Rossini

RObot enhanced SenSing, INtelligence and actuation to Improve productivity and job quality in manufacturing

D9.4 2nd Interim PEDR

Deliverable Lead: CRIT

Deliverable due date: 31/01/2021

Actual submission date: 30/01/2021

Version: 2.0

This project receives funding in the European Commission's Horizon 2020 Research Programme under Grant Agreement Number 818087

Document Control Page	
Title	D9.4 2nd Interim PEDR
Creator	CRIT
Description	This deliverable will describe how acquired data and knowledge will shared and/or made open and how will be maintained/preserved.
Contributors	All partners
Creation date	08/01/2021
Type	Report
Language	English
Audience	☒ public ☐ confidential
Review status	☐ Draft ☐ WP leader accepted ☒ Coordinator accepted
Action requested	☐ to be revised by Partners ☐ for approval by the WP leader ☐ for approval by the Project Coordinator ☒ for acknowledgement by Partners

Version	Author(s)	Changes	Date
0.0	CRIT	Preliminary ToC	2021/01/08
1.0	CORE	Communication & Dissemination	2021/01/21
1.1	CRIT	Exploitation & standardisation	2021/01/25
2.0	CRIT	Final version for partners' revision	2021/01/28

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Abbreviations

Data Management Plan	DMP
Intellectual Property Rights	IPR
Open Research Data Pilot	ORDP
Key Performance Indicators	KPI
European Commission	EC
Findable, accessible, interoperable and re-usable data	FAIR
European Union	EU
General Data Protection Regulation	GDPR
European Factories of the Future Research Association	EFFRA
Human Robot Collaboration	HRC
Dissemination and Exploitation Manager	DEM
Plan for Exploitation and Dissemination of project results	PEDR

DISCLAIMER

The sole responsibility for the content of this publication lies with the ROSSINI project and in no way reflects the views of the European Union.

Abstract

This document is the second version (M28) of the **Plan for Exploitation and Dissemination of Results (PEDR) of ROSSINI** project. With respect to the first release of the document, the second one includes an overview of the Communication, Dissemination and Exploitation activities carried out in the second year of the ROSSINI project, following the action plans agreed by the the consortium to promote the project, to foster the knowledge of its results and to ensure their uptake for future business opportunities. **Communication, dissemination and exploitation activities all aim to help maximise the impact of Research and Innovation actions.**

More into detail the document is structured in two sections:

- **PART 1: Communication and Dissemination Strategy.** This section outlines the objective of the communication and dissemination strategy, the target stakeholders and group that will be addressed to raise awareness of project results. The channel and tools that the consortium is adopting for communication actions are described, together with a list of KPIs that the communication strategy should meet to be efficient in spreading ROSSINI knowledge. The communication and dissemination activities as well as the list of KPIs have been updated with respect to the results achieved in Year2 of the project.
- **PART 2: Exploitation.** The second section of the document describes the exploitation plan of ROSSINI project. It outlines the exploitation strategy and the guidelines that the consortium will follow in terms of characterization of the individual exploitable results, characterization of the joint result "Rossini Collaborative Platform", IP management, market analysis and monitoring, standardization and data management. Furthermore, this second release of the PEDR contains a further characterization of the exploitable results that the project partners have identified.. Moreover, in this version we find also Intellectual Property rights, Foreground IP and Background IP and all the IP claims or IPR management issues on project results as well as a description of the preliminary standardisation activities.

The Plan for the Dissemination and Exploitation of Results will be constantly updated during the project to guarantee the quality of the implementation and several internal versions of the document will be reviewed by the project consortium. The final plan will be delivered by M42 and it will be the most critical and important deliverable for the impact of ROSSINI and the further exploitation of its results beyond the project lifetime.

Scope

The present document has the scope to present the strategy and activities followed by the consortium with regards to the communication, dissemination and exploitation actions, in order to promote the project, foster the knowledge of its results and to ensure their uptake for future business opportunities. **Communication, dissemination and exploitation activities all aim to help maximise the impact of Research and Innovation actions.**

1 Communication and Dissemination Activities

This section presents a report related to the dissemination and communication activities of the project following the dissemination plan which was set out in D9.2 1st Interim Plan for Exploitation and Dissemination of Results (PEDR), submitted in November of 2019. It covers all activities related to the dissemination including maintenance of the website, monitoring of social media, participation to conferences and other events, published articles and other activities. In order to collect the abovementioned information, partners have provided input to the dissemination team.

Throughout this period, ranging from M15 to M28, partners participated to a total of 9 events. This relatively limited number can be explained by the global situation due to COVID-19, which resulted in the cancellation or rescheduling of many events. To mitigate this situation more emphasis was given to the use of audio-visual material for the communication and dissemination of ROSSINI, as will be explained later in the current document.

1.1 Objectives and Strategy

The overall objective remains to communicate ROSSINI results and their benefits for the stakeholders, to the widest possible audience internationally. Communication and dissemination activities at the current stage of the ROSSINI project have 5 main objectives:

1. Create and disseminate audio-visual content explaining the key innovations of the project
2. Update and maintain the ROSSINI website
3. Expand ROSSINI network and target groups in social media accounts
4. Participate in events at national and European level to raise awareness, improve project visibility and disseminate the first technical results
5. Promote the project to the press and media at local, national and European level

To achieve the above, the dissemination strategy will target different audiences:

1. For the industrial stakeholders (manufacturers, robot integrators, third parties, etc) the strategy is aiming at creating technical and business interest in the opportunities created by the project's results;
2. For the scientific and standardisation communities the strategy is aiming at highlighting ROSSINI validated results beyond the state of the art, incl. results with potential for contribution to standards.

1.2 Timeline

The ROSSINI Dissemination timeline is structured in three main phases as seen in Figure 1:

Phase1 – Initial awareness (M1-M12) aims at: Agreeing upon communication strategy and future activities; Creating initial awareness in markets related to Project's scope and objectives.

Phase2 – Targeted awareness (M13-M36) aims at: informing targeted stakeholders and groups; Informing target market about the technological breakthroughs and business benefits of ROSSINI.

Phase3 – Strategic phase (M37-M42) aims at: Maximising target market and industry awareness regarding the ROSSINI platform and its exploitable products;

At this point, the project is at the second phase, that of "Targeted awareness/ market phase". This phase will focus on raising the interest of the public and stakeholders after having achieved the awareness of the initial phase. It is throughout this period that ROSSINI started to produce the first results, while developing and testing its technologies. Consequently, more individuals became interested in learning more about its activities. Publications and scientific papers to journals are also starting to being published, making the project and its results known to researchers and scientific communities. Project results are being presented in conferences, with the support and contribution of the consortium, according to partners' field of expertise and interest. Meanwhile, communication actions continue leveraging the potentials of social media, website, and press releases. Partnering with other projects is another important pursue during this phase, as the Consortium started disseminating the first results to the targeted stakeholders and groups, as well as to the wider public.

Figure 1: ROSSINI Dissemination Timeline

2 Communication channels and activities

The current chapter is dedicated to all communication channels and means that were utilized to promote ROSSINI and raise public awareness of the project and its activities.

2.1 The ROSSINI Website

The ROSSINI website was set up during the first year of the project and is accessible at https://www.rossini-project.com/ . The website represents the project's primary method of communication within the Consortium and with external stakeholders and the wider public and since its creation is regularly being updated to include the project's latest news and developments. Among the updates of the website the past year is that of the homepage, which now hosts the ROSSINI Project animation video and a preview of all the videos uploaded in the ROSSINI YouTube channel. This choice is in accordance with the overall shift of the communication strategy towards an approach centred more around the audio-visual material and on-line presence. This shift is mainly due to the impact of COVID-19 across Europe which has led to the cancelation of many physical events such as conferences, trades etc and obliged most sectors and activities to move to the digital sphere. Furthermore, during the last year the Resources page of the website was reorganised to include the following subpages:

- News and Press Releases, which includes a calendar regularly updated with relevant events, a section where the press releases can be previewed and downloaded, a feed linked to the Twitter account and finally a section where the videos uploaded on the YouTube channel are displayed in a rotating manner. An overview of the News and Press Releases page is presented in Figure 3 and Figure 4.
- Project Deliverables, which includes all ROSSINI's public deliverables that have been submitted and accepted.
- Communication Material, in which the ROSSINI logo, general presentation, leaflet, banner and poster are uploaded along with the recently created ROSSINI digital brochure. All material can be downloaded by the website visitors.

The Resources page is the most interactive of the website, constantly being updated with new material and its purpose is to link the ROSSINI website with the other communication channels described further along in the current document.

To better monitor the impact of the website the Squarespace analytics tool was used. In Figure 2 the number of new visitors from November 2019 (date of last PEDR) until January 2020 can be seen. During this time 3100 individuals visited the website raising the total number from the beginning of the project to 4000.

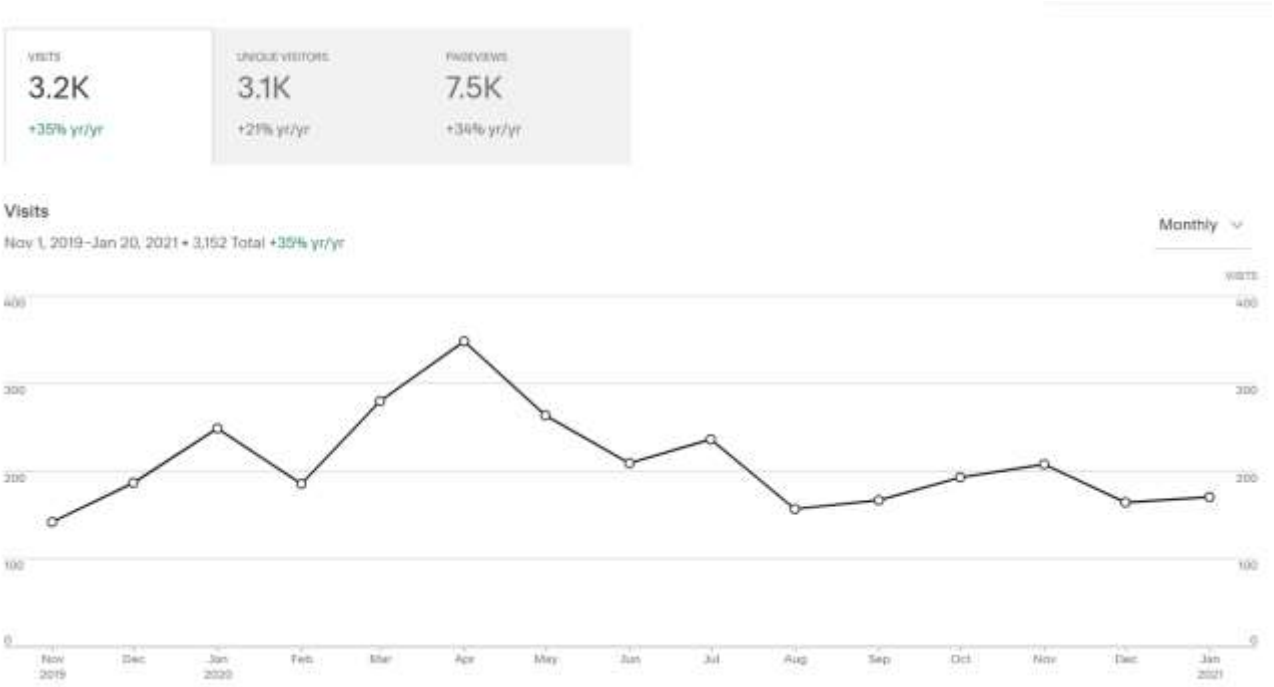

Figure 2: Website analytics

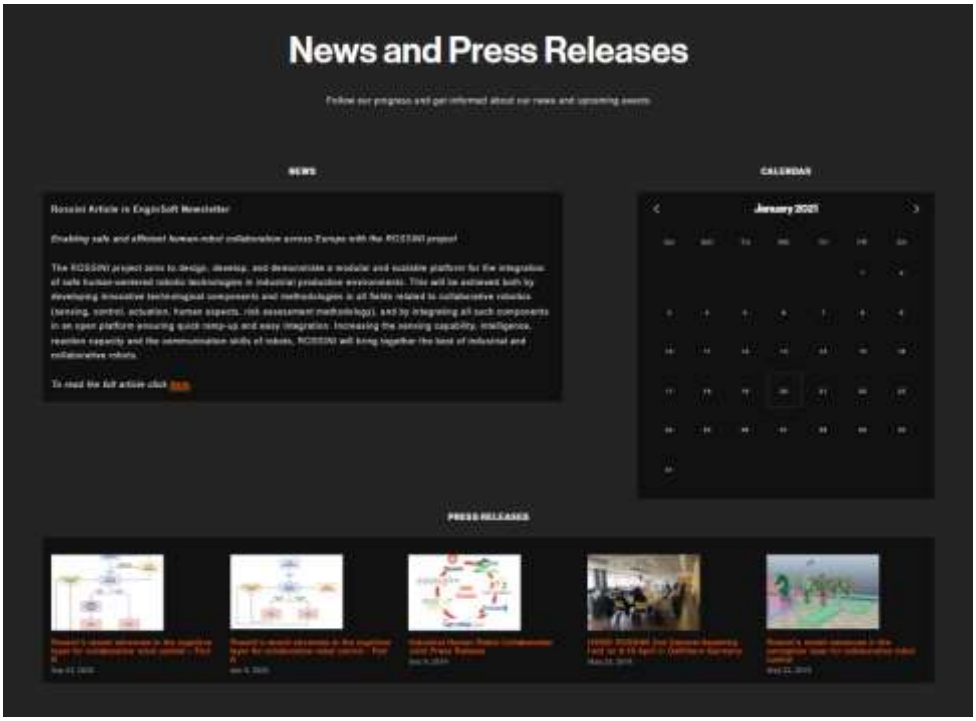

Figure 3: News and Press Releases section (1)

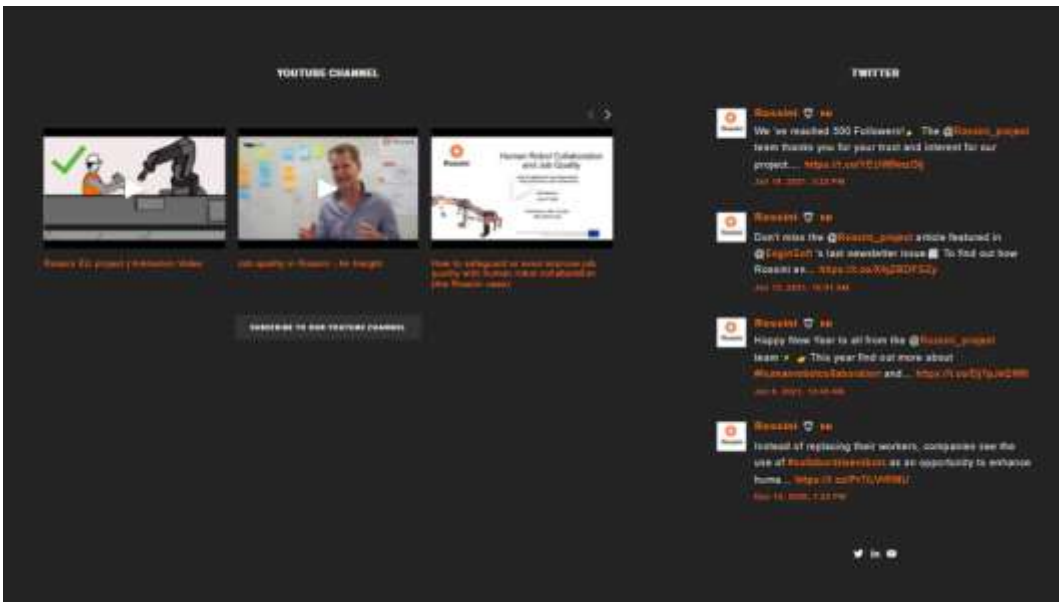

Figure 4: News and Press Releases section (2)

2.2 Communication Material

Supplementary to the original communication material (leaflet, banner, poster) that was created the first year of the project, during the last months the ROSSINI digital brochure was created and consequently shared with the consortium and the public through the website and the social media channels. The digital brochure is consisent with the project's color palette and overall visual identity and it was designed to serve as an on-line material in digital form, in comparison to the rest of the communication material which were designed to be printed as well. The notion behind this is that most events at the moment are digital so there are limited or no opportunities to circulate ROSSINI's communication material in a printed form. That is the gap that the digital brochure aims to fill. Besides the main facts about ROSSINI, the digital brochure also includes several graphics as can be seen in Figure 5. The whole digital brochure can be found in paragraph 11.2 of the Annex.

Figure 5: Part of ROSSINI's digital brochure

2.3 Social Media

The management of the website is backed up by an intense social media strategy, making usage of different social networks (LinkedIn, Twitter and YouTube). Furthermore, the existing social network channels of the consortium partners are widely exploited to enhance the dissemination of project activities and results towards the target audiences. The ROSSINI social media accounts, that have been set up so far and which are active with weekly posts and growing numbers of followers, are the following:

Twitter

The ROSSINI Twitter account is hosted on the following link: https://twitter.com/Rossini_project. The account is regularly updated with the latest project news, such as participation to events, meeting outcomes, progress on the technologies developed as well as articles related to the ROSSINI area of interest.

Twitter community is growing rapidly, leading to 500 followers so far (131 in the last 6 months), making it the most successful of the ROSSINI social media.

To better monitor ROSSINI Twitter account's activity and impact, the Twitter Analytics tool was used (Figure 7). Twitter Analytics demonstrates a successful performance upon Followers, engagement, and impressions. For example, over the period February 1st to April 30th it is shown that more than 13,5k times users got to see our content (13,5k impressions), leading to an average of 150 impressions per day. This period has had significantly higher activity in social media, due to COVID-19 outbreak, as the users were searching for online content and spending more time in those platforms.

Figure 6: ROSSINI Twitter Account

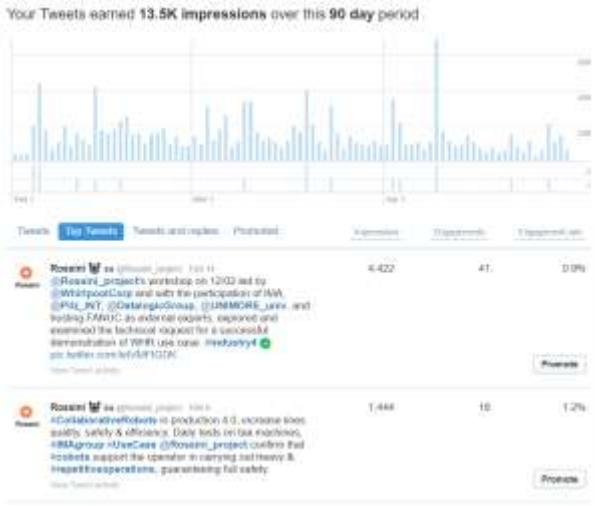

Figure 7: Twitter Analytics

The following table (Table 1) presents the number of users that followed ROSSINI Twitter account over the last 14 months with a growth rate at 74%. Follower growth rate is calculated as the number of followers you gained divided by the number of followers you started, times 100% (over a specific time period).

Table 1: Twitter growth

	Period M1-M14	Period M14-M28	Growth Rate
Project Month	M14	M28	M28
Followers	289	504	74%

LinkedIn

The ROSSINI LinkedIn account is hosted on the following link: https://www.linkedin.com/in/rossini-project-803368172/ . ROSSINI maintains a LinkedIn account where content similar to that of Twitter is frequently

shared with its network. The following figure (Figure 8) previews the LinkedIn account, showing its 396 followers so far (101 in the last 6 months).

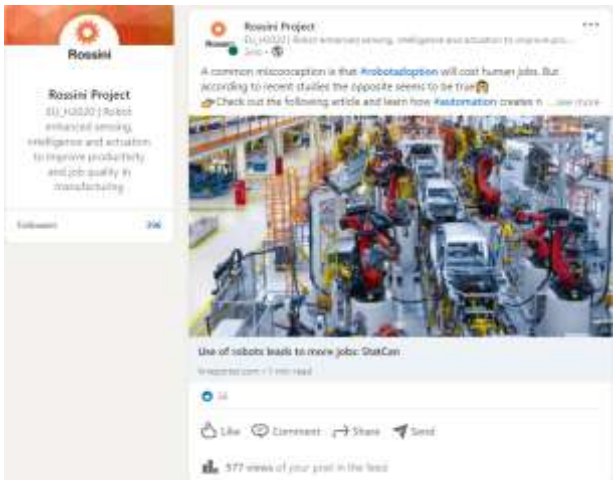

Figure 8: ROSSINI LinkedIn Account

Table 2 presents how many members followed ROSSINI LinkedIn account with a growth rate at 85%. Follower growth rate is calculated as the number of followers you gained divided by the number of followers you started, times 100% (over a specific time period). This high rate shows the increasing value of the project in various online communities.

Table 2: LinkedIn growth

	Period M1-M14	Period M14-M28	Growth Rate
Project Month	M14	M28	M28
Followers	213	396	85%

YouTube

The ROSSINI YouTube channel was set up to host videos explaining the actions taken place within the project as well as presentations on ROSSINI made by partners in various events and is hosted on the following link: https://www.youtube.com/channel/UCCpl_M-fAi2h5k_t1suy7UA . The channel counts, so far, 8 videos, 20 subscribers and an overall of 820 views. These numbers are expected to raise even more with the upcoming addition, over the next months, of technology preview videos and short interviews, provided by the partners. Several playlists according to the thematic of the different videos were also created.

More specific, the user has access to:

- The general animation video
- 3 short videos from the ROSSINI project presentation in IMA's Sensing Future Days event
- 3 videos from presentations of partners in other online events
- 1 Technology preview video in the form of an interview with Frank Krause from TNO

In Figure 9 an overview of the ROSSINI YouTube channel is presented while Figure 10 shows the most popular videos according to viewership.

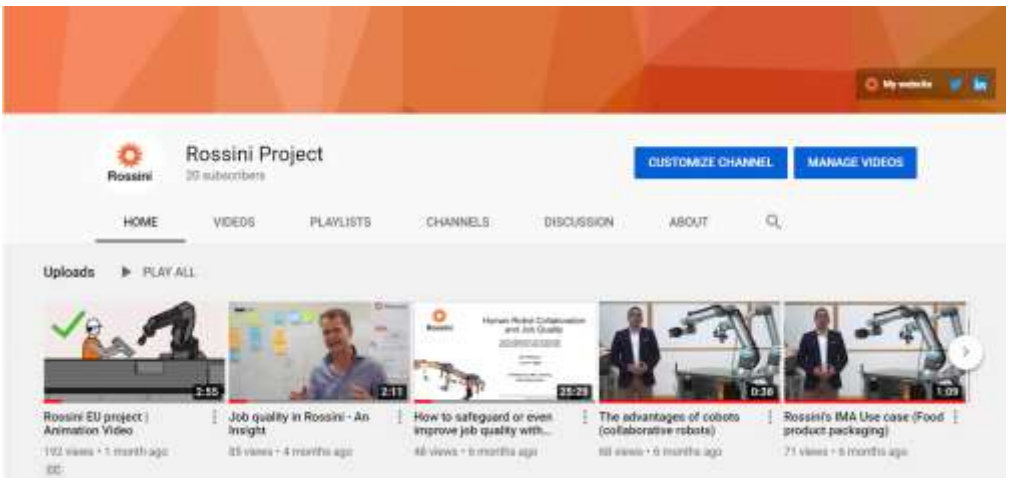

Figure 9: ROSSINI YouTube Channel

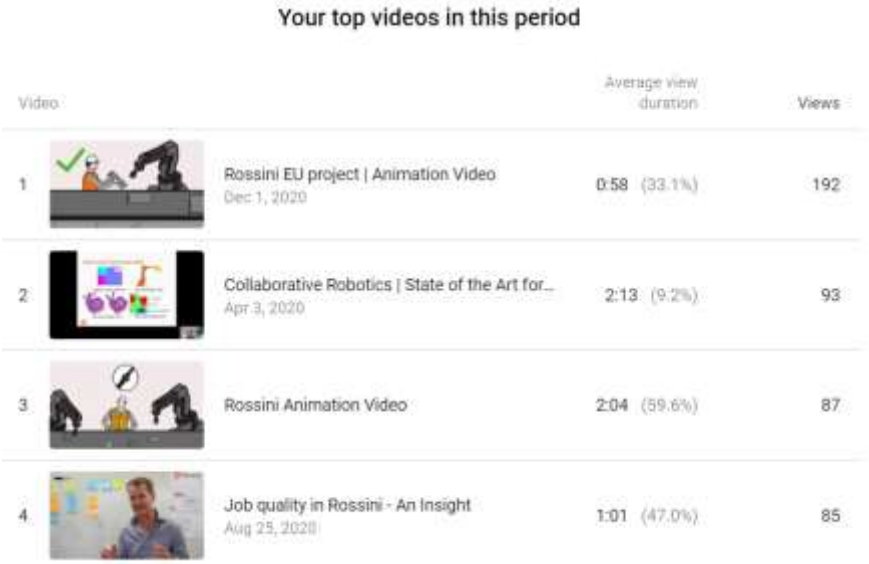

Figure 10: Top videos of ROSSINI Channel

2.4 Newsletters

Even though due to the complexity of the GDPR Privacy Policy, the consortium decided not to use newsletters as a marketing tool, the ROSSINI Project was featured in 3 newsletters these last months. The first 2 were issues of the newsletter published by the ENGINE initiative. ENGINE (EuropeaN diGital Innovation Network) is a venture aiming at strengthening connections among digital initiatives at European level, that involves projects running under the H2020 framework with the common perspective of fostering the sharing, dissemination and exploitation of up-to-date information about projects' results and initiatives. In the first issue of the Engine Newsletter ROSSINI was introduced along with the project's main facts, while in the second issue a short paragraph was included about ROSSINI's recent advances in the cognitive layer accompanied by a link to the respective press release. Finally, in December 2020 an extensive article about ROSSINI was included in the latest issue of the EnginSoft Newsletter. EnginSoft is one of the leading technology transfer companies in the field of Simulation Based Engineering Science and through their newsletter ROSSINI Project is expected to reach a large number of audience and prospective stakeholders. The EnginSoft newsletter issue is accessible on-line and was also printed to be distributed to interested parties.

Table 3: Newsletters including ROSSINI

	Link
ENGINE Newsletter 2nd issue	https://mailchi.mp/837004bcc2e4/engine-newsletter-2
ENGINE Newsletter 3rd issue	https://mailchi.mp/806dce5a242b/engine-newsletter-3?e=95fd7ccbb3
EnginSoft Newsletter	https://www.enginsoft.com/assets/pdf/newsletter/newsletter2020_4.pdf

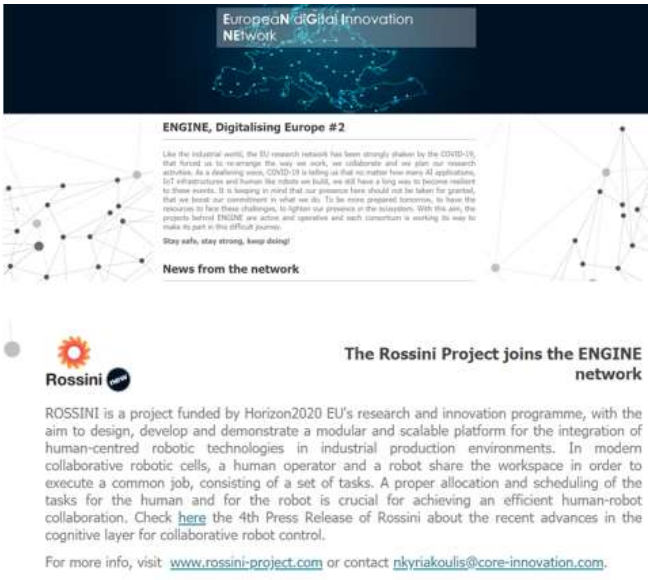

Figure 11: ENGINE Newsletter

Figure 12: Part of the ROSSINI article in the EnginSoft Newsletter

2.5 Press Releases

According to the timeline mentioned in the previous PEDR, 3 more press releases were published this year raising the total number to 5. The third one was a joint press release with other similar European projects under the title: Cluster of "Industrial Human Robot Collaboration" projects. The last 2 were dedicated to ROSSINI's recent advances in the cognitive layer for collaborative robot control, highlighting the progress made within the project in this issue. The full press releases are included in paragraph 11.1 of the current document. All press releases can also be found in electronic version at ROSSINI's website under the Resources page (Figure 13) and are furtherly promoted through ROSSINI's social media. Due to the Consortium's decision not to publish Newsletters, Press Releases constitute the main form of communicating in some detail the project's technological advancements and results.

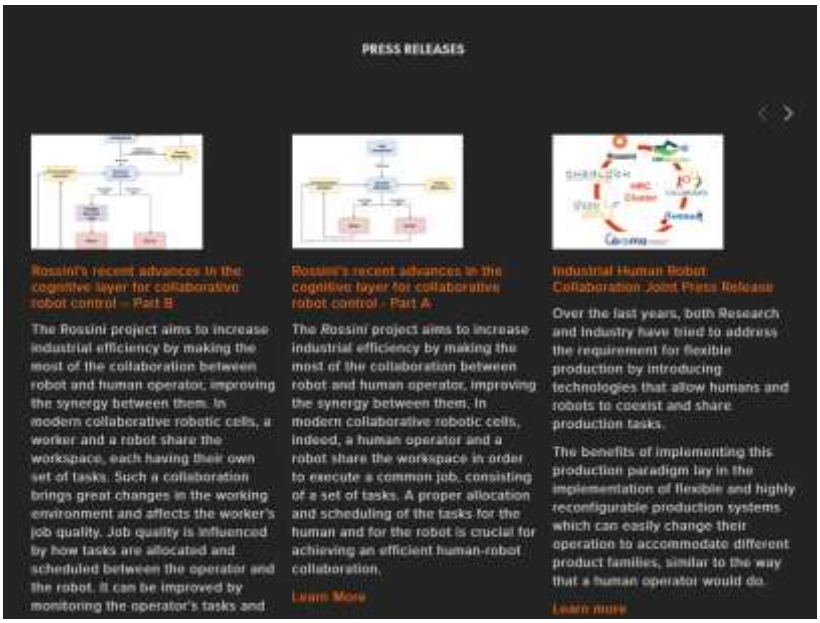

Figure 13: Press Releases on the website

2.6 Videos

As explained earlier, due to the Covid outbreak in March 2020 many events were cancelled or rescheduled. To mitigate this situation it was decided to give more emphasis on the creation and sharing of audiovisual material in order to enhance the communication and dissemination efforts of ROSSINI. In that context, it was decided to create a general animation video explaining the concept of ROSSINI and partners were urged to prepare short technology preview videos explaining their part in the project.

Project Animation Video

The main goal was to create a general video presenting the project briefly so it can be communicated to both stakeholders and the general public. CORE INNOVATION in collaboration with AnimaSyros designed and produced the project animation video, of a total of 2:55 minutes duration. The video is a powerful tool for project dissemination to events (physical and online) and to a wider audience. For example, it was displayed at the ROSSINI virtual booth of the CAE International Conference.

The video explains in a brief and simple way:

- Current situation regarding european industries and the role of robots in it
- Project challenges and objectives
- Project core technologies and services developed
- Consortium

We tried to illustrate all the aforementioned content above by translating it into a comprehensive visual language, while in accordance with the project's visual identity. An example of the aesthetic of the animation video and the visual used can be seen in Figure 14, below.

The ROSSINI animation video is the most popular of the videos uploaded in the ROSSINI YouTube channel and can be found in the following link: https://www.youtube.com/watch?v=o3FvM2gbPHo . It is also uploaded in the website homepage as well as the CORDIS YouTube channel.

Figure 14: Still from the ROSSINI Animation Video

Use Cases Videos

Partners have agreed to showcase their technologies and services in an audio-visual format. Those Technology Preview videos after being edited will be uploaded on the ROSSINI YouTube Channel. So far one such video has been created by project partner TNO (https://www.youtube.com/watch?v=HFCmjULG59w&t=1s), explaining the importance of job quality in ROSSINI project. In Figure 15 a still fron TNO's technology preview video can be seen.

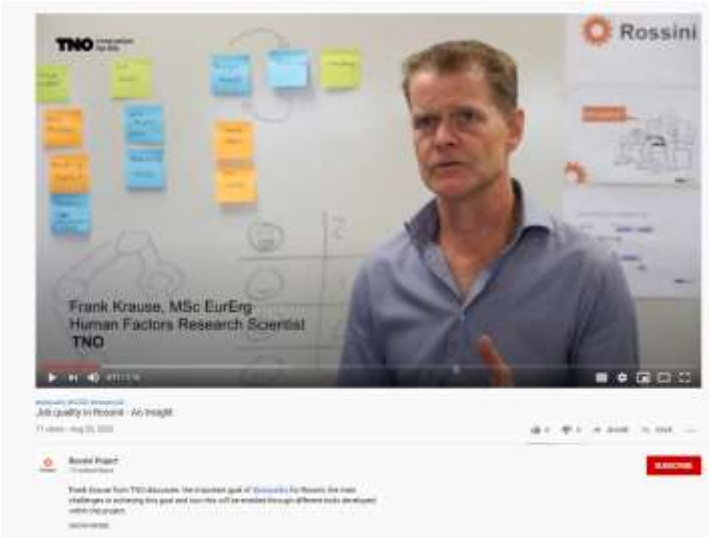

Figure 15: TNO technology preview video

3 Dissemination channels and activities

This chapter is dedicated to the dissemination activities pursued by all ROSSINI partners during the last 14 months. The current stage of publications and participation in events is presented along with the efforts made regarding synergies with similar projects. For a more effective monitoring of the dissemination activities pursued by the Consortium, 2 forms were created, one dedicated to Events and the other to Publications. Partners were urged to fill in the respective form after they have participated in an event or completed a publication.

Finally, another tool that was used to facilitate the dissemination activities is the Events calendar included both in the Microsoft teams platform of ROSSINI as well as the ROSSINI website. It is frequently updated with relevant events and accessible to all partners to enable them to discover events for participation.

3.1 Publications

The industrial and academic partners have begun to publish and present, individually and in collaboration, the scientific advances in technical papers as well as in journals (peer reviewed or not) and magazines. Scientific publications are an effective way to disseminate project results and to attract the interest of representatives of the various target groups. Publications will be mainly in open access journals in order to comply with the Horizon2020 Guidelines on Open Access[1]. To further support this activity, whenever possible, project publications will be archived or linked on the ROSSINI website.

ROSSINI partners have published 1 technical paper so far which was presented at the 13th International Workshop on Human-Friendly Robotics, while 3 more papers have been submitted and are under review (Table 5). Meanwhile 2 articles about ROSSINI have been published in IMA's corporate website and 1 article in the Italian Association of Ergonomics Magazine, as can be seen in Table 4.

Table 4: Current State (M15-M28) of publications and articles

Title of publication	Partner	Medium	Date
IEEE Transactions on RoboticsA Dynamic Architecture for Task Assignment and Scheduling for Collaborative Robotic Cells	UNIMORE	International Workshop on Human-Friendly Robotics	18/9/2020
Collaborative robotics developments	IMA	Website: https://ima.it/en/collaborative-robotics-developments/	27/3/2020

[1] Guidelines to the Rules on Open Access to Scientific Publications and Open Access to Research Data in Horizon 2020. [Online]. Available: http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf

Title of publication	Partner	Medium	Date
Rossini Project, among the 7 European projects on Human Robot Collaboration	IMA	Website: Rossini Project, among the 7 European projects on Human Robot Collaboration • IMA Group	16/12/2019
"AI = f(?) Artificial Intelligence as mathematical model. Groundwork to discuss about the role of ergonomists"	CRIT	Italian Association of Ergonomics magazine	Dec of 2020

Table 5: Upcoming publications

Title of publication	Partner	Medium
Task assignment and dynamic scheduling with job quality constraints	UNIMORE, TNO	Robotics and Automation Letters
Dynamic replanning and trajectory scaling	UNIMORE, DATALOGIC	Robotics and Automation Letters
A New Conversion Method to Evaluate the Hazard Potential of Collaborative Robots in Free Collisions	FRAUNHOFER	ISER conference

3.2 Organisation and participation in conferences, workshops and activities

During the second phase of the project, more targeted actions would have been made for participating in related events in order to maximise the visibility of the project and attract relevant stakeholders. From March 2020 and on, most events were held online, while others were postponed for next year. Especially the first couple of months after COVID-19 outbreak, a great number of events were cancelled, leading to less participations as consortium.

All in all, partners participated in 9 events during this last year (Table 6), most of which were webinars or workshops. From this list, 2 were major conferences (SPS Italia Digital Days and the International CAE Conference), in accordance with the KPI set in the Grant Agreement mentioning that *the consortium should identify at least five major international conferences in its lifetime. Participation to such events should start as of the first semester of Y2 and continue with one per semester until the end of the project.*

Table 6: Current State (M15-M28) of participation in conferences and workshops

Title of the event	Date of the event	Location of the event	Partner	Description of activity
Collaborative Robotics | State of the Art for the Rossini EU project	27.03.2020	Online workshop	CRIT	Presentation of the ROSSINI main outcomes and the current status of WP2, WP3 and WP6
IMA Sensing Future Days - (Virtual Venue)	May-June of 2020	Online event	IMA,TNO	The very first virtual event marked by innovation, manufacturing processes, digitalization, packaging materials handling, environment and sustainability. Presentation on what the Rossini project is doing with respect to job quality
Arrivano i nostri... Robot	28.05.2020	Online workshop	UNIMORE	Presentation of the collaborative robotics activities for facing COVID-19 issues in a manufacturing environment. Part of the ROSSINI technologies have been presented.
Applying Ergonomics webinar	05.06.2020	Online webinar	CRIT, TNO	Presentation on safeguarding job quality in human robot collaboration.
Safety in collaborative robot systems: technologies, standards and best practices	03.06.2020	Online webinar	CRIT	Presentation on Human-Robot Collaboration (HRC) and the work done in ROSSINI

Title of the event	Date of the event	Location of the event	Partner	Description of activity
"Shared workspace between humans and robots"	28.07.2020	Online workshop	Datalogic	Workshop sponsored by funded project HR - Recycler as satellite event of Living Machines 2020
SPS Italia Digital Days	29.09.2020	Online conference	Datalogic	Workshop "Robotics and Mechatronics: from artificial intelligence to collaborative systems"
THE SENSING FUTURE DAYS ARE BACK	7.10.2020	Online event	IMA, TNO	The second part of the digital event organized by IMA
International CAE conference and exhibition	30.11-4.12/2020	Online conference	CORE	Participation with a virtual ROSSINI booth in the Research Agora Forum

3.3 Synergies with similar projects and initiatives

ROSSINI partners have liaised with several projects which have the same or similar thematic and could benefit through the exchange of ideas and outcomes. This liaison involves the "Industrial Human Robot Collaboration" cluster in which 7 projects participate, including ROSSINI, as well as the ENGINE initiative, which was presented in paragraph 2.4. An overview of the actions pursued as part of the Synergies with similar projects endeavor can be seen in Figure 16. Meanwhile for both initiatives coordinating calls are being realized to plan joint dissemination activities and maximise the impact of all projects involved.

Social Media

- All projects of the "Industrial Human Robot Collaboration" cluster have a constant activity and interaction in both LinkedIn and Twitter. It is a common practice when a special action is posted, the other projects will support it by re-posting or re-twitting it, boosting its visilibity and engagement.

Common Events Participation

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- To maximise the results and impact on attending an event, the cluster projects many times commonly joined together events, such as the "Shared workspace between humans and robots" workshop that was sponsored by funded project HR - Recycler as a satellite event of Living Machines 2020.

Newsletters and Press Releases

- To commonly promote their actions, projects from both initiatives publish in common press releases or Newsletters. Such examples include the joint press release of the "Industrial Human Robot Collaboration cluster" and the ENGINE initiative Newsletter.

Figure 16: Synergies with similar projects and initiatives

4 KPI and Impact Assessment

For the purposes of evaluation of the ROSSINI communication and dissemination activities, quantitative indicators and associated metrics were set up where applicable in the 1st Interim PEDR. Table 7 shows all those indicators and their performance, while it states the target number over time.

Table 7: Impact Assessment for C&D activities

Communication tool/channel	Indicator	M28 (current)	Target number M30	M42	Action Plan
Website	No of unique visitors to the website	**4000**	3500	4500	Promoting the web site in social networks
Printed Brochure	No of brochures distributed	**600**	800	1000	Distribution via participation to and organisation of dedicated events and partners network
Social networks (LinkedIn, Twitter, YouTube) (LinkedIn, Twitter, YouTube)	No of members on LinkedIn	**396**	250	300	Keeping ROSSINI profiles on such networks active via regular posting and monitoring, integrate the social networks in the website
	No of followers on Twitter	**500**	400	500	
	No of views on YouTube	**820**	100	200	
Publications	No of submitted scientific papers/ articles in industry	**1**	8		Encourage partners to publish papers in peer-reviewed and indexed journals, find

Communication tool/channel	Indicator	M28 (current)	Target number M30 M42	Action Plan
	journals and magazines			appropriate events, search for additional channels
Attendance of events	No of attended conferences and fairs	**27**	30	Find alternative events, contact organizers, identify further industrial fairs of interest to the project.
Organization of events		2 meetings/year (physical or virtual)		Actions according to GA
	No of workshops organized	-	3 workshops + 1 Conference	

According to the table above, all indicators have surpassed the initial targets, highlighting the successful Communication and Dissemination strategy and activity. KPIs of the unique visitors to the website, as well as the number of followers on social media have been reached and exceeded. Even the limited number of publications so far (1) can be explained as, with 3 more publications in progress, this number is expected to drastically increase the following months. Furthermore, the closest the project comes to its completion, the more results will be available to be published, raising the value of this indicator even more.

For the following months, ROSSINI's communication and dissemination strategy will continue towards the same direction aiming to raise the aforementioned indicators even more. Exploiting all the communication channels described in this document and with increased emphasis on the on-line presence of the project the goal is to engage even more the public and stakeholders. Meanwhile, as the project progresses, more results will emerge which consequently can be disseminated through partners' participation in events and scientific publications, highlighting ROSSINI's contribution and potential business benefits. Furthermore, collaboration with similar projects will be pursued in greater extent and more methodically in order to organize shared dissemination actions, such as events, webinars or publications, thus increasing even more the visibility and impact of all projects involved. Such actions are underway, as an introductory call between projects of the Industrial Human Robot Collaboration cluster has already been realized and another is scheduled for the members of the ENGINE initiative.

5 Exploitation Plan

Communication, dissemination and exploitation are different activities taking place on a common playground: the **results of the project**. The concept standing behind the definition of exploitation, which is also the ultimate feature of the activity itself, is indeed the **effective and concrete use** of the achieved **project outcomes**.

The exploitation plan is a strategic tool for the valorisation of the project results and for the creation of a concrete impact of the project on the stakeholders' community and on the market. The plan collects the outcomes of ROSSINI, the analysis of their features and potentialities, the strategy and rules for their exploitation, the intellectual property (IP) issues and rights management approach, the knowledge and management approach.

The identification of the exploitable results is an ongoing process that starts at the proposal stage, when a preliminary list of expected results is outlined. Some of the foreseen outputs become available throughout the course of the project, some towards the end, some may result not to be feasible, some new may be identified. Therefore, **project progresses** are closely monitored to analyse already identified exploitable results and to find new outcomes not foreseen at the beginning of the project, to **follow up and manage** them through the whole lifetime of the project.

The exploitation plan is an evolving report that will be periodically updated according to the emerging results of the project, the changes in the stakeholders or work context and their potential use during the project lifetime.

5.1 Objectives

The overall objective of the exploitation plan is to maximise the impact of the project results so that they can be used and implemented beyond the lifetime of the project. This challenging final goal can be expressed as a list of sub-goals to be reached:

- Reach a synergic approach between communication, dissemination and exploitation in order to reach the stakeholders;
- Identify of the innovations and characterize them;
- Define how to get the expected innovations "out of the lab" and into (or at least closer to) the market and identify possible, most appropriate exploitation routes for the expected key exploitable results corresponding to the nature of the different results and their target users;
- Choose concrete exploitation measures to ensure that results will meet real needs and thus will be taken up. What are the relevant steps within the project's lifetime and beyond?
- Reflect on potential barriers/obstacles, and how to overcome them;
- Consider including dedicated formats (workshops, questionnaires, etc.) to capture and assess exploitation opportunities in the project;
- Plan and describe adequate internal structures safeguarding effective knowledge, IP and innovation management, helping to create, capture and manage research results.

5.2 Strategy

The ROSSINI impact enhancement plan follows a strategy based on the:

- Characterization of the exploitable results
- Market analysis and assessment
- IP management and protection
- Data management
- Standardization

5.2.1 Characterization of the exploitable results coming from the project.

ROSSINI follows a systematic approach to the characterization of the exploitable results that provides for reference points and benchmarks.

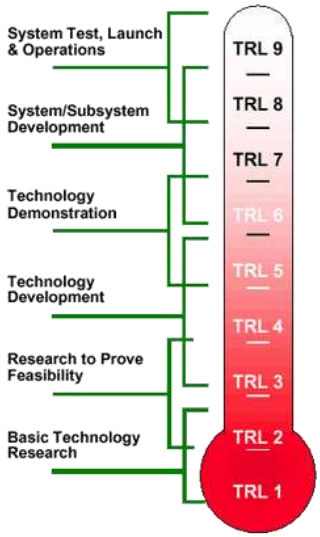
The first reference point is the category to which the exploitable results belongs represents a reference point for the identification of the nature of the outcome lays the foundation for a correct exploitation plan. Contrary to common belief, exploitable results do not necessarily correspond to a product or a service, but can be classified as:

- Equipment – the machinery or tools needed to carry out a job; a set of physical tools, devices, kit assembled for a specific purpose.
- Processes – A systematic series of mechanized or chemical operations that are performed in order to produce something.
- Products – something that is made to be sold, usually something that is produced by an industrial process (as a custom but may be personalized upon request).
- Services – offering the above products, processes, equipment, or knowledge as a help to perform a work.
- Knowledge & IP – understanding of or information about a subject that you get by experience or study, either known by one person or by people generally
- Other forms of knowledge – Platform, publications, patent.

The Technology Readiness Level (TRL)[2] is a reference tool to assess the technology maturity of the project results.

Figure 17. Technology Readiness Levels

[2] European Commission (2017), H2020 Work Program 2018-2020, General Annexes, Annex G, Technology readiness levels (TRL), https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-g-trl_en.pdf



The TRL tools may not apply to all kinds of exploitable results coming from ROSSINI project. However, it is a helpful instrument for managing the progress of research and development activities since it provides a measure of the current readiness of the exploitable results and a common understanding of their technology status.

Turning innovation actions into concrete value and impact for society is also a matter of **thinking ahead**. Nevertheless, identifying, shaping and classifying the exploitable results coming from the project do not ensure their use beyond the lifetime of the project. To **provide a future to project outcomes**, it is of outmost importance to have a **clear vision** for their exploitation and a **customised strategy** to follow depending on the nature of the results.

Depending on the TRL reached, there are several routes for carrying out further exploitation, which are presented in the figure below:

Figure 18. Exploitation visions

The characterization of ROSSINI outcomes addresses the individual exploitable results obtained by project partners but also the joint and common result “ROSSINI Collaborative Robotics Platform".

5.2.1.1 Exploitation Strategy and Tools for Individual Results

Following the refences points cited above and guided by the DEM, the consortium will outline a systematic and harmonized characterization of the individual exploitable results describing:

- The results and how it is related with project activities
- The innovation content of the result
- The development status of the innovation
- The category to which the result belongs to
- The ownership of the result

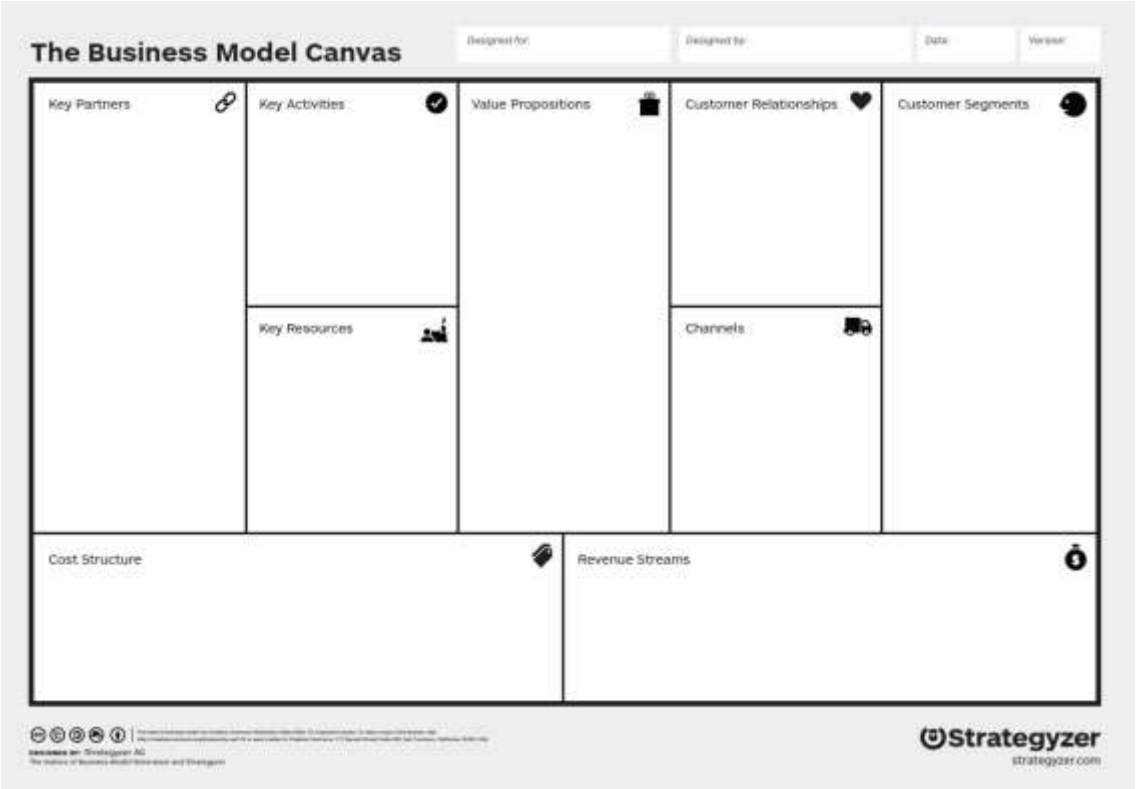
- The expected TRL to be reached
- The exploitation vision and the necessary steps to bring the innovation closer to the market
- The stakeholders to be involved to achieve the exploitation vision
- The intellectual property behind the developed innovation

The characterization of the exploitable results is a process expected to last for the whole duration of ROSSINI project. The information will be enriched at each stage of the project and correctly updated according to the developments and implementations carried out by the technological partners.

5.2.1.2 Exploitation Strategy and Tools for Joint Results

The joint result "ROSSINI Collaborative Robotics Platform" will be characterized using the Business Model Canvas (BMC) tool, the consortium will work on the Value Proposition (VP) and Customer Segments (CS) boxes.

Figure 19 Business Model Canvas Template



The VP segment describes the bundle of products and services that create value for the customer as they help them solving a problem or satisfy their needs. The technology providers will work together in groups to outline the ROSSINI Collaborative Platform VP focusing on five questions:

- What is ROSSINI collaborative platform?
- Who is the intended user of ROSSINI?
- Is the ROSSINI collaborative platform a modular or unique platform?
- Which parts are offered as extra features?
- Which information can the user access and how?

The CS block defines the groups of (profitable) people or organisations a company reaches and serves through its products and services. The use cases (IMA, WHIRPOOL, Schindler) will analysed this block focusing on four questions:

- What do we expect from ROSSINI?
- Understanding the end user and the customer:
  - Who are they (needs, characteristics, activities)?
  - What do they want to see?

- What is essential vs what is nice to have?

The characterization of the joint solution will be performed within a dedicated workshop were partners can directly interact with each other. Possibly, at later stages of the project, also the characterization of the joint solution will allow to analyse the remaining boxes of the canvas.

5.2.2 IP management and protection

The market uptake of the results of the project often requires further activities and considerable investments, which might not be encouraging unless outcomes are well protected through **IP**. In increasingly competitive economic systems, intangible assets have a strategic role. The protection of the generated innovations is therefore a priority for companies who want to maximise their economic value. In a high technology sector, like the one in which is Rossini, innovation is the only way to become leader, and it's of the utmost importance to protect and commercialize what generated. From the research institutes and universities point of view it will be of outmost importance to protect the intellectual properties behind the scientific articles published during ROSSINI project. Therefore, a crucial point of IP strategy is the alignment between the needs of scientific community and the requirements of the companies that have to be consistent and synchronized in order to avoid any breaches of secrecy.

During a H2020 project, each partner of the consortium might be called to share his knowledge, experience and technological innovations to finalize the project idea. This means that the participants might contribute with some tangible and non-tangible assets giving rise to intellectual rights, that need to be protected through confidentiality agreements between the applicants.

ROSSINI consortium has already established a set of rules to manage Intellectual property within the Grant Agreement of the project. ROSSINI IP management strategy aims to recognize from the beginning any potential disputes arising from the implementation of the project. To be effective in achieving this goal, the approach followed by the consortium includes:

a. A **preliminary training session on IP and its relationship with the exploitable results** was carried out by the Dissemination and Exploitation Manager (DEM) indicatively at M10. The webinar identified the methodology to be used for the exploitable results and IP assets characterization. The training was organized into two sections. The first one addressed Exploitable Results-related concepts: what they are, what type of information project partners should report for a more detailed characterization, who are the right organization profiles to be involved in their definition/assessment, etc. The second section was oriented to IP issues: background and foreground concepts will be introduced, the rules of H2020 program on IP were explained to create awareness among the partners on IP issues and the importance of their contribution towards the maximization of the project impact.
b. Each partner was **individually** asked to provide information on the forms of protection that intends to adopt.
c. The **BFMULO Matrix** has been implemented to determine the involvement of project partners in each of the Exploitable Results (ER).

   In a BFMULO Matrix partners indicate their intentions corresponding to each of the ERs through writing letters B, F, M, U, L and O. The letters stand for:

   - **B** = IPRs on background information:

   Information excluding foreground information, brought to the project from existing knowledge, owned or controlled by project partners in the same or related fields of the work carried out in the research project.

   - **F** = IPRs on foreground information:

   Information including all kind of exploitable results generated by the project partners or 3rd parties working for them in the implementation of the research project. To have an F in an exploitable result it is necessary that a partner has a task(s) in the project related to that very result.

   - **M** =Making the results:

   Making the products, manufacturing and selling or directly implementing it through own facilities and skills.

   - **U** = Using the result,

Using the result, implemented with own knowledge to develop new ranges of products or newer processing. Furthermore, the direct or indirect utilization of foreground in further research activities other than those covered by the project, or for developing, creating and marketing a product or process, or for creating and providing a service.

- **L** = Licensing the result:

Earning from a negotiation towards third parties outside the consortium.

- **O** = Other exploitation means:

Any other exploitation means (e.g.: consultancy, provide services, etc).

d. A final matrix will summarize the previous ones highlighting potential synergies or eventual criticalities like partners that claim the intention to exploit nearly all the exploitable results even by means of activities that are not typical of a the organization they belong to, that declare the intention of exploiting the project outcomes in any possible way apparently without any specific business model in their mind, possibility of arising disputes on the ownership.

5.2.3 Market investigation and assessment

Starting from the State of the Art assessed at the very beginning of the project, a deeper analysis of the market of collaborative robotics will be performed. Market analysis reports will be used as a support for the activity in order to investigate:

- Collaborative Robotics market: dimension and geographical location
- Market Trends, barriers, growth drivers and end-users needs
- Competitive scenario: already available and existing solution, competitors value proposition and business models.

Input from the technology partners and the end users collected during the workshop on BMC will be used to check if and how well the VP of the project aligns with the expectations of the main customer segments that will be identified. A further comparison between the product functionalities the customers wish to have and the current product design will enable to develop improvement suggestions for the technology partners.

A detailed and weighted SWOT analysis will be performed to better understand the potential of ROSSINI results and platform in the market. Partners will be asked to provide input on the Strengths and Weaknesses of their individual results, while also reporting the Opportunities and Threats that push or respectively hinder the adoption of their results. The inputs on the strengths and weaknesses provided will be analysed and clustered in key areas. The above-mentioned steps will enable to define the positioning of ROSSINI results within the market.

5.2.4 Data management

The amount of data generated is continuously increasing while the use and re-use of data to derive new scientific findings is more or less stable. This information would be useful in the future if data is well documented according to accepted and trusted standards which enable the recognition of suitable data by negotiated agreements on standards, quality level and sharing practices. For this purpose, the Data Management Plan (DMP) defines strategies to preserve and store the data over a defined period of time in order to ensure their availability and re-usability after the end of ROSSINI project.

DMP will define how this data will be managed and shared by project partners, and also, how this information will be curated and preserved during and after the project duration. According to the Guidelines of Open Research Data in Horizon 2020[3], as part of making research data findable, accessible, interoperable and re-usable (FAIR), a DMP should include information on:

- The handling of research data during & after the end of the project.
- What data will be collected, processed and/or generated.
- Which methodology & standards will be applied.
- Whether data will be shared/made open access.
- How data will be curated & preserved (including after the end of the project).

[3] https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm

With the aim of collecting this information and suggestion, CRIT prepared a questionnaire for all the ROSSINI consortium at early beginning of the project. To ensure that the information given at early stages of the project is continuously updated, partners have been asked to check and updated the questionnaire.

In the WP development process, data related to the scientific and technical content and objectives might be generated. This data can be object of analysis and evaluation and it may contribute to the global knowledge generated. The mentioned questionnaire that aims at identifying and gathering all the data sets to be generated by all consortium partners during the lifetime project, covers the following aspects:

1) **Scope**

- State the purpose of the data generation/collection
- Explain the relation to the objectives of the project/WP/Task

2) **Types**

- Are the data digital/hard copies or both?
- What types of data will the WP generate/collect? Specify the types and formats of data generated/collected (for example .xls files, .ppt files, emails, .doc files)
- Is the data generated or collected from other sources under certain terms and conditions?
- How is generated/collected? Specify the origin of the data and instruments/tools that will be used.
- State the expected size of the data (if known)
- Standards

3) **Ownership**

- Is another organization contributing to the data development?

4) **Reuse of existing data**

- Specify if existing data is being re-used (if any)

5) **Data use**

- How will this data be exploited and/or shared/made accessible for verification and re-use? Outline the data utility: to whom will it be useful

6) **Dissemination Level of Data**

- Confidentiality/ Sensitive data. If data cannot be made available, explain why. Who will have access?

7) **Storage and disposal**

- How will this data be stored?
- How long is it required to keep the data? Expire date. Will revisions be kept?

8) **Rules for Data naming**

- Standards or internal rules

These data can be object of analysis and evaluation and may contribute to the global knowledge generated.

Some of these data will be public while some other are expected to be confidential, only accessible for ROSSINI consortium, or sensitive data, only accessible for certain partners.

The kind of data collected are:

- Feedback and data from demonstration activities within the three use cases. The types of information are:
  - KPI's and some data files on performance of machines.
  - .xls files, .ppt files and/or .doc files. for reports.
  - Rtf documents for user acceptance questionnaires/online instruments doc files and .xls files.

- Algorithms to be used for diagnosis and predictive maintenance.
- Data to be feed into the cognitive monitoring embedded system.

5.2.5 Standardization

The DEM will assess and monitor which are the already existing standards on collaborative robotics. The objective is to investigate where ROSSINI innovations could give their contribution in terms of standardisation and possibly bridge gaps. For this purpose, the DEM will be in contact with the national standardisation UNI. Moreover, with the help of the other partners of the consortium and, thanks to the liaison with the other HRC project funded under H2020, the task leader will establish contacts with standardization entities in Europe.

6 Exploitable results characterization

This section of the document is dedicated to the characterization and deep analysis of the individual and joint exploitable results achieved by the project.

Based on the definition of EU Horizon 2020, the 'Results' of the project is any tangible or intangible output of the action, such as data, knowledge and information, whatever their form or nature, whether or not they can be protected". The exploitable results can be used by the project partners or by other stakeholders, after their agreement.

As previously stated, it is essential to start with the identification and characterization of the exploitable results. Indeed, not all of what has been achieved throughout course of the project is likely to have an exploitation route. Exploitable results are only those having a potential scientific, economic and social significance. During the project these outcomes provide a mechanism to capture and quantify impact, while, by the end of the project, a way to achieve impact beyond project's completion.

The identification of the exploitable results is an ongoing process that starts at the proposal stage, when a preliminary list of expected results is outlined. Some of the foreseen outputs become available throughout the course of the project, some towards the end, some may result not to be feasible, some new outputs may be identified.

Table 8 below lists the exploitable results of the ROSSINI project at M28. These results have been updated taking into consideration project's developments and results achieved up to now and may be further updated in the future versions of the PEDR adapting to the project's progresses.

Table 8 ROSSINI exploitable results at M28

Type of ER	Exploitable result	WP	ER Manager	Involved partner(s)	Exploitation vision
Products	New Safety System based on 3D flexible **cameras**; New Safet System based on **multiple sensing technologies;** Advanced **SLS cluster**;	3	DATALOGIC	PILZ	Product sales; Use in company processes
Product	Using of HF, capacitive and tactile sensors to reach **qualitative improvements at HRC applications**	3	PILZ	DATALOGIC	Internal product development
Process	Perception and data fusion layer for optimum collaborative robot control with artificial intelligence techniques	4	IRIS	UNIMORE; PILZ	Use in company processes

Type of ER	Exploitable result	WP	ER Manager	Involved partner(s)	Exploitation vision
Product	**"Collaborative by Birth"** robotic arm	5	SUPSI		Product sales
Service	Software design to improve the integration of man-robot collaboration applications	6	MACHINEBOUW	SUPSI, DATALOGIC, PILZ	Product sales; Use in company processes; License
Product & Service	**Dynamic model of the human body** to determine the transient contact behavior of HRC applications	7	IFF		License;
Process	**HRC Workcells** for domestic appliances & electronic components	8	WHIRLPOOL, SCHINDLER	PILZ, DATALOGIC, MACHINEBOUW	Use in company processes; market replication
Product	**Mobile collaborative robotic solution** for raw material feeding and machine tending with high speed capabilities by using **dynamic safety**	8	IMA	PILZ, DATALOGIC	Product sales; Use in company processes
Product	A novel **safety aware control architecture** for collaborative robotic cells	3,4,6,8	UNIMORE	DATALOGIC, PILZ, IRIS, SUPSI	TBD
Service	Technology to evaluate and monitor the job quality underlying variables that are relevant for the adoption of collaborative robots in manufacturing	4,6	TNO	UNIMORE, SUPSI	TBD

During year 1 of ROSSINI, project partners have carried out a preliminary characterization of exploitable results in terms of innovation content, category of result, partners involved and market proximity estimations. This preliminary work has been further developed by partners considering some new parameters:

- The exploitation claims of ER Manager with respect to each ER: each responsible partner was asked to use the **BFMULO Matrix** to indicate if they have provided background or foreground information to the development of their results and the exploitation claim that they have towards their results (M-making the result; U – using the result: L – licensing – O – other);
- Main & Secondary markets where their results could be presented;
- Strengths and Weaknesses of their solution:
  - STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?
  - WEAKNESSES – What are you missing to further/better develop this solution?
- Price and payment: unit price and price mechanisms (pay upfront, annual fee…)

The following tables illustrates the further characterization of project results, which is still in progress:

6.1 Cluster of Safety Laser Scanners managing occlusions due to multiple objects in the scene

ER Name	Cluster of Safety Laser Scanners managing occlusions due to multiple objects in the scene	
ER Owner	DATALOGIC	
Other partners involved		
WP involved	The result will be achieved in WP3. Safety warnings and alarms will be passed to WP4 and WP5. The entire system will be tested on the use cases of WP8.	
ER category (equipment, process, product, service, knowledge and IP, other)	Improved product	
ER Innovation Content	The aggregated measurements of a cluster of Safety Laser Scanners will be used to guarantee the safety of an operator working in proximity of automatic machines where one or more scanners could be occluded by one or more objects. The system will rise an alarm in case an operator enters in a forbidden area or if the occlusions don't allow this check.	
Exploitation vision	**On Going**	**Planned**
	Prototyping in laboratory environment	Technology transfer
		Market study
		Prototyping in real world environment
		Complying with existing standards
		Business plan
Main markets/users	HRC, industrial, AGV	
Secondary markets/users	OEM	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 1 and 3 years	
IP Management		
Do you want to protect your resulst?	☒ yes ☐ no	

If yes, how? (IP rights)	The project' results will be protected with a combination of patents and other form of IP rights, according to the type of results.
Do you bring background or foreground information to this ER?	☐Yes, background information ☒Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	Datalogic has specific knowledge developed in Rossini and previous knowledge related to this technology.
Which exploitable claims do you have?	☒M =Making the results ☒U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	Integrated operation of multiple SLSs allows to monitor an industrial/HRC scene to provide the acquired information to a centralized safety controller for safety function realization. With respect to prior use, the SLS cluster create a single aggregated map of the monitored area allowing an easy definition of warning or forbidden zones, binded to a specific safety function. Through the fusion of data coming from multiple sensors, it's possible to minimize the occlusions made by obstacles in the scene.
WEAKNESSES – What are you missing to further/better develop this solution?	The possible improvements to this solution are related to the reduction of the measurement uncertainty related to asynchronous acquisition between multiple devices.

6.2 Safety system for collaborative robotics based on 3D cameras

ER Name	Safety system for collaborative robotics based on 3D cameras	
ER Owner	DATALOGIC	
Other partners involved		
WP involved	The result is related to WP3. The data acquired by the system will be passed to the robot control algorithms developed in WP4. This data will contain both raw images/depth maps and processed data like safety alarms or the relative distance between a human and a robot. Safety alarms will be passed to the low-level robot controller of WP5. The entire system will be tested on the use cases of WP8.	
ER category (equipment, process, product, service, knowledge and IP, other)	New product	
ER Innovation Content	A set of 3D cameras will be used to guarantee the safety of operators working with robots based on "Method 3: speed and separation monitoring" of ISO/TS 15066. The system will rise an alarm to the robot controller in case of danger. Based on this alarm the robot will be stopped or its speed will be drastically reduced.	
Exploitation vision	**On Going**	**Planned**
	Prototyping in laboratory environment	Technology transfer
		Market study
		Prototyping in real world environment
		Pilot, Demonstration or Testing activities
		Complying with existing standards
		Business plan
Main markets/users	HRC, industrial, AGV	
Secondary markets/users	OEM	

Unit Price and price mechanisms (pay upfront, annual fee…)	TBD
Time to market	Between 3 and 5 years
IP Management	
Do you want to protect your resulst?	☒ yes ☐ no
If yes, how? (IP rights)	The project' results will be protected with a combination of patents and other form of IP rights, according to the type of results.
Do you bring background or foreground information to this ER?	☐Yes, background information ☒Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	Datalogic has specific knowledge developed in Rossini and previous knowledge related to this technology.
Which exploitable claims do you have?	☒M =Making the results ☒U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	Safe acquisition, processing and transmission of 3D images related to an industrial/HRC environment. With respect to SoA, the 3D Camera system can monitor a 3D space, allowing an effective implementation of Speed and Separation Distance, described in ISO/TS 15066. It provides data to trigger the safety actions as a function of the distance between relevant objects or between a relevant object and a defined area inside the monitored scene. Moreover, even if each single 3D camera is safe by itself, the integration of up to three cameras can solve the occlusion due to the overlapping of more objects with respect to the perspective of a single camera.
WEAKNESSES – What are you missing to further/better develop this solution?	The possible improvements to this solution are related to the incorporation inside a single camera of the safety functions actually demanded to an external safety controller, to perform not only the image acquisition and processing, but also the scene elaboration and the safe actuations.

6.3 Safety system for collaborative robotics using multiple sensing technologies including 3D vision, 3D radar, laser scanners, proximity sensors and more.

ER Name	Safety system for collaborative robotics using multiple sensing technologies including 3D vision, 3D radar, laser scanners, proximity sensors and more.	
ER Owner	DATALOGIC	
Other partners involved	PILZ	
WP involved	The result is related to WP3. Datalogic will develop the safety controller, the safety 3D cameras and an improved version of its safety laser scanners. Pilz will develop a 3D radar and other proximity sensors. Pilz will also experiment a new type of safe fieldbus to connect a subset of sensors to the safety controller. The data acquired by the safety controller will be passed to the robot control algorithms developed in WP4. Safety alarms will be passed to the low-level robot controller of WP5. The entire system will be tested on the use cases of WP8.	
ER category (equipment, process, product, service, knowledge and IP, other)	New product	
ER Innovation Content	Information coming from sensors based on different technologies will be fused to guarantee the safety of operators working with robots, implementing different methods of ISO/TS 15066. The number and type of sensors will be defined based on the application but will include 3D cameras, 3D radar, safety laser scanners and others.	
Exploitation vision	**On Going**	**Planned**
	A partner's research team and business units are both engaged in activities relating to this innovation	Technology transfer
	Prototyping in laboratory environment	Market study
		Prototyping in real world environment
		Pilot, Demonstration or Testing activities
		Complying with existing standards
		Business Plan
Main markets/users	HRC, industrial, AGV	
Secondary markets/users	TBD	

Unit Price and price mechanisms (pay upfront, annual fee…)	TBD
Time to market	Between 3 and 5 years
IP Management	
Do you want to protect your resulst?	☒ yes ☐ no
If yes, how? (IP rights)	The project' results will be protected with a combination of patents and other form of IP rights, according to the type of results.
Do you bring background or foreground information to this ER?	☐Yes, background information ☒Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	Datalogic has specific knowledge developed in Rossini and previous knowledge related to this technology.
Which exploitable claims do you have?	☒M =Making the results ☒U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	Safe acquisition, elaboration and actuation of safe actions related to industrial/HRC scenes at high frame rate to realize the safety function needed in the final application. With respect to SoA, the safety controller is able to safely fuse and merge data and information coming from safety sensors based on different technologies. It provides different performances depending on the final actuator to which is connected; therefore, can be adapted to a safe industrial robot as well as to a smarter collaborative robot, by obtaining the same level of safety performances with different levels of functional performances. If safety information are retrieved from the robot system, better performances in terms of higher working speed and shorter collaboration distances are reachable.
WEAKNESSES – What are you missing to further/better develop this solution?	The possible improvements to this solution are related to the introduction and integration of AI without affecting the level of safety and a better integration with the final manipulator/machine to receive safe information and exploit al the potentialities of the system for the downtime reduction of the final application.

6.4 A novel safety aware control architecture for collaborative robotic cells

ER Name	A novel safety aware control architecture for collaborative robotic cells	
ER Owner	UNIMORE	
Other partners involved	DATALOGIC, PILZ, IRIS, SUPSI	
WP involved	The safety aware control architecture is related to the following workpackages: WP4 will develop the main body of the safety aware control architecture, i.e. the semantic map, the cognitive layer, the flexible execution layer, the safety layer and their integration to form the safety aware control architecture WP3 will provide the safety certified sensing layer that will be the main perception source used to build the semantic map WP6 will provide the human related data that will be exploited within the cognitive layer WP8 will provide the information necessary for testing the safety aware contro architecture in real world scenarios, i.e. the ROSSINI use cases.	
ER category (equipment, process, product, service, knowledge and IP, other)	Significantly improved product	
ER Innovation Content	The safety aware control architecture is a novel control system for a collaborative robotic cell. It allows to treat safety as a constraint to satisfy rather that an unexpected phenomenon to react to. In this way it is possible to optimize efficiency while satisfying safety. Human factors are explicitly taken into account in order to plan the behavior of the collaborative cell.	
Exploitation vision	**On Going**	**Planned**
	Prototyping in laboratory environment	Prototyping in laboratory environment
	Prototyping in real world environment	Prototyping in real world environment
	Feasibility study	Feasibility study
Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 3 and 5 years	
IP Management		
Do you want to protect your resulst?	☐ yes ☐ no	

If yes, how? (IP rights)	The result will be protected by means of patents.
Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	
Which exploitable claims do you have?	☐M =Making the results ☐U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	TBD
WEAKNESSES – What are you missing to further/better develop this solution?	TBD

6.5 Perception and data fusion layer for optimum collaborative robot control with artificial intelligence techniques

ER Name	Perception and data fusion layer for optimum collaborative robot control with artificial intelligence techniques	
ER Owner	IRIS	
Other partners involved	DATALOGIC, UNIMORE, PILZ	
WP involved	WP4 with interdependencies to WP3 and WP7	
ER category (equipment, process, product, service, knowledge and IP, other)	Significantly improved process	
ER Innovation Content	The perception layer receives input from a calibrated set of different sensors and performs a data fusion, followed by object identification, position, speed/direction, and key indicators such a distance alert between robot and human, all processed in a timely manner as a unified vision. State of the art AI techniques are used for object and position identification.	
Exploitation vision	**On Going**	**Planned**
	A partner's research team and business units are both engaged in activities relating to this innovation	
	Prototyping in laboratory environment	
	Prototyping in real world environment	
	Pilot, Demonstration or Testing activities	
	Feasibility study	
	Complying with existing standards	
	Contribution to standards	
Main markets/users	Cooperative robotic, AGVs, industry, security	
Secondary markets/users	Public and private security, marketing, sports and events	
Unit Price and price mechanisms (pay upfront, annual fee…)	The solution is strictly related to a hardware application. The price of the system is strongly dependent on the hardware (type and quantity of sensors, elaboration unit). The pricing mechanism can differ depending on the complexity of the solution and its application.	
Time to market	Between 3 and 5 years	
IP Management		
Do you want to protect your resulst?	☒ yes ☐ no	

If yes, how? (IP rights)	NDA with collaborators, clients and 3rd party. Patent and Intellectual Properties to be agreed with the other partners who participate to the development and integration.
Do you bring background or foreground information to this ER?	☒Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	IRIS brought the knowledge related to object recognition trough the application of convolutional neural network algorithms, as well as the human pose estimation and distance estimation.
Which exploitable claims do you have?	☐M =Making the results ☒U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	The system is modular and flexible. It integrates specific software modules to perform specific actions. The system proved of being reliable, running for several weeks without suffering issues or slowing in performance. The system runs on commodity hardware that is commonly available on the consumer market. This allows to drastically reduce the price.
WEAKNESSES – What are you missing to further/better develop this solution?	There is still a certain relation with the hardware that limit not only the freedom of choosing the hardware vendor, but also in some cases it can affect the performance. Further improvement of the solution will consist in assessing the performance in different use cases and limiting as much as possible the dependency with the hardware.

6.6 "Collaborative by Birth" robotic arm with enhanced safety features, performance and advanced human robot interface.

ER Name	"Collaborative by Birth" robotic arm with enhanced safety features, performance and advanced human robot interface.	
ER Owner	SUPSI	
Other partners involved		
WP involved	Interdependencies to WP5	
ER category (equipment, process, product, service, knowledge and IP, other)	Product	
ER Innovation Content	SUPSI will design a "Collaborative by Birth" robot. A natively Collaborative Robot which will feature optimized technical solutions, weight/payload ratio, materials and production methods resulting in improved braking capabilities, thus allowing to work closer to the human operator and at faster pace. An advanced human robot interface will allow a more natural behavior from the operator.	
Exploitation vision	**On Going**	**Planned**
	A partner's research team and business units are both engaged in activities relating to this innovation	
	Market Study	
	Prototyping in laboratory environment	
	Prototyping in real world environment	
	Pilot, Demonstration or Testing activities	
	Complying with existing standards	
Main markets/users	Manufacturing industry	
Secondary markets/users		
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 3 and 5 years	
IP Management		
Do you want to protect your resulst?	☒ yes ☐ no	
If yes, how? (IP rights)	NDA with collaborators, clients and 3rd party. Patent and Intellectual Properties to be agreed with the other partners who participate to the development and integration.	

Do you bring background or foreground information to this ER?	☒Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	Know-how in mechanical and advanced robotics design
Which exploitable claims do you have?	☒M =Making the results ☐U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	- More accurate positioning - More sensitive - Faster cobot - More communicative
WEAKNESSES – What are you missing to further/better develop this solution?	- More expensive

6.7 Technology to evaluate and monitor the job quality underlying variables that are relevant for the adoption of collaborative robots in manufacturing

ER Name	Technology to evaluate and monitor the job quality underlying variables that are relevant for the adoption of collaborative robots in manufacturing	
ER Owner	TNO	
Other partners involved	UNIMORE, SUPSI	
WP involved	Interdependencies to WP4 and WP6	
ER category (equipment, process, product, service, knowledge and IP, other)	New service	
ER Innovation Content	Effects of the use of collaborative robots on job quality are: (1) often not clear beforehand, (2) can be diverse for different underlying variables and (3) depend on the (context of) application rather than the robot itself. The aimed technology will be integrated in the Rossini platform to enable the measurement of physical, cognitive and psycho-social variables, to evaluate and monitor the effects on job quality, and also to be able to intervene if necessary.	
Exploitation vision	**On Going**	**Planned**
		Prototyping in laboratory environment
		Prototyping in real world environment
		Pilot, Demonstration or Testing activities
		Feasibility study
Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 1 and 3 years	
IP Management		
Do you want to protect your resulst?	☒ yes ☐ no	

If yes, how? (IP rights)	The result will be protected, but the approach needs to be discussed.
Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	
Which exploitable claims do you have?	☐M =Making the results ☐U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	TBD
WEAKNESSES – What are you missing to further/better develop this solution?	TBD

6.8 Dynamic model of the human body to determine the transient contact behavior of HRC applications

ER Name		
ER Owner	Fraunhofer IFF	
Other partners involved		
WP involved	The work is related to WP 7.1. It is intended to be used within the ROSSINI Platform solution. It will be an input for WP 7.3 (Platform integration).	
ER category (equipment, process, product, service, knowledge and IP, other)	New process and service	
ER Innovation Content	In the closest form of Human Robot Collaboration (HRC) the robot and the human complete common tasks simultaneously. In order to guarantee safety to the human worker, the operation mode Power and Force Limiting (PFL) in combination with biomechanical limit values is applied. Depending on the contact situation, there are different limit values for quasi-static and transient contact used for a free or clamping contact situation. In order to ensure that the biomechanical limit values are not exceeded the impacts are tested within a risk assessment using a biofidel force-measurement device. This kind of measurement device must be fixed to a stiff structure to work properly. However, for free transient contacts this setup does not represent the real condition, where the human body part is free, resulting in higher force values. For the application this means, that the robots velocity must be reduced and the system works less efficient. Within the ROSSINI project, Fraunhofer IFF develops a method to transform the force values of a fixed measurement device into a free transient contact. For this purpose, Fraunhofer IFF develops a model, which calculates the apparent mass of the colliding human body part with respect to the impact direction and body posture. The method can be integrated into third-party software and will make HRC applications significantly more economical.	
Exploitation vision	**On Going**	**Planned**
	TBD	TBD

Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 1 and 3 years	
IP Management		
Do you want to protect your resulst?	☒ yes ☐ no	
If yes, how? (IP rights)	The result will be protected, but the approach needs to be discussed.	
Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☐No	
If yes, specify which type of information and the partner owner of this information		
Which exploitable claims do you have?	☐M =Making the results ☐U = Using the result ☒L = Licensing the result ☐O = Other exploitation means	
Preliminary SW(OT)		
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	Current methods to determine the apparent mass of the affected human body part only take the mass of the colliding body part itself into account. They neglect the dynamic behaviour of coupled joints and the influence of body posture and collision direction. However, to determine a safe robot speed for unconstrained/ free collisions an accurate estimate of the apparent mass is required. The new method considers the aforementioned criteria and delivers sufficiently accurate results. It is therefore suitable for the evaluation of unconstrained/ free collisions between humans and robots.	
WEAKNESSES – What are you missing to further/better develop this solution?	-	

6.9 Using of HF, capacitive and tactile sensors to reach qualitative improvements at HRC applications

ER Name	Using of HF, capacitive and tactile sensors to reach qualitative improvements at HRC applications	
ER Owner	PILZ	
Other partners involved		
WP involved	The work is related to WP 7.1. It is intended to be used within the ROSSINI Platform solution. It will be an input for WP 7.3 (Platform integration).	
ER category (equipment, process, product, service, knowledge and IP, other)	New product	
ER Innovation Content	Vision systems are one of the most used systems in industry sector for both application and safety aspects. The performance and costs of the components and the limitations of the vision system under certain conditions, like dusty environment or extreme lighting conditions could be improve or complement with the use of different sensor technologies working together with vision systems. This could be a very smart solution for the deployment of new solutions for the HRC applications	
Exploitation vision	**On Going**	**Planned**
		Prototyping in laboratory environment
		Prototyping in real world environment
		Pilot, Demonstration or Testing activities
		Complying with existing standards
		Contribution to standards
		Business Plan
Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 3 and 5 years	
IP Management		
Do you want to protect your resulst?	☐ yes ☐ no	
If yes, how? (IP rights)	After research of current and future standards and patents will be checked the possibility to protect the result. The result will be protected according to the PILZ`s IPR procedures/policies.	

Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	
Which exploitable claims do you have?	☐M =Making the results ☐U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	TBD
WEAKNESSES – What are you missing to further/better develop this solution?	TBD

6.10 Mobile collaborative robotic solution for raw material feeding and machine tending with high speed capabilities by using dynamic safety.

ER Name	Mobile collaborative robotic solution for raw material feeding and machine tending with high speed capabilities by using dynamic safety.	
ER Owner	IMA	
Other partners involved	DATALOGIC, PILZ	
WP involved	The result are related to WP8 (demonstration) and WP3 (development of the Rossini Smart Safe Sensing System) as the improvement of the efficiency is mainly due to the monitoring of the environment performed by the safe sensors. Interdependencies with the other WP: • WP1 Ethics Requirement. Mandatory. • WP2 Technical Requirement. State of the art, requirements and use case design are essential to define the technical information to start the activities. • WP4 Safety Aware Control Architecture. The semantic map, the scheduler and planner developed within this WP will be used for task allocation and trajectory optimization within the IMA use case. • WP5 Collaborative by Birth Robot Arm. The information gained from the development of the Collaborative by Birth Robot Arm will be exploited to move the robotic arms used in the IMA use case. • WP6 Human-Robot Mutual Understanding. The information coming from the Job quality analysis will be exploited to promote the solution among the IMA customers. • WP7 Integration Layer. The Method for assessing the transient contact will be exploited during the definition of the speed limits of the robotic arms. The Platform integration will be essential to integrate the safe sensors of WP3 in the robotic platform. • WP9 Impact Enhancement. Mandatory. • WP10 Management. Mandatory	
ER category (equipment, process, product, service, knowledge and IP, other)	Significantly improved product	
ER Innovation Content	The innovation consists in the integration of a mobile robotic solution in a real shop floor, where people, AGV and cobots are collaborating/cooperating, this is achieved by using innovative safe sensors that guarantee the safety of operators and enable the usage of equipment at the best of their capability. These sensors will be fix positioned. The velocity and trajectory of the platform will be adjusted based on the position and speed of human workers adopting a dynamic security system capable of meeting the safety requirements.	
Exploitation vision	**On Going**	**Planned**
	Technology transfer	Pilot, Demonstration or Testing activities

	Prototyping in laboratory environment	Feasibility study
		Complying with existing standards
Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 1 and 3 years	
IP Management		
Do you want to protect your resulst?	☐ yes ☐ no	
If yes, how? (IP rights)	The result will be protected by means of patents.	
Do you bring background or foreground information to this ER?	☒Yes, background information ☒Yes, foreground information ☐No	
If yes, specify which type of information and the partner owner of this information	**Background information.** Manipulation of raw material using robots. Owner: IMA. **Foreground information.** Dynamic safety using external sensors. Owner: Datalogic and Pilz. Dynamic trajectory planning with obstacle avoidance: Owner: Unimore and IMA.	
Which exploitable claims do you have?	☒M =Making the results ☒U = Using the result ☐L = Licensing the result ☐O = Other exploitation means	
Preliminary SW(OT)		
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	The new solution has the following strengths: • Faster. • More safe. • Improved human robot communication.	
WEAKNESSES – What are you missing to further/better develop this solution?	The new solution has the following weakness: • More expansive mainly due to the additional sensors. • Needed industrialization process (ROSSINI demo will reach TRL5).	

6.11 Collaborative work cell for the production of electronic components.

ER Name	Collaborative work cell for the production of electronic components.	
ER Owner	SCHINDLER	
Other partners involved	SUPSI, DATALOGIC, PILZ	
WP involved	As use case provider the result is related to all the precedent work packages. The innovations developed within the other work packages will be part of the sought result.	
ER category (equipment, process, product, service, knowledge and IP, other)	Significantly improved process	
ER Innovation Content	Production of Electronic Components using a developed collaborative work cell to optimally combine the repetitive performance of robot with the individual strong skills and high ability level of people.	
Exploitation vision	**On Going**	**Planned**
	Prototyping in laboratory environment	A partner's research team and business units are both engaged in activities relating to this innovation
		Prototyping in real world environment
		Pilot, Demonstration or Testing activities
		Feasibility study
		Complying with existing standards
		Business plan
Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Not defined yet	
IP Management		
Do you want to protect your resulst?	☐ yes ☐ no	

If yes, how? (IP rights)	The result will be protected according the defined Schindler Group's procedures, using the Schindler certified services and respecting the Group IPR policy.
Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	
Which exploitable claims do you have?	☐M =Making the results ☐U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	TBD
WEAKNESSES – What are you missing to further/better develop this solution?	TBD

6.12 Workstation for assembly heavy loads in Washing Machine factory implementing a collaborative robot with an improved cognitive perception of the working environment

ER Name	factory implementing a collaborative robot with an improved cognitive perception of the working environment	
ER Owner	WHIRPOOL, DATALOGIC, PILZ	
Other partners involved	DATALOGIC, PILZ	
WP involved	WP7, Strong interaction in WP2	
ER category (equipment, process, product, service, knowledge and IP, other)	Significantly improved process	
ER Innovation Content	The innovative workstation will use a native collaborative robot or an industrial robot capable to manipulate heavy loads (> 10kg) in a strict cooperation with a human worker by integrating operational and environmental data coming from supervision system, local and distributed sensor. The robot will assist human worker in assembly a part weighting 14kg into the washing machine by taking the part from a container and moving it close to the final position and then, in a hand-guided modality, the human will drive the fine position and release of the part. The robot will use intensively all the data available to adapt its behavior according to the specific situation (part and product position, human identity and biometric data, work-cycle phase, environmental and safety) facilitating the human work and reducing ergonomic risk.	
Exploitation vision	**On Going**	**Planned**
	TBD	TBD
Main markets/users	TBD	
Secondary markets/users	TBD	
Unit Price and price mechanisms (pay upfront, annual fee…)	TBD	
Time to market	Between 3 and 5 years	
IP Management		

Do you want to protect your resulst?	☐ yes ☐ no
If yes, how? (IP rights)	
Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☐No
If yes, specify which type of information and the partner owner of this information	
Which exploitable claims do you have?	☐M =Making the results ☐U = Using the result ☐L = Licensing the result ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	TBD
WEAKNESSES – What are you missing to further/better develop this solution?	TBD

6.13 Software design to improve the integration of man-robot collaboration applications.

ER Name		
ER Owner	MACHINEBOUW	
Other partners involved	SUPSI, DATALOGIC, PILZ	
WP involved	MACHINEBOUW will coordinate Task 2.3 (Use Case Design), and will support the implementation of Work Package 7 (Platform Integration) and Work Package 8 (Demonstration), providing the skills and knowledge of experienced robot integrators, including risk assessment and validation.	
ER category (equipment, process, product, service, knowledge and IP, other)	Significantly improved service, implementation and in the end better solutions for the end users.	
ER Innovation Content	The specific software code will be developed in order to facilitate human robot cooperation. By using components and innovations developed by the consortium we will integrate these in one software application.	
Exploitation vision	**On Going**	**Planned**
	TBD	TBD
Main markets/users	Manufacturing Industries (cross sector), robot integrators, machine builders.	
Secondary markets/users	Educational institutions	
Unit Price and price mechanisms (pay upfront, annual fee…)	Pay per use, Pay per application, Software licensed?	
Time to market	Between 1 and 3 years	
IP Management		
Do you want to protect your resulst?	☒ yes ☐ no	
If yes, how? (IP rights)	By coded software packages. (VINTIV) DATALOGiC/Pilz by patents?	
Do you bring background or foreground information to this ER?	☐Yes, background information ☐Yes, foreground information ☒No	

If yes, specify which type of information and the partner owner of this information	
Which exploitable claims do you have?	☒M =Making the results (Datalogic, Pilz) ☒U = Using the result (VINTIV, Datalogic, Pilz) ☒L = Licensing the result (Datalogic, Pilz) ☐O = Other exploitation means
Preliminary SW(OT)	
STRENGHTS - How better is your solution (faster, cheaper, more reliable, more efficient, with less undesired effects)?	Current collaborative solutions are safe, but extremely slow and often miss flexibility. In this solution task allocation, safety functions and working parameters can be easily adapted to production requirements, and to specific human operators' needs. It will improve the implementation of controls and communication of data but also simplify the design of efficient applications and make them safer and more ergonomic. This will result in faster implementation and better customized solutions.
WEAKNESSES – What are you missing to further/better develop this solution?	Technology development in process. At this stage high-performance safety sensors that will detect and predict human-robot behaviour with an acceptable safety level is still in development.

7 IP management

The corner stones of the IPR and Exploitation management of ROSSINI will be the Consortium Agreement (CA) and the Plan for Exploitation and Dissemination of Results (PEDR).

Some principal rules have been already established in the proposal of ROSSINI project:

- Patents. Partners who will develop patentable knowledge will be encouraged to apply for patent or similar form of protection and shall supply details of each such application to the other partners.
- Access Rights. Partners grant to each of the other partners royalty-free access right to knowledge generated in the project to the extent needed to successfully perform the project. Access rights to a partners pre-existing knowledge for use outside the project is, when needed and only to the extent necessary to make use of the project result, given on preferential conditions to the other partners. Any details concerning the access rights to will be defined in the Consortium Agreement.
- Ownership of Knowledge. Knowledge is owned by the partners who carried out the work generating it, or on whose behalf such work was carried out. If a partner wishes to assign any knowledge to a third party he should inform the other partners and request their consent, which should not unreasonably be withheld.
- IP Ownership. Foreground IP shall be owned by the project partner carrying out the work leading to it. If any Foreground IP is created jointly by at least two project partners and it is not possible to distinguish between the contributions of each of the project partners, such work will be jointly owned by the contributing project partners. The same shall apply if, while carrying out work on the

project, an invention is made having two or more contributing parties contributing to it, and it is not possible to separate the individual contributions. Any such joint inventions and all related patent applications and patents shall be jointly owned by the contributing parties.

The Consortium Agreement (CA) provides the legal basis for the internal relationships and responsibilities among the beneficiaries. The CA has been signed and gives details of IPR management including terms and conditions of protection and transfer IPR; access rights to background or foreground for carrying out the project or for use of a beneficiary´s own foreground, etc.

During the first 12 months of ROSSINI project the DEM carried out a **preliminary training session on IP and its relationship with the exploitable results**. The webinar illustrated to the partners what exploitable results are, what type of information project partners should report for a more detailed characterization, the strategy and methodology that the consortium will follow to exploit project outcomes. The webinar also introduced the concepts of background and foreground, the possible approaches to manage the IP and the issues associated with it.

Starting from M15 the discussion on IP Management was further developed and some questions related to the IP Management of the Rossini Exploitable Results have started to be introduced as it can be seen from the tables above (see Chapters 6.1 to 6.13).

8 Market analysis and assessment

Startimng from M15 the conrtium began to work on the Market assessment of the ROSSINI Platform and components.

CRIT introduced the theme of the "Market Discovery" with the purpose of identifying behaviours, expectations, fears of possible customers and users of the ROSSINI Platform; of identifying needs and opportunities offered by ROSSINI products and services; of defining a Value Proposition (VP) of the ROSSINI Platforms and components for each Customer Segment (CS).

To perform this analysis input from the technology partners and the end users were collected during the workshop on the Business Model Canvas (BMC) to check if and how well the VP of the project aligns with the expectations of the main customer segments that will be identified. A further comparison between the product functionalities the customers wish to have, and the current product design will enable to develop improvement suggestions for the technology partners.

8.1 T9.3 Exploitation Workshop Results – Part I

Project partners performed a brainstorming workshop to start defining the Value Proposition and Customer Segments of the ROSSINI Platform.

To do so, partners were firstly asked to assess the CORE and EXTRA features of the ROSSINI Platform, as follows:

CORE Components	EXTRA Components
WP3 - Smart Safe Sensing System	
RS4 CAMERA (VISION)	RS4 LASER (SLS)
RS4 Controller	RS4 Skin
WP4 - Safety Aware Control Architecture	
Semantic Map	-
Task Scheduler	-
Motion Planner	-
WP5 - Collaborative by Birth Robot Arm	
-	Safe Position Signalling
WP6 - Human-Robot Mutual Understanding	

Design tool for industrial human-robot collaboration	-
Software for flexible assignment of tasks	-
Human-To-Robot and Robot-To-Human communication framework (HMI)	-

The identification of CORE and EXTRA Features will be further assessed within WP7 to develop a common definition of the ROSSINI Platform.

Subsequently, we also performed a preliminary analysis of the intended user of the ROSSINI Platform, taking into considerations the Market Segment and possible actual users of the ROSSINI Platform within companies by using a Customer map.

This chart allowed to identify users and market segments and to provide a first assessment of their relevance. Indeed, both market segment and actual users were analysed as:

- CORE: Main users of the Robotic Platform and components and key market segments;
- DIRECT: users directly involved in the use and implementation of the ROSSINI Platform;
- INDIRECT: indirect beneficiaries or second users of the ROSSINI Platform.

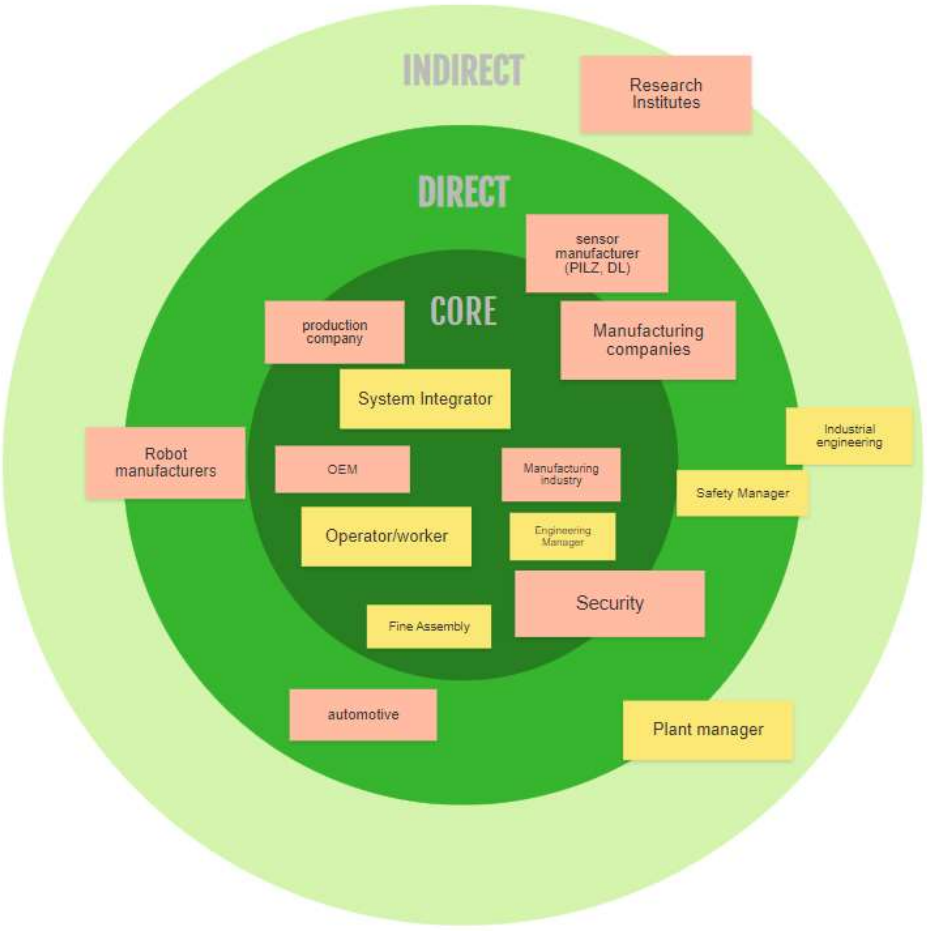


Figure 20 - Customer Map

The main market segments identified in the brainstorming workshop with partners are:

- Manufacturers: robot manufacturers, sensors manufacturers, OEM, automotive companies;
- Research institutes

- Security

The main possible users identified in the brainstorming workshop with partners are:

- Workers & Engineers at various levels
- System integrators
- Safety managers
- Plant managers

This first brainstorming session will be enriched through the use of market analysis reports in order to further investigate:

- Collaborative Robotics market: dimension and geographical location
- Market Trends, barriers, growth drivers and end-users needs
- Competitive scenario: already available and existing solution, competitors value proposition and business models.

8.2 T9.3 Exploitation Workshop Results – Part II

In the second part of the workshop partners were asked to assess the Customer Segments and Value Proposition through the Value Proposition Canvas.

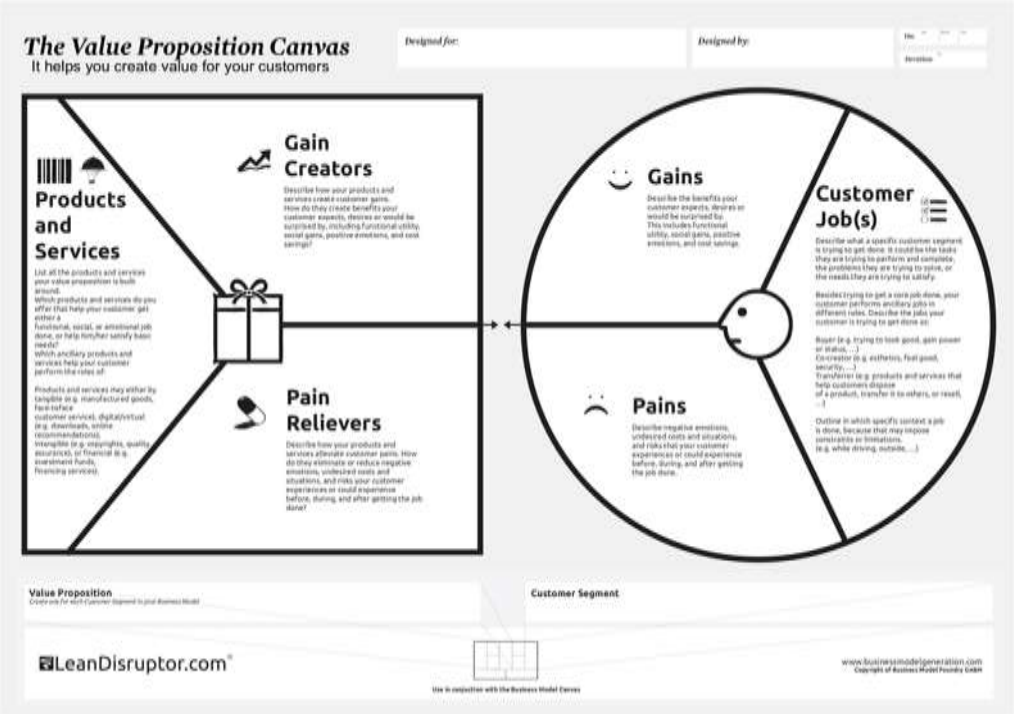


Figure 21 - Value Proposition Canvas

Through the Value Proposition Canvas, it was understood what customers want and why customers should buy the ROSSINI Platform and its components. This tool is based on the relationship between two main parts, customer profile and value proposition, focusing on the needs the Platform help customer satisfy; the customers' negative emotions/experience and the risks that they face and the main difficulties and challenges customers encounter.

The analysis started from the right part, Customer Profile, where there is a circle which is divided in three sections:

- Customer Jobs: the tasks (social, emotional and functional) which the customers wants to perform
  - What functional/emotional jobs are we helping our customer get done?
  - What basic needs are we helping our customer satisfy?
- Customer Pains: customers' negative emotions/experience and the risks that they face and think about
  - What functional/emotional jobs are we helping our customer get done?
  - What basic needs are we helping our customer satisfy?
- Customer Gains: the benefits of a product, which make it more likely to adapt the solution that the product/service provides
  - What our customers are looking for?
  - What would increase the likelihood of adopting a solution?

During the workshop, participants were divided into 2 groups who worked on different, but related questions regarding the three sections above (see Figure)

Group 1 focused on the following questions:

- Customer Job: What basic needs are we helping our customer satisfy?
- Customer Pain: What are the main difficulties and challenges our customer encounters?
- Customer Gain: What would make the life of our customer easier/better?

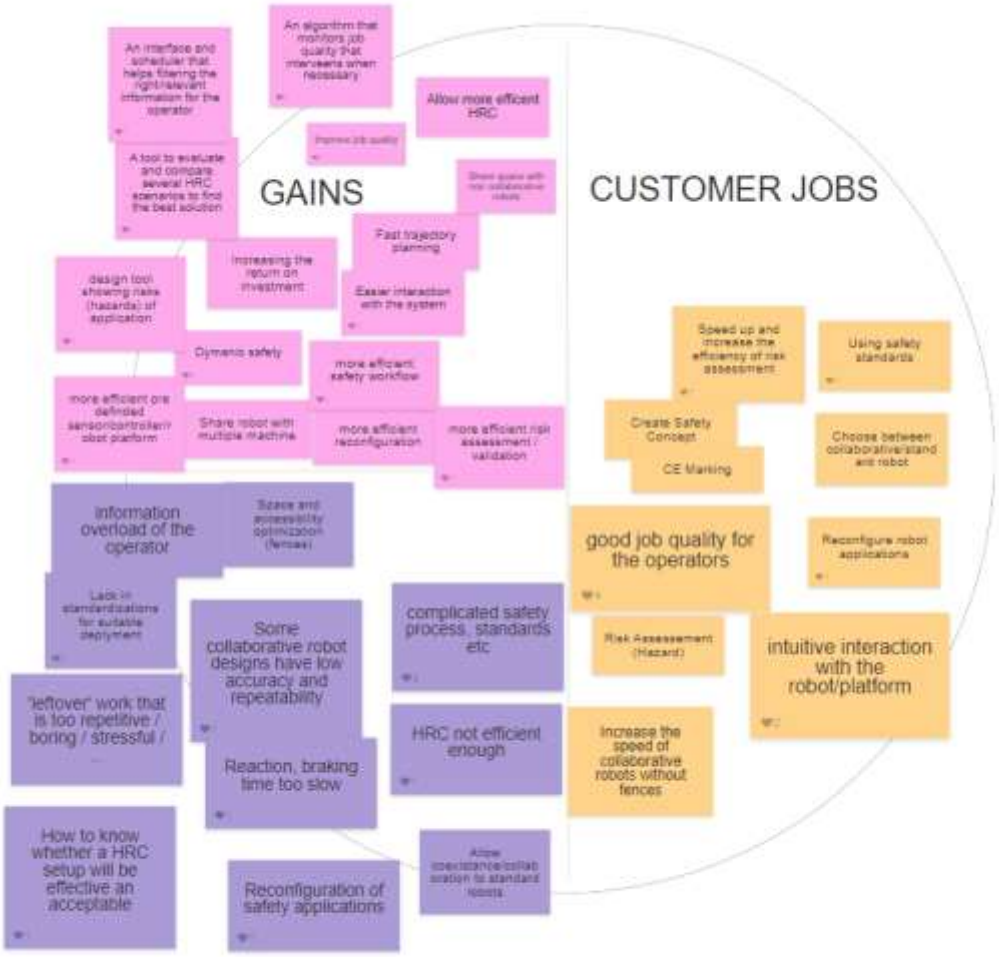


Figure 22 - Customer Profile Group 1

Group 2 focused on the following questions:

- Customer Job: Which functional/emotional jobs are we helping our customer get done?
- Customer Pain: Which barriers are keeping our customer from adopting solutions?
- Customer Gain: What our customers are looking for?

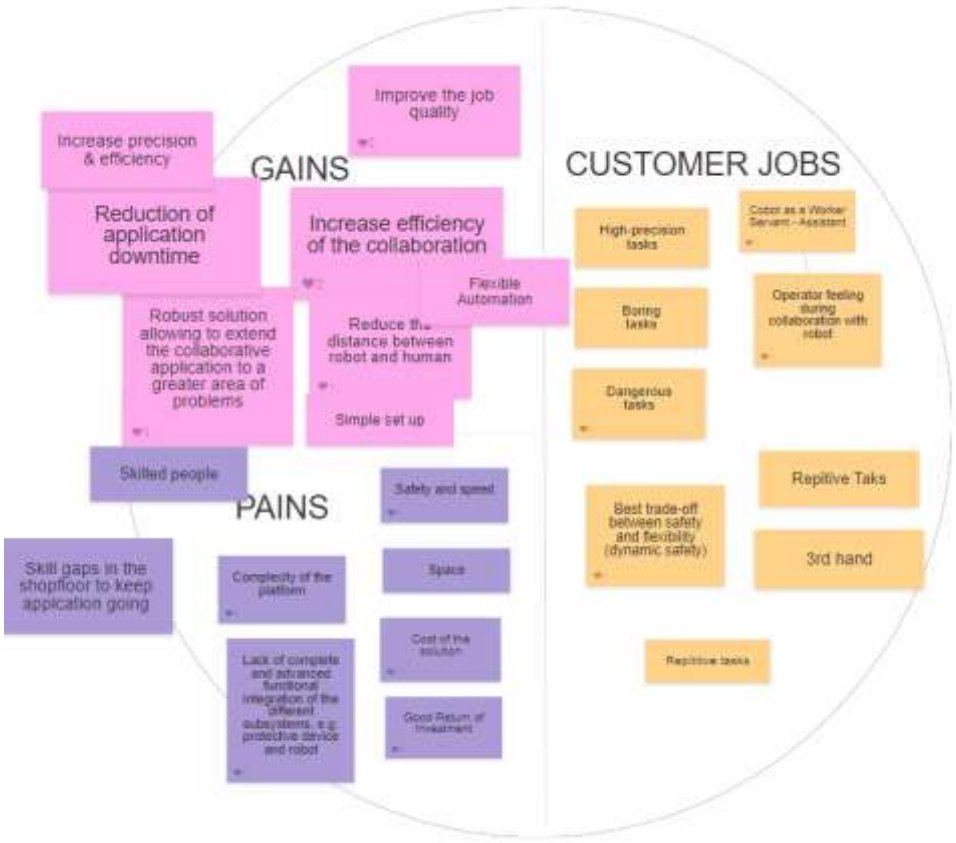


Figure 23 - Customer Profile Group 2

Figure 22 & Figure 23 illustrates the customer profile for the ROSSINI Platform. The emotional/functional jobs/needs of the customers were gathered, with the related pains/problems and the gains, which could arise in case they choose to adapt the solution. At the end of the brainstorming activity all partenrs were asked to vote the ideas (post-it) they considered more relevant (received more ”likes”) for the project and the main job functions selected by partcipants are:

- Intuitive interaction with the robot/platform
- Good job quality for the operators
- Best trade-off between safety and flexibility (dynamic safety)

The need of an intuitive interaction with the robot would be achieved through “An interface and scheduler that helps filtering the right/relevant information for the operator” or a “A tool to evaluate and compare several HRC scenarios to find the best solution” (GAINS, intended as potential benefits). This would solve for example the problem of “information overload of the operator” and would bring benefit also on the safety side since it could facilitate current “complicated safety process, standards etc” or solve the problem of the “lack of complete and advanced functional integration of the different subsystems”.

In parallel, the possibility to improve job quality of operators would be guaranteed by “An algorithm that monitors job quality and intervenes when necessary”, thus identifying for example possible “'leftover' work that is too repetitive / boring / stressful” for operators or and making the robot intervene to support the worker.

Lastly, the search for the best trade-off between safety and flexibility, could be achieved through the “dynamic safety" which allows to extend the collaborative application to a greater area of problems by guaranteeing the speed of operations and safety of operators.

After this brainstorming, partners were asked to select the pains and gains that they considered more important for the ROSSINI solution. These pains and gains have been the starting point to define the Value Propositions

of the ROSSINI Platform. The "Value Proposition", which deals with the product/service and its aim is to address the customer needs. Similar to the right side, the Value Proposition is divided into three sections:

- Products & Services: the products or/services that are sold and try to correspond to the customers jobs.
  - Which products and services do we offer that help our customer get either a functional, social, or emotional job done, or help them satisfy basic needs?
- Pain Relievers: how these services/products could alleviate the customer pains
  - Do they fix underperforming solutions? Eliminate risks your customers fear? and Get rid of barriers that are keeping your customer from adopting solutions?
- Gain Creators: how the provided product/service alleviate the customer pains
  - Do they provide with something customers are looking for? Produce positive outcomes matching your customers success and failure criteria? Help make adoption easier?

Given the initial activity of assessing core and extra components of the ROSSINI Platform, which answered to a certain extent to the objectives of the "Products&Services" section of the Canvas, we focused on the Gain Creators and Pain relievers that the products and services associated to the ROSSINI Platform offer.

Participants were divided into two groups. Group 1 worked on the most liked Customer gains to identify which ROSSINI Components allowed to better achieve those benefits and how. For instance, the Dynamic Safety applies to all RS4 components. The adoption of these solutions would be made easier by the fact that it increases the speed of collaborative robots, it allows to share robots with multiple machines and in doing so it increases the return of investment of companies.

The second group worked on Pain Relievers staring from the major pains identified in the previous activity, to understand what can relives those pains. For instance, the group tried to address the problem of the lack of complete and advanced functional integration of the different subsystems, e.g. protective device and robot**.** What emerged from the discussion is that the overall ROSSINI platform seamlessly integrate safety, perception and control thus ensuring accuracy and latency of the safety controller and good reaction time and position and speed data sharing of the robot.

Next steps regarding the Market Discovery of the ROSSINI Platform will be implemented in the next months and they will include:

- The agreement on the Core & Extra Features of the ROSSINI activities, also on the basis of results from WP7
- Finalisation of the Value Proposition Canvas and the identification of a value proposition for each customer segment
- Competitors' analysis through market reports by CRIT (at least 3 competitors will be analysed)
- SWOT Analysis of the ROSSINI Platform
- Completing the BMC
  - Associating the VP proposals with the ER (Key Activities)
  - Identification of Key Resources, Partners
  - Channels
  - Revenues streams and costs associated to the platform

9 Standardization

After a preliminary contact with the national UNI by the DEM and the feedback received by the consortium, partners agreed on the following standardisation plan:

- Internal brainstorming on existing standard and the contribute ROSSINI research and development activities can give (M28-M31)
- Organisation of working groups with EU projects, bodies and other partner organisations (M31-M39)
- Presentation of ROSSINI technologies at ISO/TC 299 (Robotics) (M31-M39)
- Definition of the D9.7 Strategic Standardization Roadmap (by M42)

Hence, a first brainstorming session with partners organizations was set in order to:

- Assess a "Standards park", intended as a list of standards currently in use by partners or interesting to them. DATALOGIC & FRAUNHOFER IFF & TNO provided the list of standards per sector.
- What do we know about them? We wanted to evaluate partners' knowledge on standards to consider possible follow-up or acquisition of standards within the project;
- Evaluate the applicability of these standards to ROSSINI technologies: which standards can we contribute the most? Which modules can we apply those standards to?

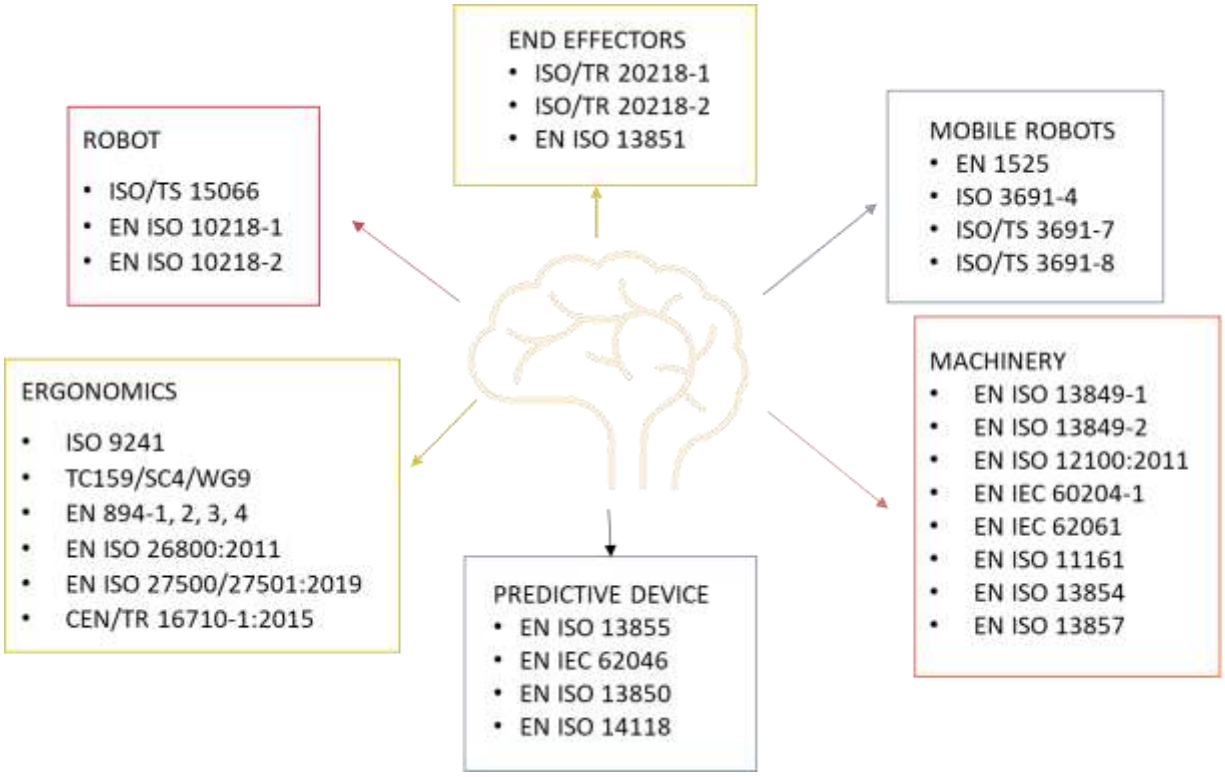


Figure 24 - standards ROSSINI can contribute actively

In the next months, these first results will be further integrated by partners. Moreover, we'll seek the opportunity to collaborate with other EU-finded projects and organisations, such as the Hybrid Production Systems Cluster whose ROSSINI is a member together with EURECAT, COLLABORATE, COROMA, HR-RECYCLER, THOMAS, SHAREWORK and SHERLOCK project. The Cluster was set up to foster dissemination activities among projects working in collaborative robotics, but other collaboration possibilities will be investigated, starting from standardization working groups. Lastly, ROSSINI technologies will be presented in national and European working groups, thanks to the engagement and sponsorship of ROSSINI's partners.

10 Conclusions

The document has outlined the strategy to be followed by the consortium with regards to the communication, dissemination and exploitation activities. The aim of the plan is to lay the foundation to maximise the impact of the project during its duration and beyond its lifetime. This second draft of the deliverable has been focused presented the progresses and developments achieved by the consortium in the dissemination and communication and it presented the first results of the exploitation and standardisation activities.

Despite the restrictions imposed by the Covid- 19 pandemic and the impossibility to take part in events and conferences in presence, ROSSINI partners were able to successfully disseminate the project's results through online formats, including newsletter, participation and organisation of webinars and online conferences.

So far, thirteen project results have been collected and among these 3 are improved processes, 7 are new or significantly improved products, 3 are new services. The project partners have confirmed the will to protect their results by means of patents or the will to license their services, these aspects will be further investigated in the following months to find the most appropriate solutions for the consortium. The next actions will be

focused on monitoring the progresses of the results and completing the Business Model of the ROSSINI Platform. Once the results and the partners involved will be more precisely defined, IP right will be managed and issues will be addressed. Market analysis activities have just started to investigate the market potential of ROSSINI exploitable results; in the following months a competitors' and market analysis will be performed using market reports as reference point.

11 Annex

11.1 Press Releases

PRESS RELEASE
09/12/2019

Cluster of "Industrial Human Robot Collaboration" projects

Over the last years both Research and Industry have tried to address the requirement for flexible production by introducing technologies that allow humans and robots to coexist and share production tasks. The benefits of implementing this production paradigm lays in the implementation of flexible and highly reconfigurable production systems which can easily change their operation to accommodate different product families, similar to the way that a human operator would do.

In this direction, the latest trends of European Research foster the integration of new forms of interaction between robots and workers aiming to make the most out of the synergy effect. This means to efficiently combine and exploit the robot's precision, repeatability and strength with the human's intelligence and flexibility.

Currently, there are 7 EU projects that are addressing the topic of Human Robot Collaboration (HRC) targeting on industrial applications in different manufacturing domains. The objective is to increase the maturity of technologies developed and validated in laboratory by deploying and demonstrating prototypes in real or relevant manufacturing environments.

Each project addresses human-robot collaboration in different market sectors, and therefore they will explore new business models and means to overcome the lagging adaptation of robotics in manufacturing. A key element to such adaptation will be the reproducibility of the research results in more use-cases.

These projects came together under a fruitful workshop, organized by European Commission, targeted on illustrating potential benefits of funding research and innovation on robotics. The identification of consolidated and emerging technology trends was a core activity. The findings in each of the projects will provide policy recommendations on measures to maximise the environmental, economic and societal impacts. Partners exchanged information and early insights from their respective projects, to map the fields where technology and experience can be transferred among the researchers. The results of this workshop will be formulated as basis for a report on robotics performed by European Commission that will be published before the end of this year.

These projects have received funding from the European Union's Horizon 2020 Research and Innovation programme.

1

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Figure 26: ROSSINI 3rd Press Release | Page 2

Figure 27: ROSSINI 3rd Press Release | Page 3

PRESS RELEASE

April 2020

For immediate release

Rossini

Rossini's recent advances in the cognitive layer for collaborative robot control – Part A

The *Rossini* project aims to increase industrial efficiency by making the most of the collaboration between robot and human operator, improving the synergy between them. In modern collaborative robotic cells, indeed, a human operator and a robot share the workspace in order to execute a common job, consisting of a set of tasks. A proper allocation and scheduling of the tasks for the human and for the robot is crucial for achieving an efficient human-robot collaboration.

Project partner UNIMORE focuses on the "cognitive layer" of the project, which receives data from the "perception layer" and generates an optimal schedule for the human operator and the robot. Moreover, in order to deal with the dynamic and unpredictable behaviour of the human and for allowing the human and the robot to negotiate about the tasks to be executed, the "cognitive layer" adapts online the schedule. However, continuously and automatically changing the order of the tasks assigned to the human can lead to confusion and poor efficiency of the operator. Thus, the "cognitive layer" reschedules online only the list of tasks assigned to the robot. The list of tasks assigned to the human changes only when the human decides to execute a task assigned to the robot or when the robot cannot execute a task and asks for the help of the human.

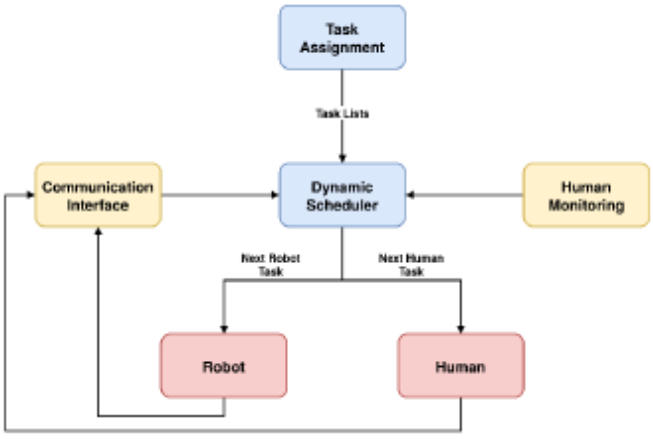

Figure 1 / The overall architecture. The blue blocks represent the two layers. The yellow blocks, instead, symbolize the strategies implemented to provide richer information to the Dynamic Scheduler. The red blocks represent the two agents.

Figure 28 ROSSINI 4th Press Release | Page 1

The proposed architecture is shown in *Figure 1*, where two main layers can be distinguished:

- **Task Assignment.** It is responsible for generating initial nominal schedules for the robot and the human, based on the maximum parallelism criterion. This first layer optimally solves a multi-objective *Mixed Integer Linear Programming* (MIP) problem considering nominal execution times of tasks.
- **Dynamic Scheduler.** It is responsible for scheduling the tasks, considering the real execution time and the requests coming from the human and from the robot.

The Dynamic Scheduler aims at creating an effective and intuitive cooperation in a human-robot collaboration scenario. To achieve that, it firstly exploits a **Human Monitoring** algorithm, in order to estimate the real execution time of the human operator. If the human operator is late, the Dynamic Scheduler reschedules a new task for the robot based on the more time required by the human operator. Subsequently, it investigates a **Communication Interface** in order to understand if both the human operator and the robot are taking decisions about their activities. Based on this communication, the Dynamic Scheduler improves the schedule, making the collaboration more natural.

About the project

ROSSINI is a project funded by Horizon2020 EU's research and innovation programme, with an aim to design, develop and demonstrate a modular and scalable platform for the integration of human-centred robotic technologies in industrial production environments.

Project title: RObot enhanced SenSing, INtelligence and actuation to Improve job quality in manufacturing

Project ID: 818087

Start Date: 01/10/2018

Project Duration: 42 months

Project Consortium:

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For additional information please contact
Project Coordinator: DATALOGIC
Matteo Zanaroli matteo.zanaroli@datalogic.com

Figure 29 ROSSINI 4th Press Release | Page 2

PRESS RELEASE

Reggio Emilia, 21 September 2020

For immediate release

Rossini

Rossini's recent advances in the cognitive layer for collaborative robot control - Part B

The *Rossini* project aims to increase industrial efficiency by making the most of the collaboration between robot and human operator, improving the synergy between them. In modern collaborative robotic cells, a worker and a robot share the workspace, each having their own set of tasks. Such a collaboration brings great changes in the working environment and affects the worker's job quality. Job quality is influenced by how tasks are allocated and scheduled between the operator and the robot. It can be improved by monitoring the operator's tasks and adapting the task allocation and scheduling whenever needed. In the *Rossini* project all this is managed by the "cognitive layer", which has the goal to generate an optimal schedule for the worker and the robot.

Job quality is a multi-dimensional concept that brings together a wide range of factors ranging from job security to job demands such as time pressure. The *Rossini* project focusses specifically on the factors related to the quality of the working environment. This part of job quality is influenced by many factors that fall in four main categories: physical, cognitive, psycho-social and environmental aspects. Project partner TNO focused on translating job quality factors into outcome metrics that can be taken in the workplace, for example measuring the time a person performs heavy lifting task during a day.

Starting from these metrics, project partner UNIMORE is responsible for building the optimal schedule, also exploiting the data coming from the "perception layer". The perception layer combines data from multiple sensors in the working environment and facilitates reasoning about task allocation and scheduling. As human behaviour has a limited predictability, creating a pre-set scheduling strategy with no connection to what the worker actually does, would lead to a suboptimal solution.Therefore, in order to deal with this human unpredictability and to allow the robot and the operator to negotiate about the tasks to be executed, the "cognitive layer" adapts the schedule online. However, continuously and automatically changing the order of the tasks assigned to the human can lead to confusion and reduce the operator's efficiency. Thus, the "cognitive layer" reschedules online only the list of tasks assigned to the robot. The list of tasks assigned to the operator changes only when he decides to execute a task assigned to the robot or when the robot cannot execute a task and asks for the help from the operator.

The proposed architecture is shown in Fig. 1, where two main components can be

Figure 30: ROSSINI 5th Press Release | Page 1

distinguished:

- The **Task Assignment Layer** generates an initial nominal schedule for the robot and the human, based on the maximum parallelism criterion. This first layer optimally solves a multi-objective *Mixed Integer Linear Programming* (MIP) problem considering nominal execution times of tasks, the order in which tasks can be executed, and the job quality outcome metrics.
- The **Dynamic Scheduler Layer** dynamically adapts the schedule, taking into account the real execution time and the requests coming from the human and from the robot.

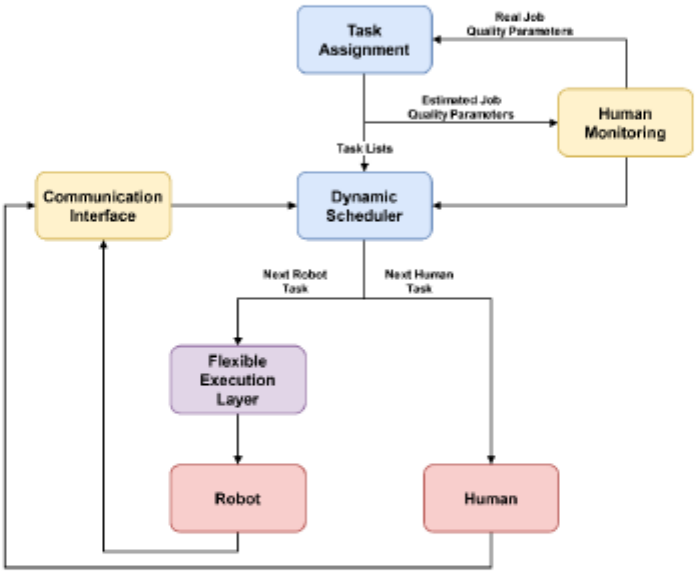

Fig 1. The overall architecture. The blue blocks represent the two layers. The yellow blocks, instead, symbolize the strategies implemented to provide richer information to the layers. The red blocks represent the two agents.

The "cognitive layer" aims at creating an effective and intuitive cooperation in a human-robot collaboration scenario, improving the operator's well-being in the working environment. To achieve this, it exploits a **Human Monitoring** algorithm, allowing an estimation of the operator's actual execution time and a calculus of job quality indices. If the worker requires more time to accomplish a task, the actual execution time is exploited by the Dynamic Scheduler to reschedule a new task for the robot based on the increased required execution time. The job quality indices are updated every time a new job is concluded and used as input when a new Task Assignment is required.

To reach a more harmonious synergy, a **Communication Interface** is used to enrich the Dynamic Scheduler with the decisions that the operator and the robot are taking about their activities. Based on this communication, the Dynamic Scheduler improves the schedule, making the collaboration more natural.

Figure 31: ROSSINI 5th Press Release | Page 2

About the project

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For additional information please contact

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Dissemination & Exploitation Manager: CRIT
Nikola Raule: raule.n@crit-research.it

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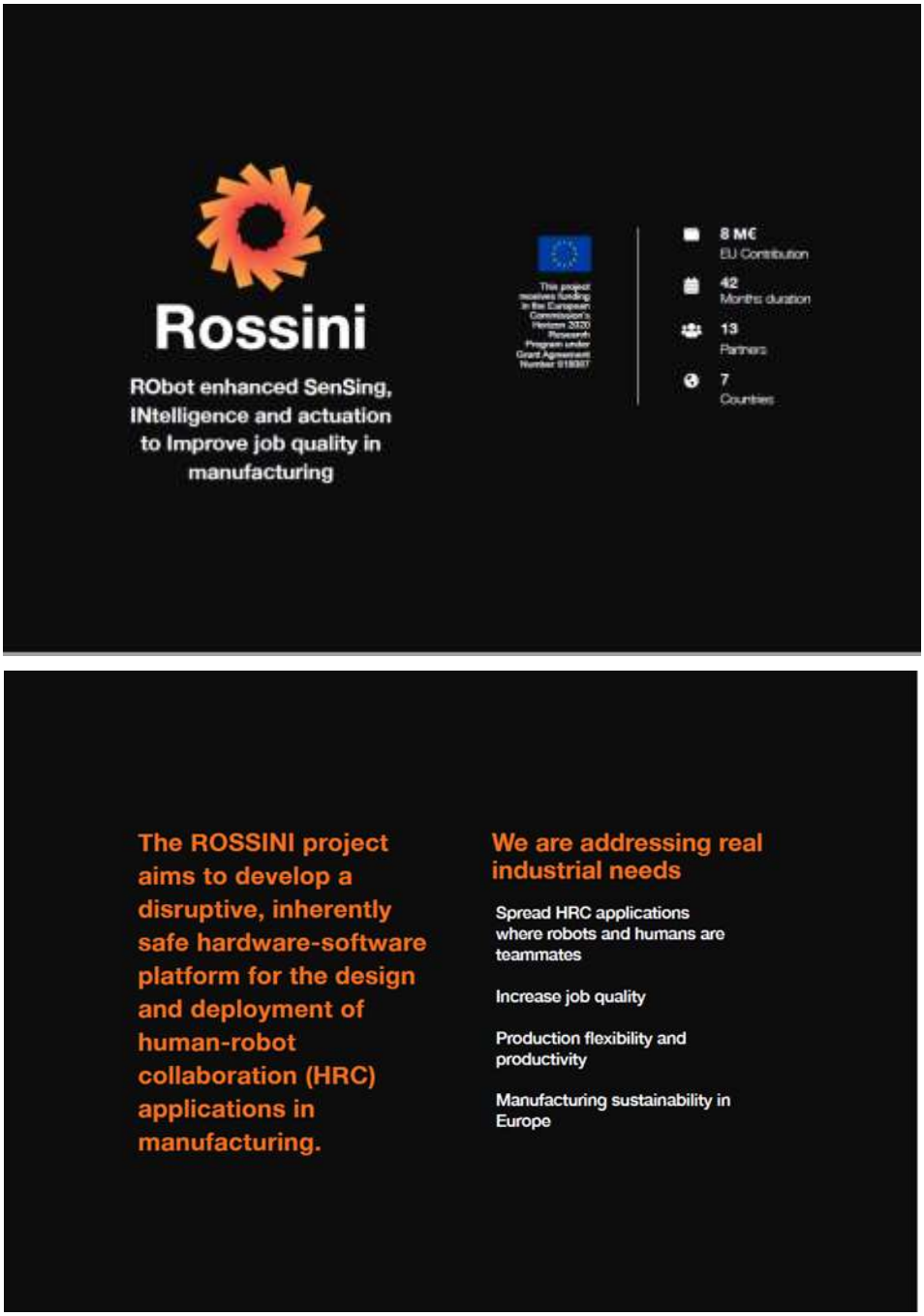
Figure 32: ROSSINI 5th Press Release | Page 3

11.2 The ROSSINI Digital Brochure




The Rossini Platform
Key features that will allow effective and safe Human-Robot collaboration
Sensing Layer
Perception Layer
Cognitive Layer
Control Layer
Actuation Layer
Human Layer
Integration Layer


We are testing in real industrial environments
Whirlpool
Domestic Appliances Assembly
IMA
Packaging Machines
Schindler
Elevator Components Production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