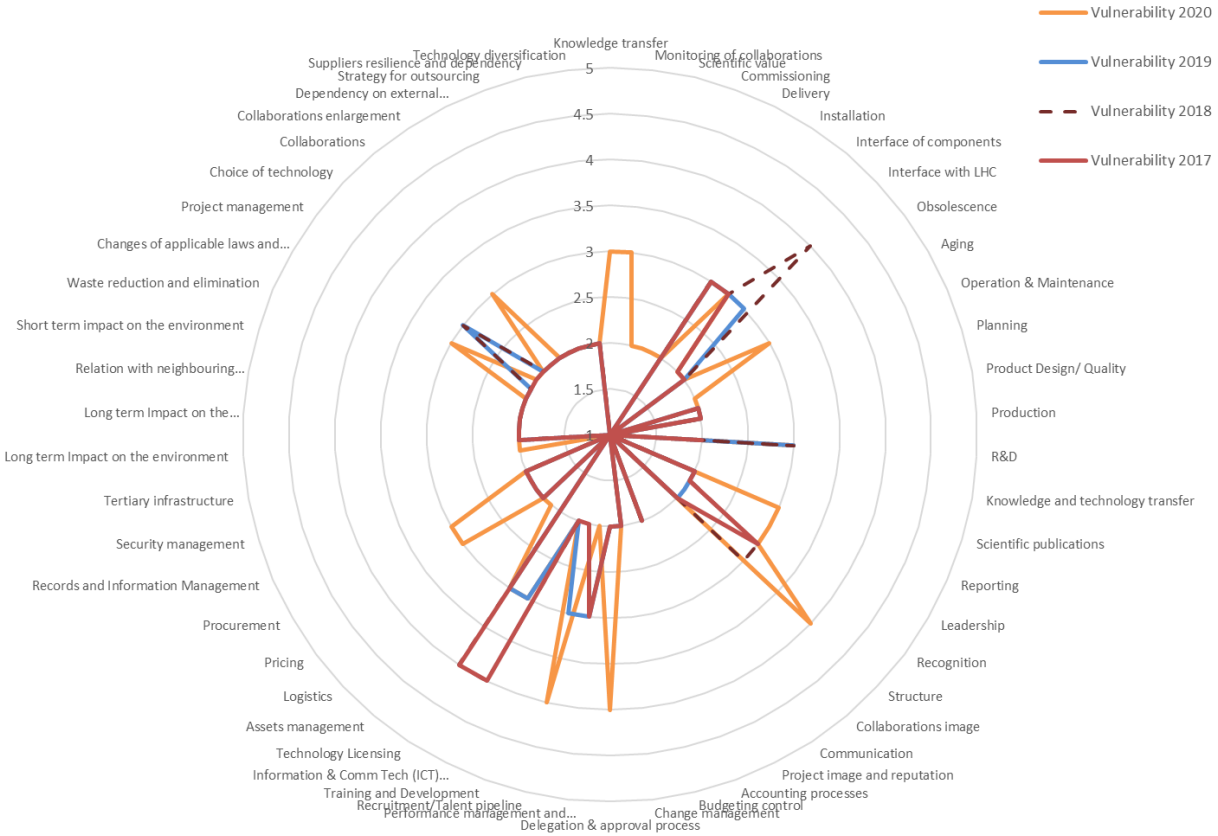
IxV	ID	Risk	Actions
From 6 to **9**	53	Suppliers resilience and dependency	Investigate a potential second supplier for the MKI ceramic chamber as the production of the present supplier has an anomalous number of nonconformities, none in spec and only 16 over 22 were accepted with a potential concession.
From 6 to **9**	49	Collaborations	This action is moved to WP1 as the collaborations have to be “activated” so that not only the contact person, but the teams are defined in Russia
From 6 to **8**	25	Accounting processes	No real action required yet but monitoring on the final estimate of the cost of the dump during 2021

WP15

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP15	0	1	10	21	22



WP15


Vulnerability 2020
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Short term impact on the environment
Waste reduction and elimination
Changes of applicable laws and...
Project management
Choice of technology
Collaborations
Collaborations enlargement
Dependency on external...
Strategy for outsourcing
Suppliers resilience and dependency
Technology diversification
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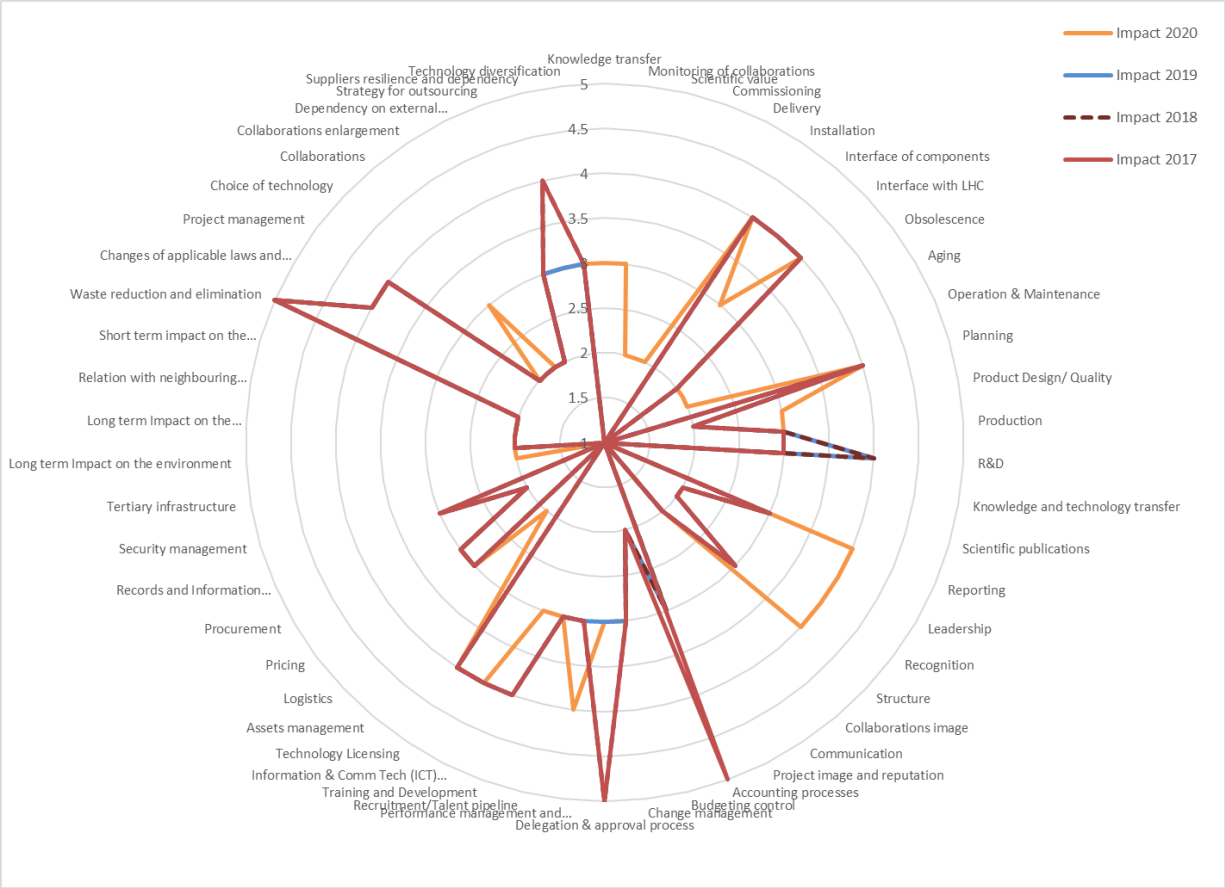
WP15


Impact 2020
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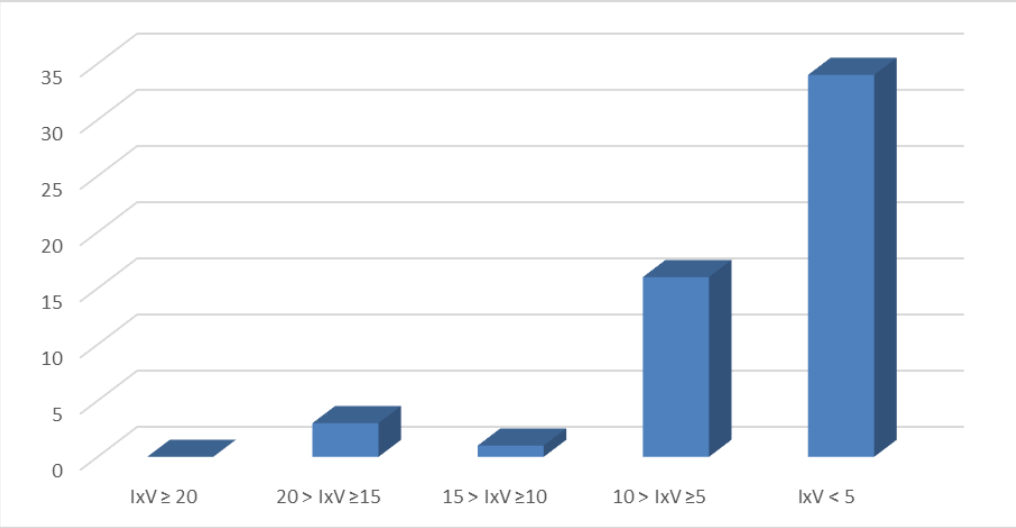
WP15 – MAIN ACTIONS

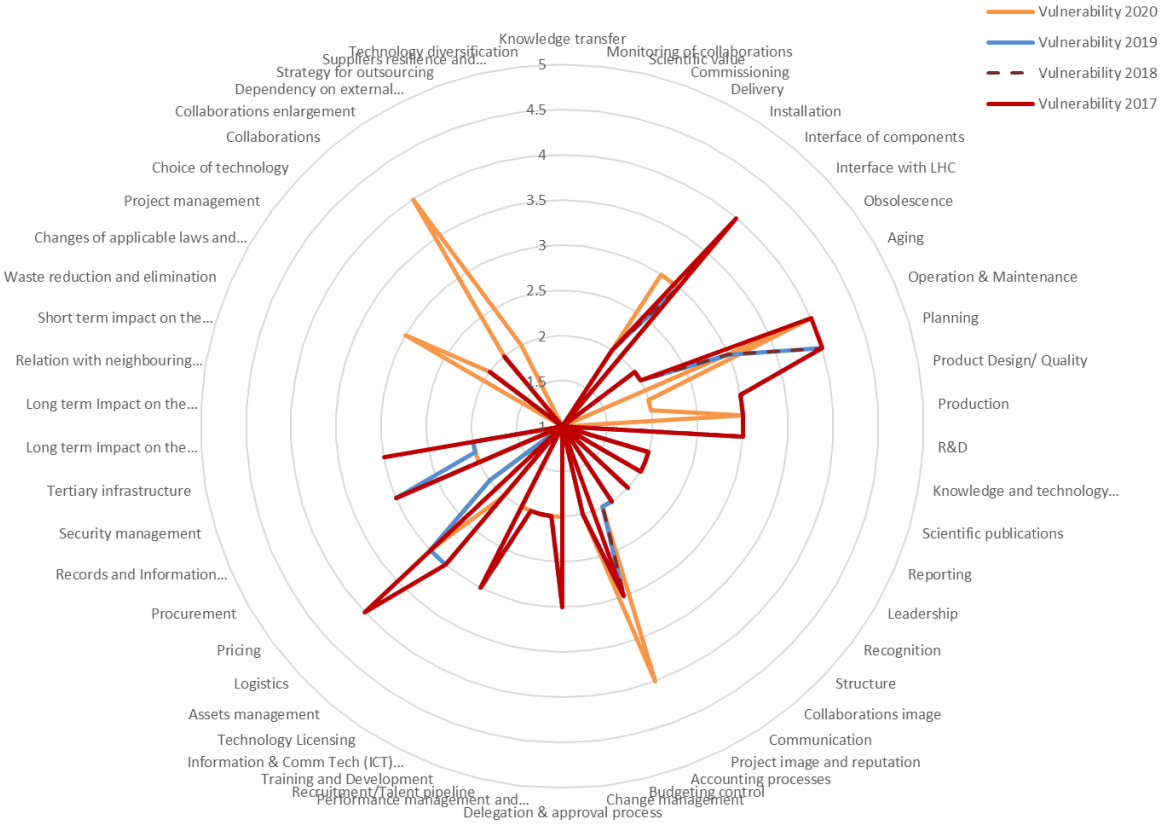
IxV	ID	Risk	Actions
From 12 to **12**	32	Information & Comm Tech (ICT) architecture	Follow up: Request to have a representative in the CAEC to give the project input in the replacement of CATIA and smart team and on the impact of the migration.
From 12 to **12**	33	Technology Licensing	Same as for risk 32.
From 12 to **9**	7	Interface of components	Finalize the integration study for the new baseline components
From 10 to **10**	45	Waste reduction and elimination	WP1 should address a Project on waste disposal
From 12 to **12**	15	R&D	Finalise the validation of the alignment table and perform transfer to Fermilab. Place the contract to Titans supplier. Start technical discussions with Serbia.
From 9 to **12**	30	Recruitment/Talent pipeline	Escalated to WP1
From 6 to **12**	18	Reporting	Escalated to WP1
From 4 to **12**	19	Leadership	Escalated to WP1
From 4 to **12**	20	Recognition	Escalated to WP1
From 6 to **16**	21	Structure	Escalated to WP1
From 8 to **12**	46	Changes of applicable laws and regulations	Push group to complete evaluation of the compression of the planning and monitor COVID situation
From 2 to **9**	49	Collaborations	Launch technical discussions with the Serbian collaboration
From 6 to **12**	28	Delegation & approval process	Refer to risk 21
From 6 to **9**	36	Pricing	Reaction will depend on the results of the IT
From 1 to **9**	2	Monitoring of collaborations	See Risk 49
From 1 to **9**	1	Knowledge transfer	See Risk 49

WP16

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP16	0	3	1	16	34



WP16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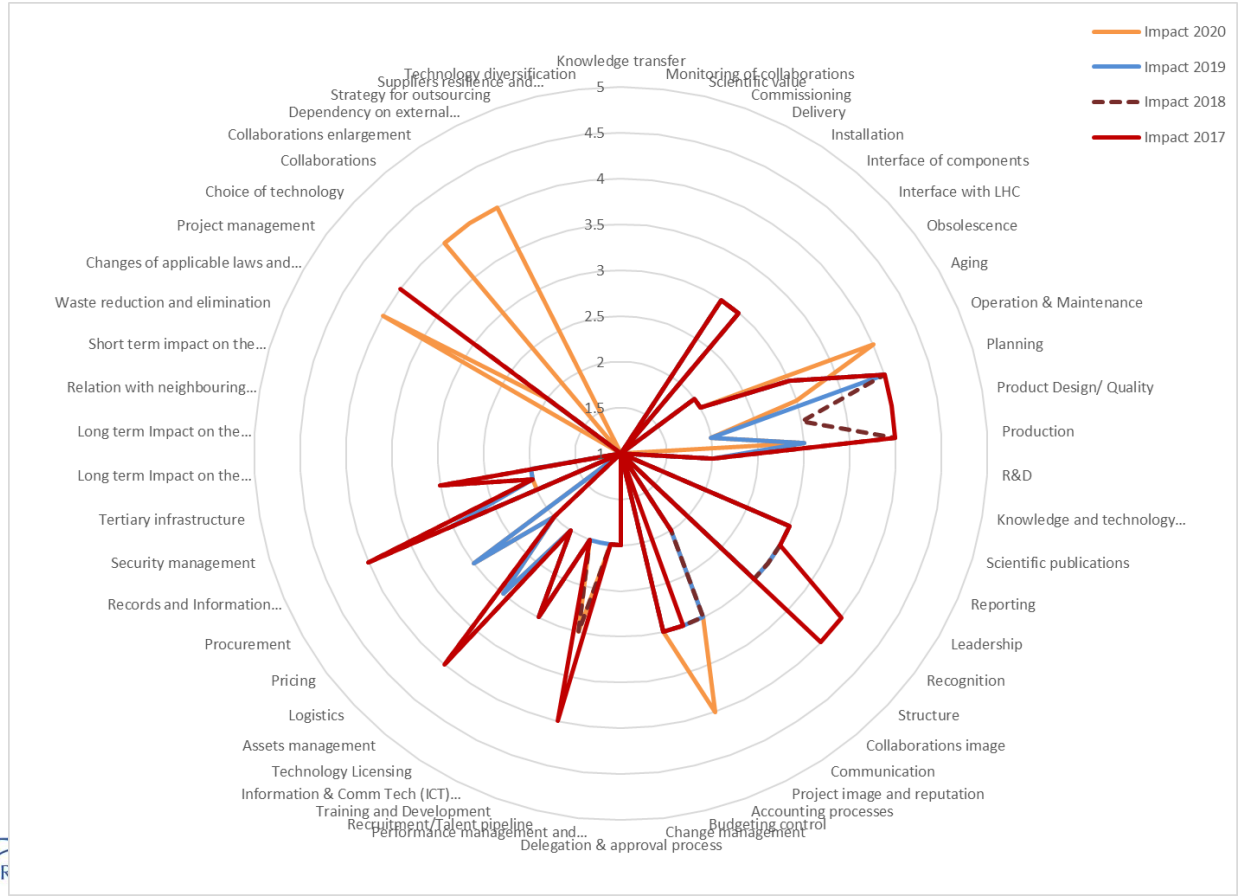
Suppliers resilience and...
Technology diversification

WP16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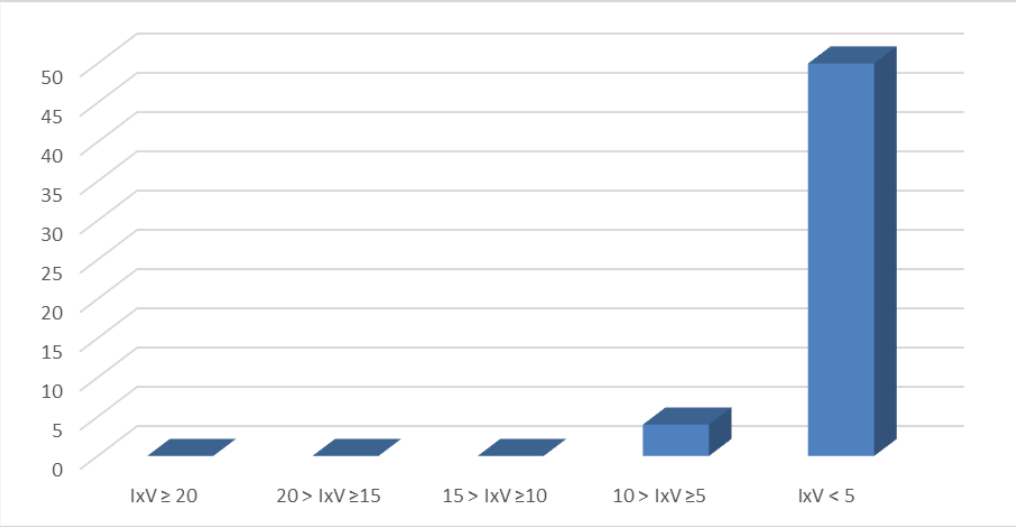
WP16 – MAIN ACTIONS

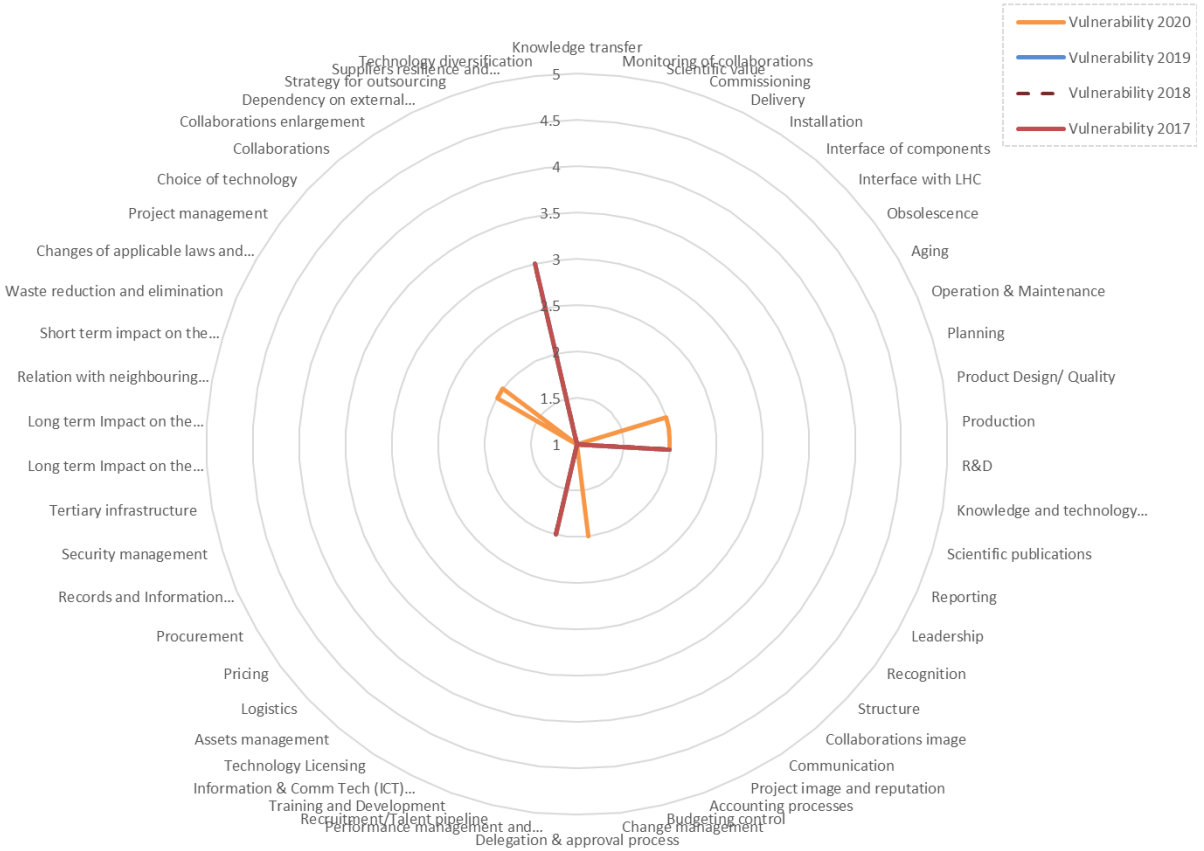
IxV	ID	Risk	Actions
From 9 to **9**	7	Interface of components	The work of integration will be finalised during 2021
From 9 to **16**	11	Operation & Maintenance	An agreement at DH level is needed to find a solution for the lack of a -full time- operator, which may imply more than one person in order to work in shifts and be able to accommodate the full IT String operation in 2023 as requested by the project. See also action for the control room that will have to be adapted to the new COVID measures and also requiring improvements for sanitary conditions (ventilation)
From 9 to **9**	14	Production	Continue monitoring the arrival of the components
From 9 to **16**	25	Accounting processes	This year the action is maintained as we need to obtain the final cost linked to the final design. Aspects such as the handling and the interfaces have cost that have not been accounted for.
From 6 to **9**	6	Installation	A person for the installation was foreseen but now it is an external position that will not have the required experience. Action is required from WP1
From 1 to **12**	46	Changes of applicable laws and regulations	Review once the final cost of the modifications is known
From 1 to **16**	50	Collaborations enlargement	Study the advantages and disadvantages of the Pakistani collaboration carefully before taking the decision.

WP18

IxV	IxV ≥ 20	20 > IxV ≥15	15 > IxV ≥10	10 > IxV ≥5	IxV < 5
WP18	0	0	0	4	50



WP18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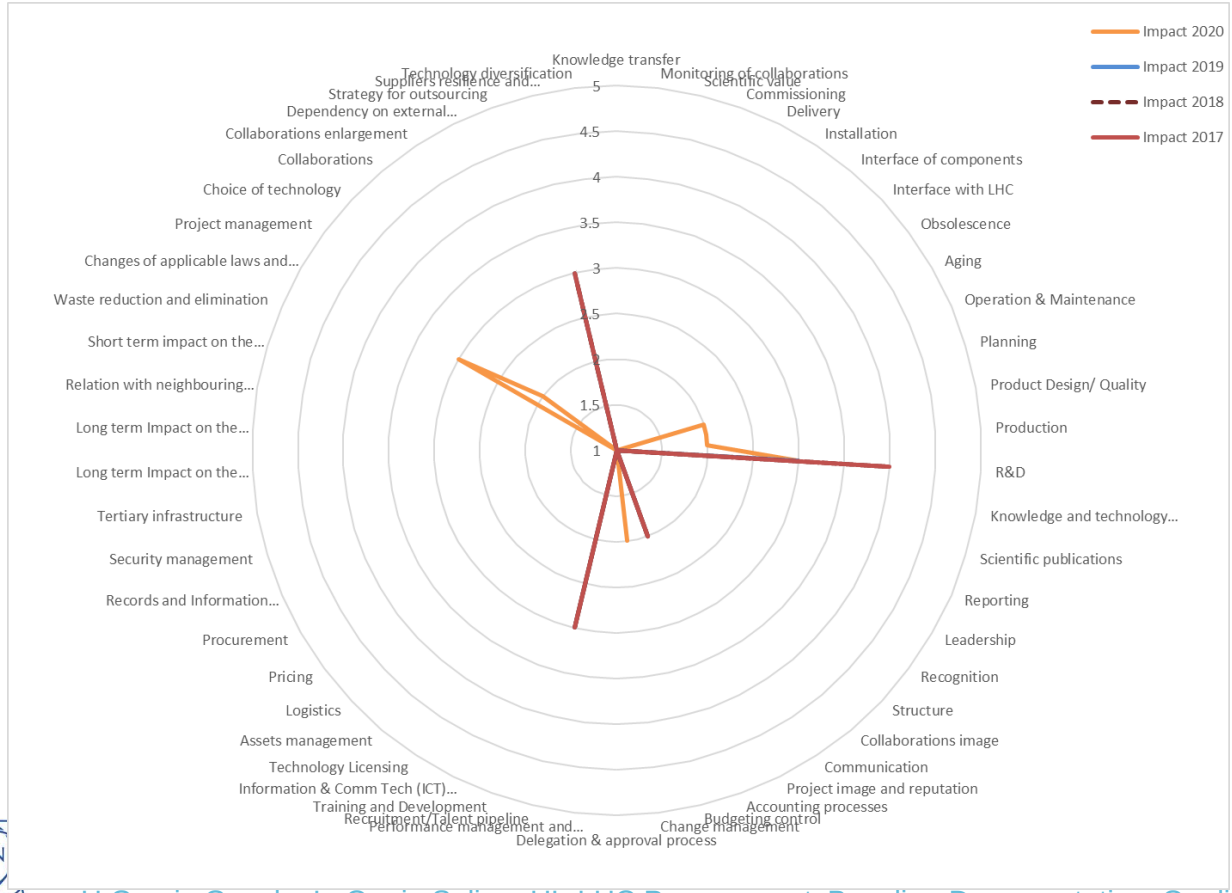
WP18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WP18 – MAIN ACTIONS

IxV<	ID	Risk	Actions
From 1 to **4**	47	Project management	Update the planning