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PHOTONICS PUBLIC PRIVATE PARTNERSHIP

VOSTARS

Video Optical See-Through Augmented Reality Surgical System

D11.5	Report on use and dissemination of results		
Project :	VOSTARS H2020 - 731974	**Start / Duration:**	1 December 2016 / 48 Months
Dissemination[1]:	CO	**Nature[2]:**	**R**
Due Date :	M48		

ABSTRACT:

This deliverable is going to report on the activities developed under task 11.1 Dissemination strategy and actions towards scientific and industrial community implemented actions for the time period M37-48.

1 PU = Public; CO = Confidential, only for members of the Consortium (including the EC services).
2 R = Report; R+O = Report plus Other. Note: all "O" deliverables must be accompanied by a deliverable report.

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1 Executive summary

This deliverable reports on the activities developed under **task 11.1 Dissemination strategy and actions towards scientific and industrial community**, implemented for the time period M37-48.

Originally, communication and dissemination pathways were planned into three main treads:

1) **Scientific dissemination activities**, aimed to publish non confidential VOSTARS results and knowledge to the scientific community. (i.e.: conferences, papers, articles, workshops, seminars, journals, contacts with other research projects).

2) **Commercial oriented communication and dissemination activities**, aimed to inform potential customers about VOSTARS achievements. (i.e.: workshops, patients associations, trade fairs, articles in trade magazines, etc.).

3) **General Public oriented communication activities**, aimed to inform the general public about developments and progresses in VOSTARS. (website, social media, press, etc.).

The Sars Cov 2 pandemic affected significantly the dissemination plan implementation, that was mainly based on VOSTARS presentation at medical congresses and technical fairs. Most of the dissemination planned events were cancelled and no remote session was scheduled.

Accordingly, communication and dissemination activity were implemented in especially via social media as described in the following paragraphs.

2 Report on communication and dissemination activities (M37-48)

This section will report on the communication and dissemination activities performed in the time period from M37 to the end of the project (M48).

Details will be reported about:

in presence events, communication and dissemination channels and tools, the VOSTARS website restyling, general media communication, social media communication, communication and dissemination materials, dissemination events, networking and synergies with other EC projects and initiatives, scientific publications. At the end of the section a KPIs monitoring and analysis of communication and dissemination results will be presented.

2.1 List and report of in presence events

According to the VOSTARS dissemination plan, in the time period from M37 to M48 of project implementation, it was planned to present the VOSTARS project during a certain number of medical congresses and scientific events. Given the Covid-19 pandemic these events were cancelled and no remote session was scheduled.

Table 1: List of main scientific events addressed to surgeons

Event title and description	Target audience	Audience size and provenance	Date and Location	Responsible Partner	notes
3DBO5 2020 From the increased reality to the personalised surgery: surgeons and engineers together	Craniofacial surgeons Healthcare managers Medical device industry Engineers and technicians	**300** Italian surgeons	2020/02/21 Bologna, ITALY	**UNIBO**	**done**
AAOS 2020 American Academy of Orthopaedic Surgeons	Orthopaedic surgeons Healthcare managers Medical device industry	**32.000** From all over the world	2020/03/12-16 Las Vegas, USA	**ORTHOKEY**	
ESPN2020 27th Biennial Congress of the European Society for Paediatric Neurosurgery	Paediatric neurosurgeons Healthcare manager Medical device industry	**400/500** participants from all over the world	2020/05/03-06 Athens, Greece	**MECTRON**	
SIO2020 Italian Society of Otorhinolaryngology	ENT surgeons Healthcare managers Medical device industry	**2000/3000** Italian surgeons	2020/05/20-23 Milan, Italy	**MECTRON** **SGK**	

2.1.1 In presence events report

3DBO

The 3DBO was the unique in presence event that the Consortium could manage in the M37-48. This event was organized by the partner University of Bologna.

Event title:	***3DBO[5]***
Event title:	DALLA REALTÀ AUMENTATA ALLA CHIRURGIA PERSONALIZZATA (from Augmented Reality to Personalized Surgery)
Place and date:	Bologna (Italy) – February 21st, 2020
Website:	https://www.face3dbo.com/it/chirurgia/congressi/3dbo4.html
Official language:	Italian
Responsible partner:	UNIBO
Attendees for Vostars project (Name and affiliation):	Giovanni Badiali - UNIBO Laura Cercenelli - UNIBO Vincenzo Ferrari - UNIPI Fabrizio Cutolo - UNIPI
Target Audience:	Surgeons & Engineers
Audience size:	50/100 participants
Type of presentation:	DEMO and Oral presentation
Presentation details	Realtà Aumentata - il Progetto Europeo VOSTARS: presentazione del prototipo e dei risultati preliminari conseguiti (Augmented Reality – The European project: VOSTARS – presentation of the prototype and the preliminary results) Dott. Giovanni Badiali Università di Bologna Prof. Ing. Vincenzo Ferrari, Ing. Fabrizio Cutolo Università di Pisa/EndoCAS Lab
Objective:	To present preliminary results of the trial
Expected impact:	Give to the participants the possibility to know more about VOSTARS project and even to try it
Outcomes and KPI:	Feedback about acceptance, possible applications of the system
N. of Questionnaires:	20
N. of surgeons contacts:	20
Comments and feedback:	Interest from about 20 surgeons to receive more information and detail

Figure 1: Photos of the 3DBO event

American Academy of Orthopaedic Surgeons

According to VOSTARS dissemination plan, on March 2020 it was planned to participate at the American Academy of Orthopaedic surgeons (AAOS). Orthokey booked the booth #3673 and the stand preparation was planned. On the 10th of March the event cancellation was officially announced on the AAOS website.

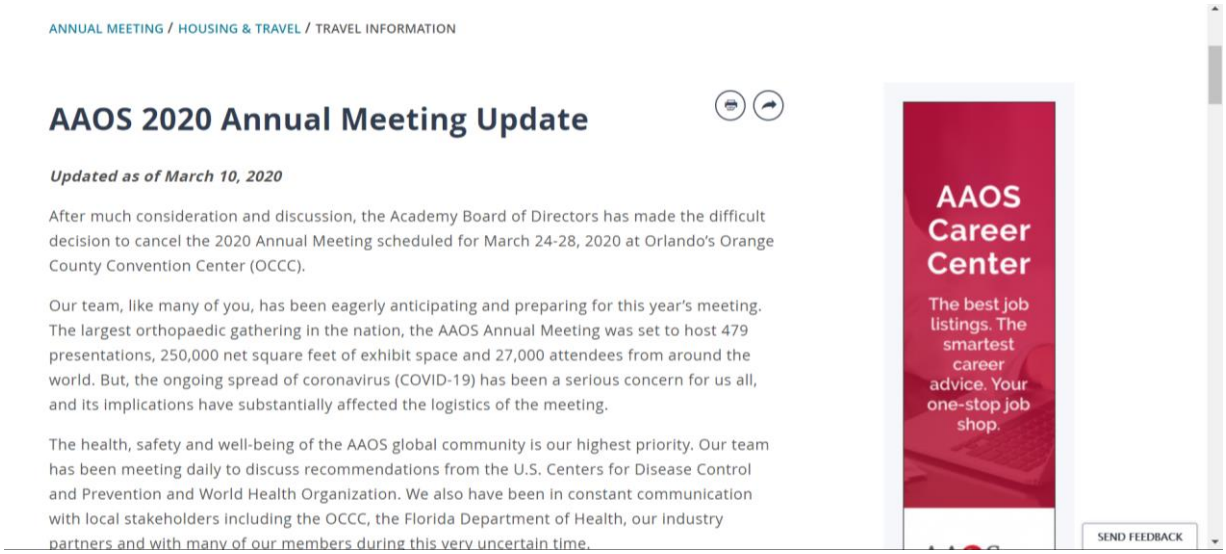


Figure 2: Communication of AAOS cancellation

Many activities for the event preparation were implemented and ready. The shipment of all materials was executed on the 5th March, before the event cancellation announcement. Communication on the website and social media was ready.

Figure 3 AAOS participation on the Orthokey's website

The stand preparation material was ready for VOSTARS exhibition and demo session.

Figure 4: VOSTARS table for system exposition

Figure 5: Monitor for video session

A demo booking system was fine tuned in order to allow participants to schedule a VOSTARS system demo session https://orthokey.setmore.com

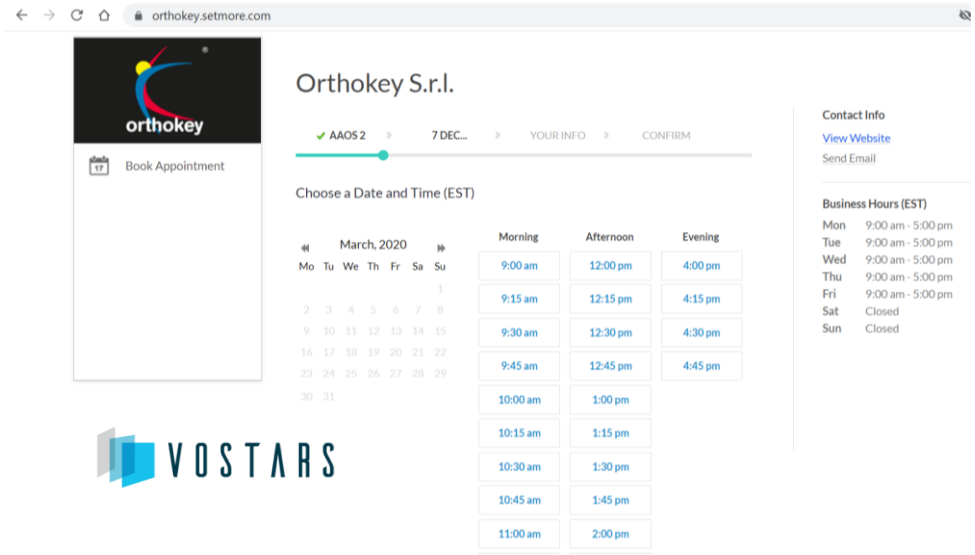


Figure 6: AAOS demo session booking

Thus, the AAOS did not take place, missing the opportunity to present the System at a very huge audience as planned. The Covid 19 pandemic forced the consortium to revise the dissemination plan and go for on line communication and dissemination strategy.

2.2 Communication and dissemination channels and tools

The VOSTARS website, www.vostars.eu, is the main communication channel for showcasing the project to stakeholders and the wider public. At M28 a web site restyling was subcontracted to a communication agency (TRIWU' s.r.l.) specialized in scientific communication, with the objective to create a dynamic and constantly updated platform that could be a reference point for the product, addressing the various targets identified. VOSTARS is edited in two languages: English and Italian (Coordinator language).

Following a presentation of the project website status at **M48**.

2.2.1 VOSTARS website

At M36, when the D11.3 Plan for use and dissemination of results was submitted, the VOSTARS website was under restyling. From M36 some sections were modified or integrated in order to be more effective and catchy for visitors. Following a brief overview of the main sections is presented.

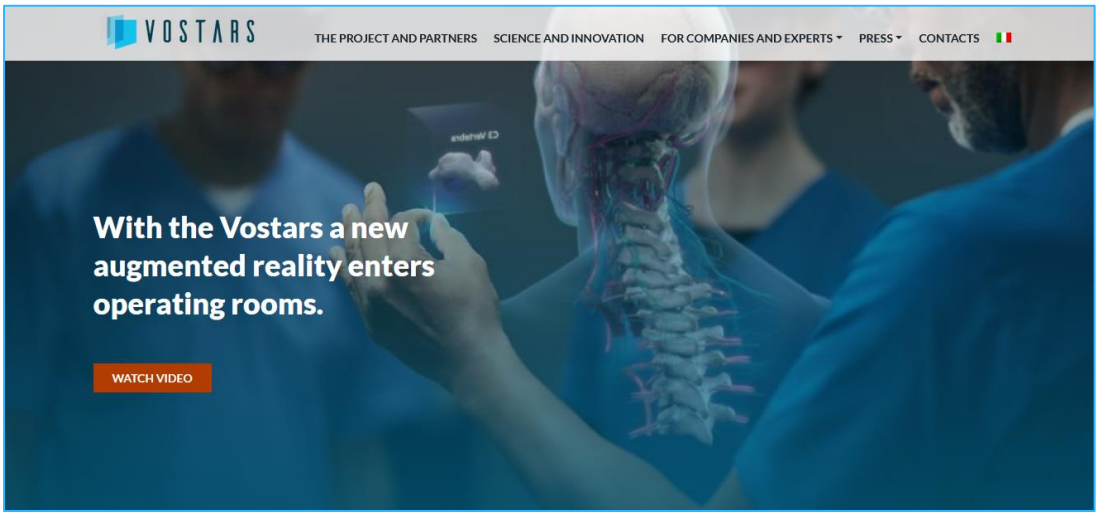
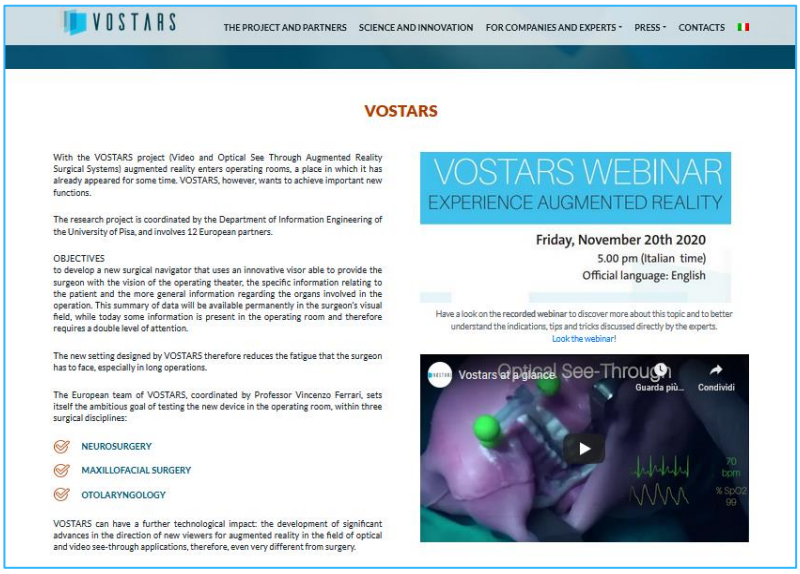


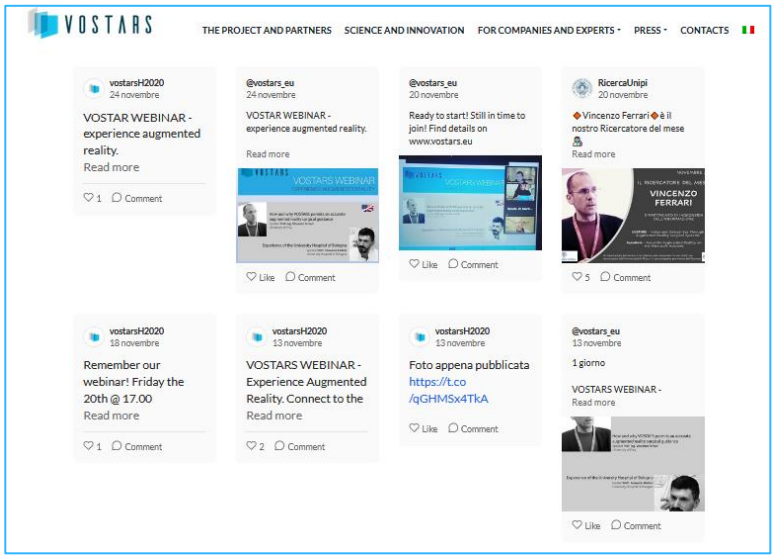
Figure 7: VOSTARS website homepage

HOME PAGE

The home page contains a **video animation** easily understandable by general public, included non-experts. The video is supported with an appealing description of the project and the latest more important information concerning the events and some new recorded videos.



The footer contains the latest project blog posts and links directly to the project's **social media feeds** (Instagram, Twitter and LinkedIn). This section makes the VOSTARS website always up to date with the last news and posts.



THE PROJECT AND PARTNERS

The PROJECT AND PARTNERS page is dedicated to the Consortium. Each partner profile is reported and there's also space for the researchers, even the most junior profiles of the projects, discovering their background, interests, motivations to participate in the project. Partners are also interviewed to understand the strategic role they play in the project.

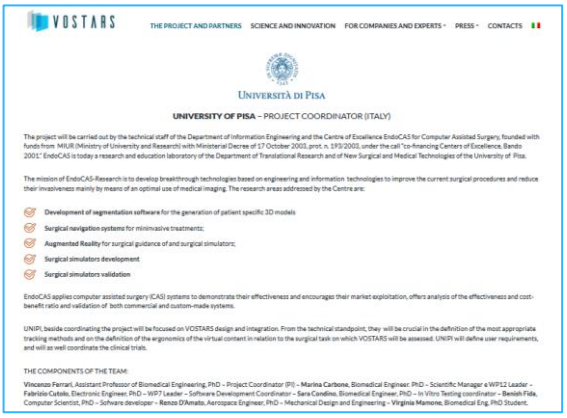
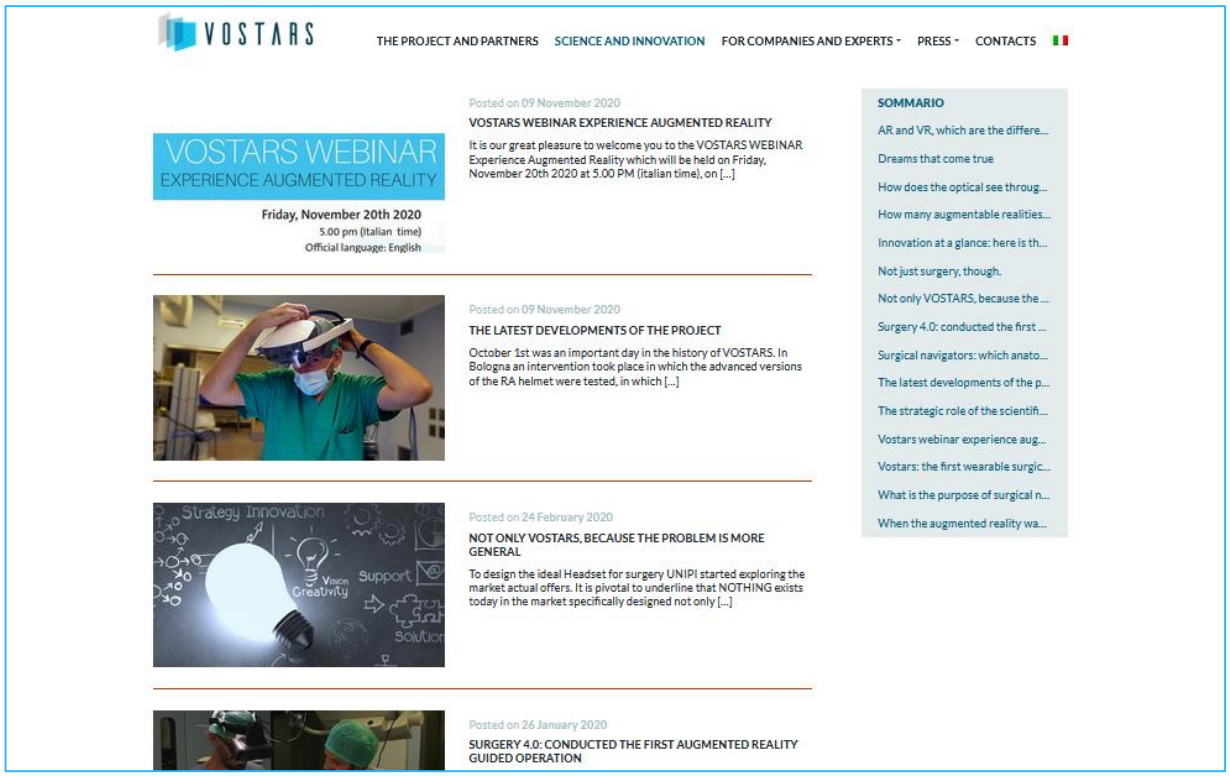


Figure 8: Project & partner page

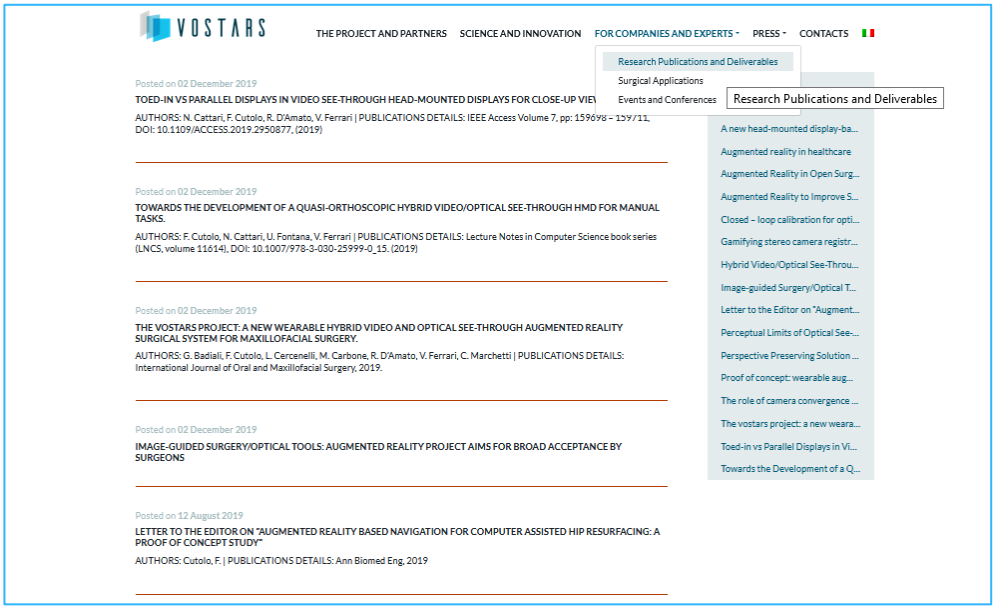
SCIENCE AND INNOVATION

All the most relevant and significant information about the Project and the Augmented Reality topic is listed in this section. Here are inserted articles of popular and curiosity type.



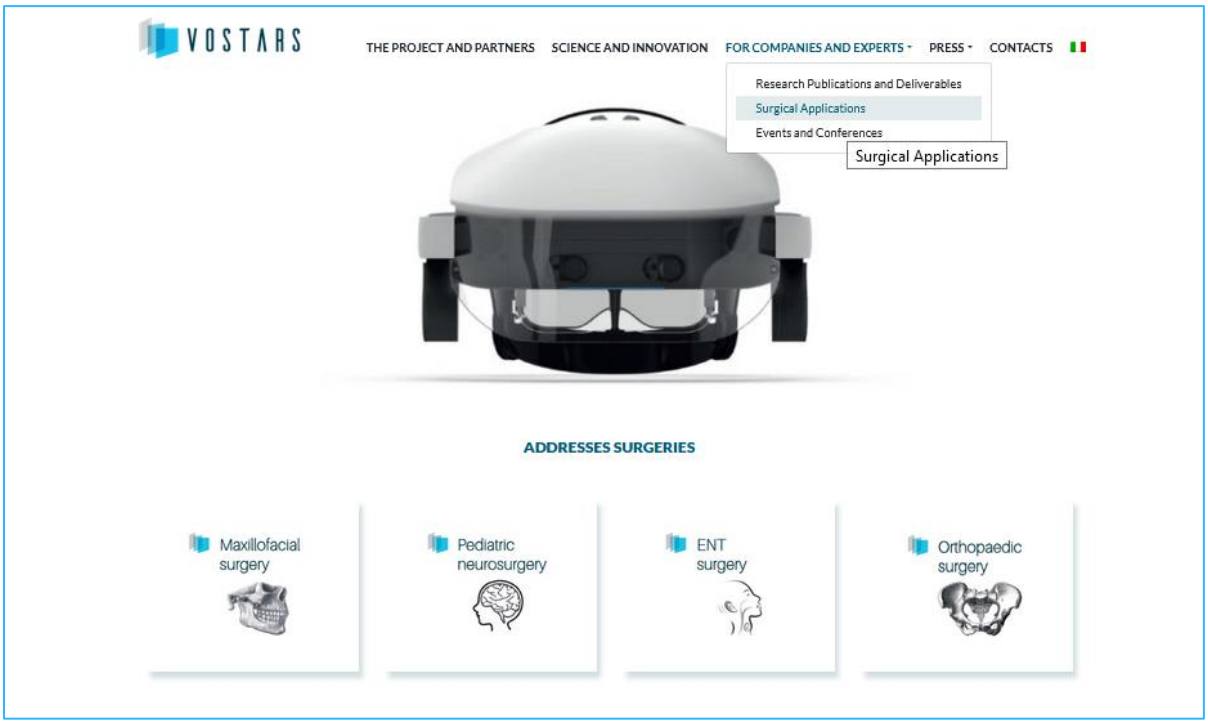
COMPANIES AND EXPERTS

This section is dedicated to public and private entities that professionally operates in the research areas of the project and are interested in contacts, very specific indication, applicative developments. The section is organized in three categories with possibility to read publications and medical contents:

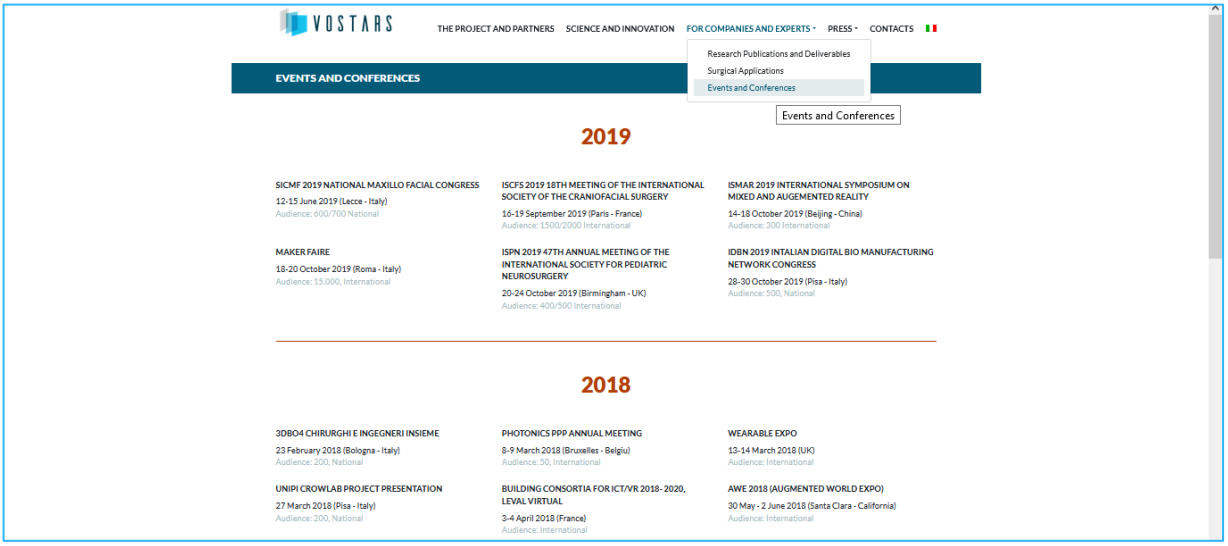


- **Research publications and deliverables**: abstracts of new papers are inserted, with a brief comment on the importance they have in the field of research;

- **Surgical Applications**: for each surgical field of interest (Maxillofacial surgery, Paediatric Neurosurgery, ENT surgery and Orthopaedic surgery) the whole list of advantages introduced by the use of the VOSTARS system and the list of the surgeries possibly performed with it.



- **Events and conferences**: this subsection reports on the presentations made during national and international conferences;

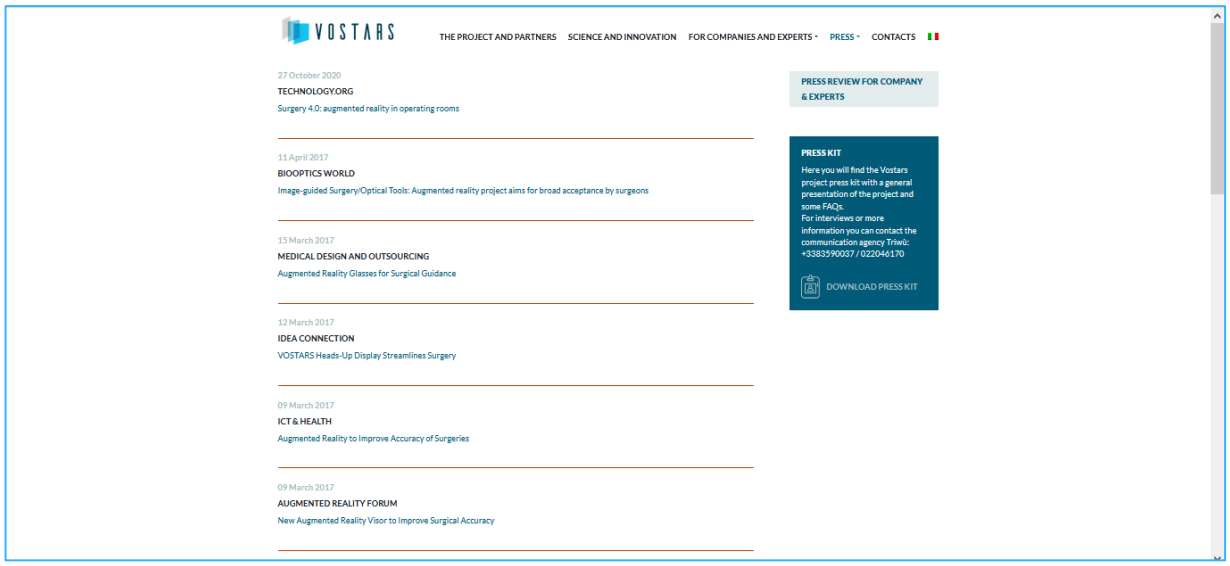


PRESS

In this section there are articles that have been written about VOSTARS and the material prepared to support journalists.

- Press

- Press for companies and experts



VOSTARS WEBSITE ANALYSIS & STATISTICS

Having a look on the graphs herewith below it's possible to have a clear overview of the trend of the website traffic from the beginning of 2020 till November 2020.

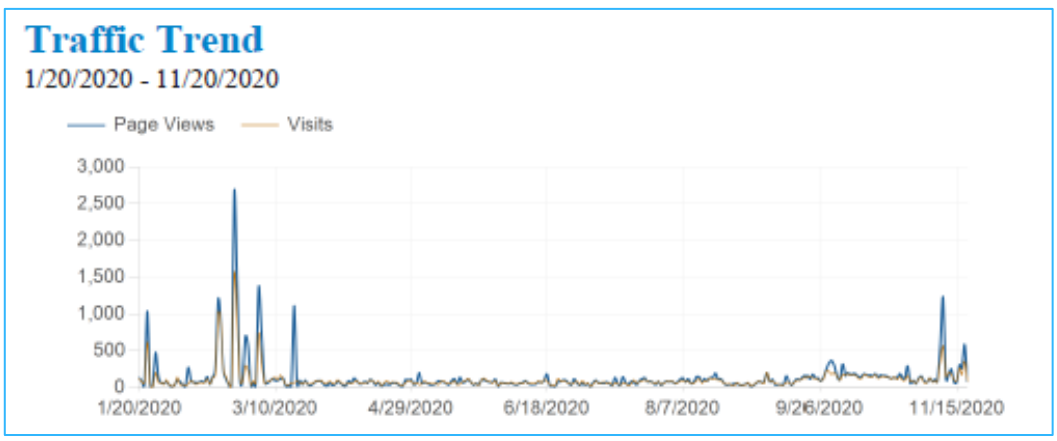
Noteworthy are the peaks from January to March and on November.

These peaks are related to some important activities made with the Visor, in details:

- From January to March: the first IN VIVO tests made by Dr. Giovanni Badiali in the OT (operating theatre) at S. Orsola University Hospital in Bologna, just before the first lockdown, imposed by the pandemic situation. This activity created a lot of interest between surgeons in the device and its applications.

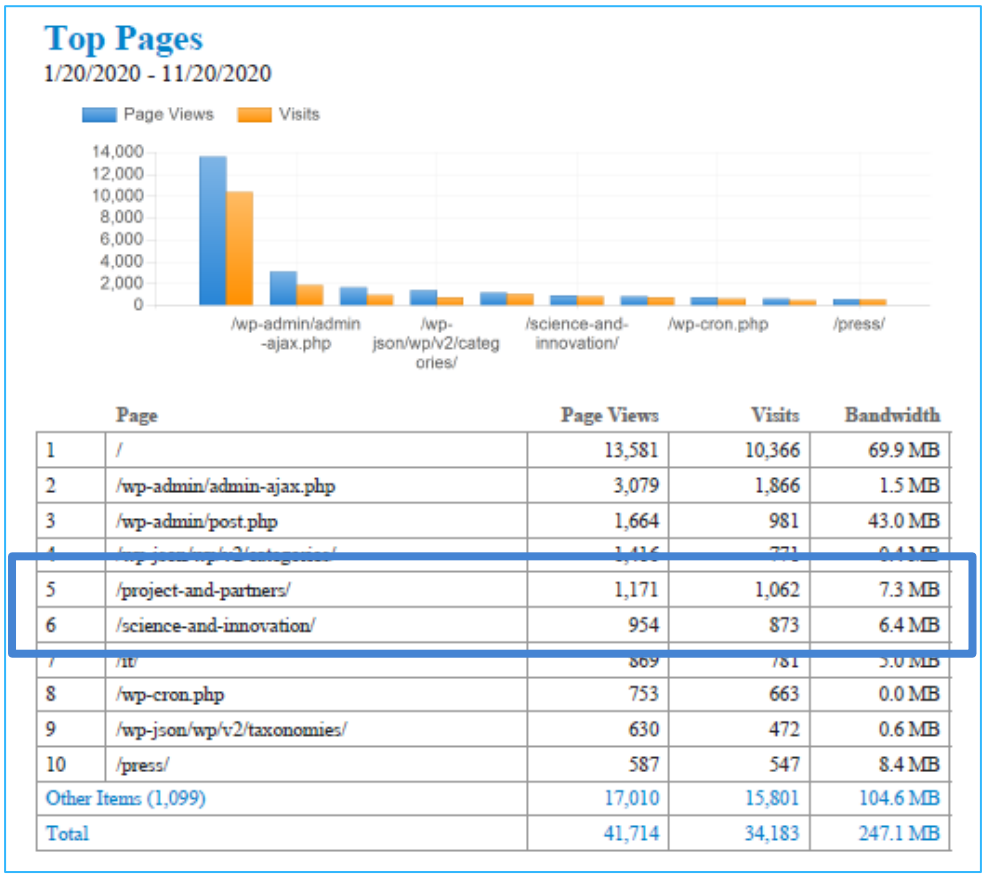
- On November: the WEBINAR organized in collaboration with Dr. Giovanni Badiali (S. Orsola University Hospital in Bologna) and Prof. Ing. Vincenzo Ferrari (University of Pisa) to spread the knowledge about VOSTARS system between the Maxillofacial surgeons, world-wide. (read the paragraph related the WEBINAR to know more)

Table 2: From January to today the pages viewed there were about 41.000



About 33.000 visitors, this means an average of 200 visitors per day. With frequent peaks of 1000 visitors/ 600 visitors per day.

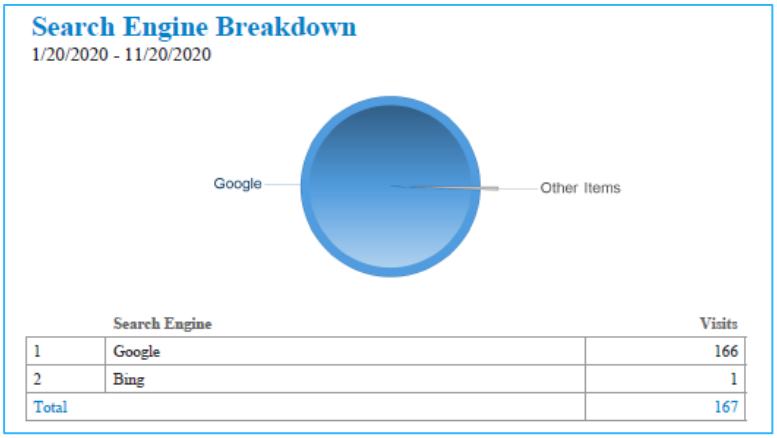
Table 3: Most viewed pages



	Page	Page Views	Visits	Bandwidth
1	/	13,581	10,366	69.9 MB
2	/wp-admin/admin-ajax.php	3,079	1,866	1.5 MB
3	/wp-admin/post.php	1,664	981	43.0 MB
4	[illegible]	[illegible]	[illegible]	[illegible]
5	/project-and-partners/	1,171	1,062	7.3 MB
6	/science-and-innovation/	954	873	6.4 MB
7	/it/	869	781	5.0 MB
8	/wp-cron.php	753	663	0.0 MB
9	/wp-json/wp/v2/taxonomies/	630	472	0.6 MB
10	/press/	587	547	8.4 MB
Other Items (1,099)		17,010	15,801	104.6 MB
Total		41,714	34,183	247.1 MB

This graph shows the most viewed pages, which turn out to be: Project and Partners and even Science and Innovation. The first are those of the site administration.

Table 4: Search engine breakdown



	Search Engine	Visits
1	Google	166
2	Bing	1
Total		167

Huge prevalence of audiences from Google, which means also that google has indexed many words in the proper way, to support the users to find the right contents.

Table 5: Referring links

Referring Links

1/20/2020 - 11/20/2020

	Referrer URL	Visits
1	https://www.google.com	703
2	http://site.ru	254
3	https://hightechforum.org	205
4	https://trends.thinknowa.com	165
5	https://www.ilfattoquotidiano.it/2020/02/18/bologna-il-chirurgo-indossa-un-visore-prima-operazione-al-mondo-con-la-realta-aumentata/5709625	141
6	http://www.google.com	138
7	http://m.facebook.com	95
8	http://www.orthokey.com/index.php/research-innovation/projects/40-vostars-project	70
9	https://www.google.it	66
10	https://sankt-gertrauden.de	62
Other Items (213)		637
Total		2,536

Here are documented the main sites from which users arrive to the vostars.eu website. The first one is Google, and then other sites such as newspapers websites.

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2.2.2 General media

Addressing general media in the last year of the project has been really difficult. Anyway it was the year of the biggest results: the 1st intervention with the VOSTARS surgical navigation platform as well as the 1st time in the world the surgeon hands were actually guided by a Wearable Augmented Reality device on a real patient.

Unluckily we tried to push this news in the exact period when the Covid-19 pandemic hit Italy and Europe. We reached anyway the main Italian media: TV, radios, and newspapers, with less success in Europe.

Below some highlights on the most important media reached from M37 to M48, while a full press review can be found in the website following this link https://www.vostars.eu/press/ .

Table 6: General media press review M37-48

Date	Review/Magazine/Newspaper	Title & link
27 October 2020	Technology.org	Surgery 4.0: augmented reality in operating rooms
22 September 2020	Scienzedellavita.it	La realtà aumentata applicata alla medicina: l'esperienza di Vostars guida la mano del chirurgo
24 June 2020	Ai4business.it	Realtà aumentata: cos'è, come funziona, esempi e applicazioni
10 April 2020	Wired.it	Come la realtà virtuale può cambiare l'economia dopo il coronavirus
16 March 2020	Euractiv.com	Photonics, the 'Green Deal' technology
10 March 2020	Euractiv.com	The world's first augmented reality surgical operation
20 February 2020	Osservatore Romano	A Bologna prima operazione al mondo guidata in realtà aumentata
19 February 2020	RADIO 24 OBIETTIVO SALUTE	Sanità. Prima operazione al mondo utilizzando la realtà aumentata all'ospedale S. Orsola-Malpighi di Bologna. Progetto finanziato dalla Commissione Europea. Int. Vincenzo Ferrari (Università di Pisa). Ospite: Giovanni Badiali (Policlinico Universitario S. Orsola-Malpighi di Bologna).
19 February 2020	RADIO CAPITAL GR RADIO CAPITAL – 13.00	Sanità. Prima operazione al mondo utilizzando la realtà aumentata all'ospedale S. Orsola-Malpighi di Bologna. Progetto finanziato dalla Commissione Europea. Int. Vincenzo Ferrari (Università di Pisa).

19 February 2020	ITALIA 7 TGT – 13.45	Bologna – E stata eseguita la prima operazione chirurgica al monda guidata con la realtà aumentata, con un visore nato da un progetto dell'Università di Pisa. Intervista a Vincenzo Ferrari, Ingegnere biomedico Unipi.
19 February 2020	RAI 3 TGR TOSCANA – 14.00	Bologna – E stato usato un visore speciale creato dall'Università di Pisa per la prima operazione chirurgica guidata dalla realtà aumentata. Interviste a Vincenzo Ferrari, Ingegnere biomedico Unipi e a Marina Carbone, Ingegnere biomedico Unipi.
19 February 2020	RAI 3 TGR LEONARDO – 14.50	Sanità. Al Sant'Orsola di Bologna primo intervento chirurgico al mondo con realtà aumentata. Il visore utilizzato dal chirurgo è stato realizzato all'Università di Pisa. Int. Vincenzo Ferrari (Università di Pisa); Martina Carbone (Università di Pisa)
19 February 2020	RAI 1 TG1 – 13.30	Bologna. Eseguito all'osp. Sant'Orsola il primo intervento con la realtà aumentata. Int. Giovanni Badiali (Univ. Bologna), Marina Carbone (Univ. Pisa)
19 February 2020	Tirreno Pisa-Pontedera 8	Prima operazione guidata dalla realtà aumentata grazie al visore pisano
19 February 2020	Resto del Carlino Bologna	Intervista a Giovanni Badiali – «Anni e anni di studio per arrivare a un risultato incredibile. Che emozione»
19 February 2020	Resto del Carlino Bologna	Il dottor futuro – Pionieri della realtà aumentata. Il primo intervento lo fa un 'precario'
19 February 2020	Resto del Carlino	Il chirurgo con il visore È il bisturi del futuro – Il visore entra in sala operatoria La tecnologia opera con il chirurgo
19 February 2020	Repubblica Bologna	La prima chirurgia virtuale ricostruita una mandibola – Il chirurgo ha la supervista operazione record in 3D
19 February 2020	Nazione Pisa-Pontedera	Un visore per la chirurgia 4.0 Ecco la realtà aumentata
19 February 2020	Gazzetta del Sud	In sala operatoria la realtà aumentata
19 February 2020	Corriere di Bologna	Tre operazioni con la realtà aumentata, le prime al mondo – Il chirurgo col visore-guida Operazione unica al mondo
19 February 2020	Centro	Per la prima volta la realtà virtuale entra in

		sala operatoria
19 February 2020	Metro	Ecco i “ferri” del futuro – Il gran “salto” della chirurgia
19 February 2020	Avvenire	Il chirurgo opera in realtà aumentata – Il chirurgo? Nella realtà virtuale
19 February 2020	Messaggero	Realtà aumentata, il primo intervento
18 February 2020	VIDEO.LASENTINELLA.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.LAPROVINCIAPAVESE.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.LANUOVAFERRARA.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.ILTIRRENO.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.ILPICCOLO.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.GAZZETTADIREGGIO.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.GAZZETTADIMODENA.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.GAZZETTADIMANTOVA.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	VIDEO.CORRIEREALPI.GELOCAL.IT	Prima operazione con la realtà aumentata: passo dopo passo, ecco come funziona il visore
18 February 2020	TGCOM24	Chirurgia, a Bologna il primo intervento al mondo con la realtà aumentata
18 February 2020	RAINEWS	Medicina. A Bologna prima operazione al mondo con la realtà aumentata
18 February 2020	PISA TODAY	Chirurgia 4.0’: condotta la prima operazione guidata dalla realtà aumentata
18 February 2020	NOVE.FIRENZE	Chirurgia 4.0: prima operazione guidata dalla realtà aumentata

18 February 2020	HUFFPOST	A Bologna prima operazione al mondo guidata in realtà aumentata
18 February 2020	IN TOSCANA.IT	CHIRURGIA 4.0: LA PRIMA OPERAZIONE GUIDATA DALLA REALTÀ AUMENTATA
18 February 2020	In salute news	Un visore di realtà aumentata guida l'atto chirurgico. Primo intervento al mondo in Italia
18 February 2020	IL TIRRENO PISA	Prima operazione al mondo con realtà aumentata: il visore è dell'università di Pisa
18 February 2020	IL MESSAGGERO SALUTE	Operazione chirurgica guidata dalla realtà aumentata, a Bologna il primo intervento al mondo
18 February 2020	IL FATTO QUOTIDIANO	Bologna, il chirurgo indossa un visore: prima operazione al mondo con la realtà aumentata
18 February 2020	IL CITTADINO ONLINE	A Bologna la prima operazione al mondo con la realtà aumentata
18 February 2020	GoNews	Operazione chirurgica guidata dalla realtà aumentata: è Vostars
18 February 2020	La Gazzetta di Firenze	A Bologna la prima operazione al mondo con la realtà aumentata
18 February 2020	Bologna.Repubblica.it	Bologna, al Sant'Orsola la realtà virtuale è entrata in sala operatoria: primo intervento al mondo con il visore
18 February 2020	DIRE	A Bologna condotta prima operazione con realtà aumentata
18 February 2020	Ansa	Prima operazione al mondo guidata in realtà aumentata
18 February 2020	Ansa	1/a operazione mondo in realtà aumentata – Hi-tech – ANSA
18 February 2020	ADNKronos	Bologna, prima operazione al mondo con la realtà aumentata
18 February 2020	TyN Panamá	La cirugía 4.0, la primera operación en el mundo, guiados por la realidad aumentada
18 February 2020	Terra.Com	Itália realiza 1ª cirurgia do mundo com realidade aumentada
18 February 2020	RENOVA Mídia (liberação de imprensa)	1ª cirurgia do mundo com realidade aumentada é realizada na Itália
18 February 2020	Época Negócios	Itália realiza 1ª cirurgia do mundo com realidade aumentada

18 February 2020	ANSA	World's 1st augmented reality op
18 February 2020	Agipress	La prima operazione al mondo guidata dalla realtà aumentata
18 February 2020	RAI 3 TGR TOSCANA – 19.30	Bologna-Prima operazione chirurgica con l'uso della realtà aumentata. Il visore indossato dal chirurgo è stato realizzato all'Università di Pisa
18 February 2020	TV 2000 TG – 18.30	Bologna. Ospedale S. Orsola. Prima operazione con realtà aumentata. Progetto coordinato dall'Università di Pisa.
18 February 2020	RADIO CAPITAL MASTER MIXO	Bologna. Osp. Sant'Orsola: operazione con realtà aumentata. E' la prima al mondo. – Il visore, di nuova generazione, è il risultato di un progetto europeo coordinato dall'Università di Pisa che vede l'Università di Bologna come partner responsabile della sperimentazione clinica.
18 February 2020	RTV 38 TG RTV 38 – 20.30	Bologna-Prima operazione chirurgica in realtà aumentata grazie al progetto europeo coordinato dall'Università di Pisa
16 February 2020	Video.Repubblica.it	Pisa, il visore che cambia la sala operatoria
16 February 2020	Firenze.Repubblica.it	Chirurgia 4.0, la prima operazione al mondo guidata dalla realtà aumentata
16 February 2020	Video.Repubblica.it	Pisa, il visore che cambia la sala operatoria
16 February 2020	Firenze.Repubblica.it	Chirurgia 4.0, la prima operazione al mondo guidata dalla realtà aumentata
30 January 2020	COSMO Radio Colonia – Beitrag	Una intervista alla Radio tedesca per gli italiani in Germania

2.2.3 Social media

At M48 VOSTARS social media were established and implemented as defined in the communication and dissemination plan. Related KPIs monitoring about social media activities are reported in section 2.7-Communication and dissemination outcomes and KPIs.

While here we report for each social a brief analysis of the impact of the VOSTARS channel.

During these very difficult months, where all the contacts with people have not been allowed and all the events in presence have been cancelled, the Social Media play a crucial role in the communication and dissemination plan.

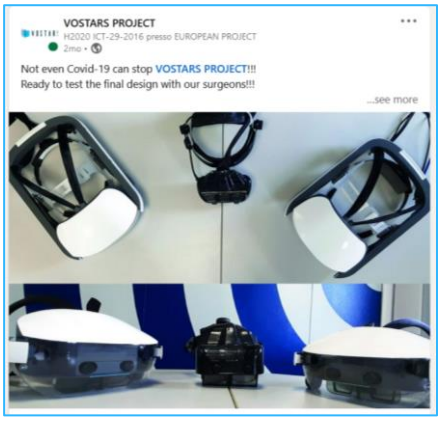
Thanks to LinkedIn, Instagram, Twitter and the YouTube channel, we were able to improve the knowledge about VOSTARS System, creating ad hoc organic posts about different topics and with different purposes. Different posts were launched with different objectives:

Graphic posts

Objective: to capture the attention and to transfer clear messages through some slogans.

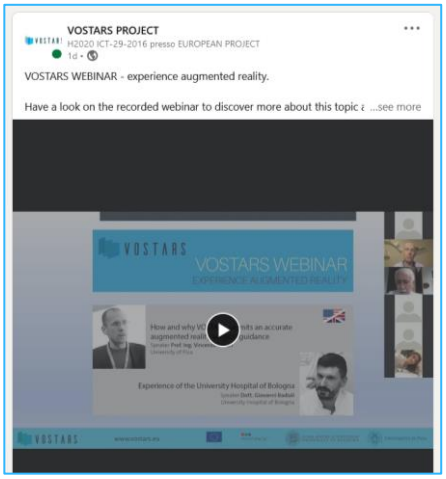
Informed posts

Objective**:** to keep updated people about the latest news and the developing steps of the project.



Promoting posts

Objective**:** to promote the online activity (WEBINAR) organized on November and consequently even the recorded video of the event itself.



All these posts were shared on all Social Media platforms (LinkedIn, Instagram, Twitter).

Linkedin Followers: 125 (December 10th, 2020)

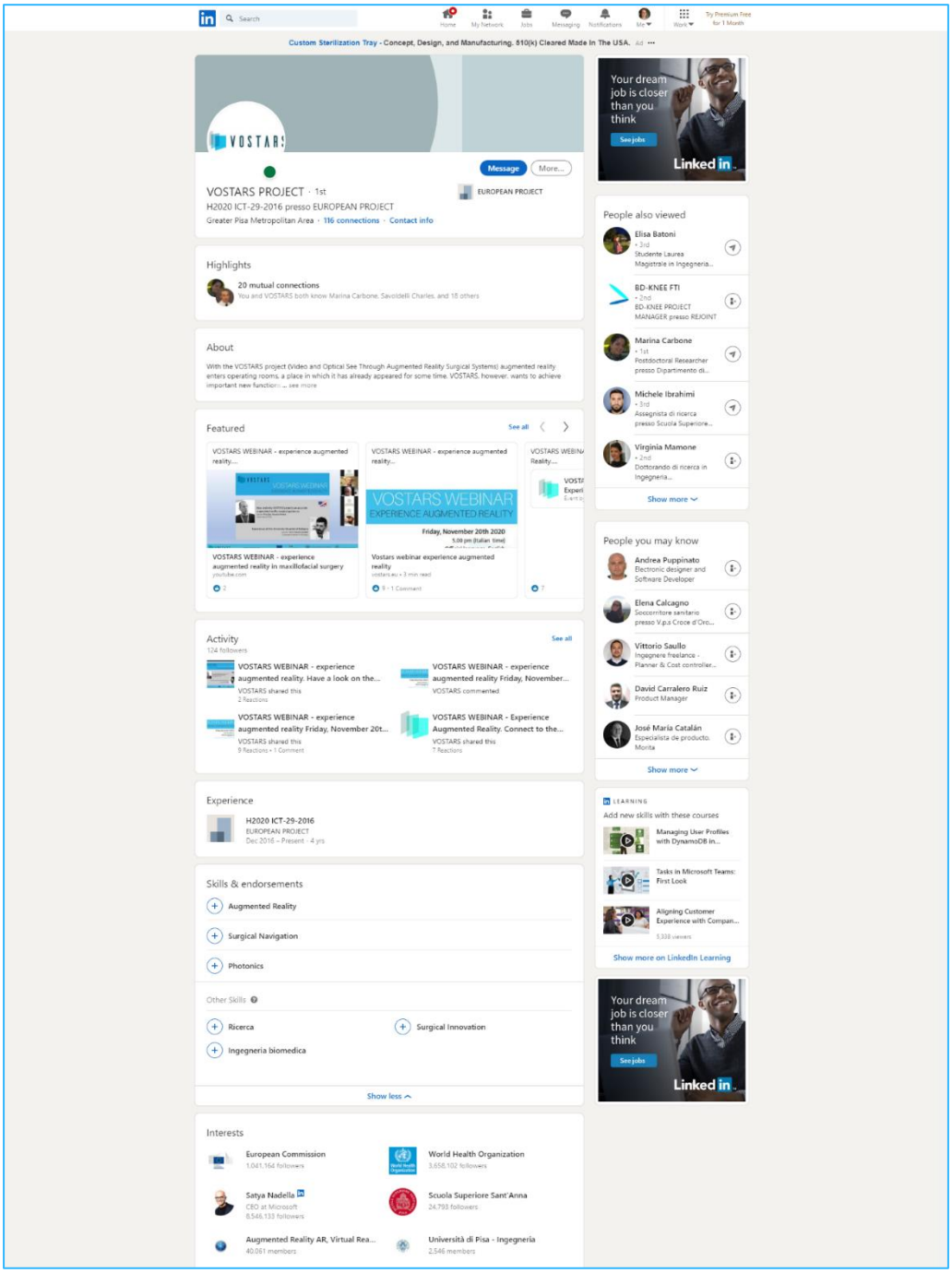


Figure 9: VOSTARS Linkedin page

Herewith below some analysis about the number of visualizations got per post and even the number of visualizations per month. For sure the more we posted and we are active on the Social Media and better are the results and the audience ‘s feedback.

Table 7: Number of visualizations per published posts on LinkedIn

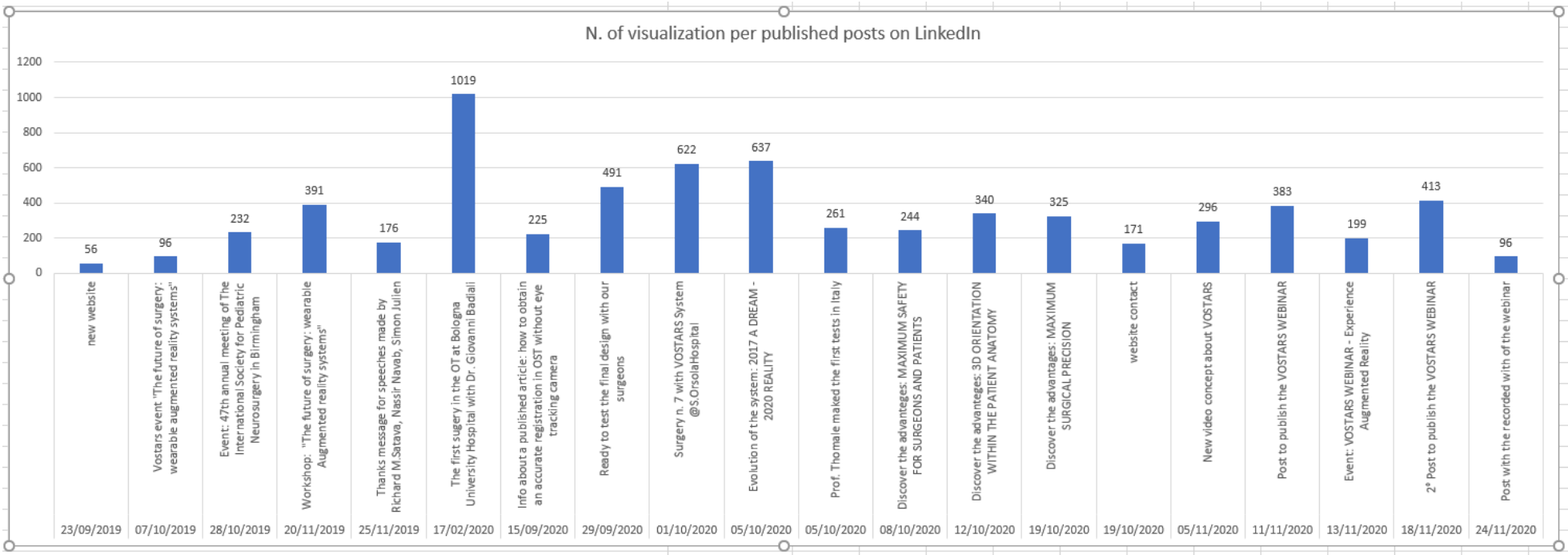
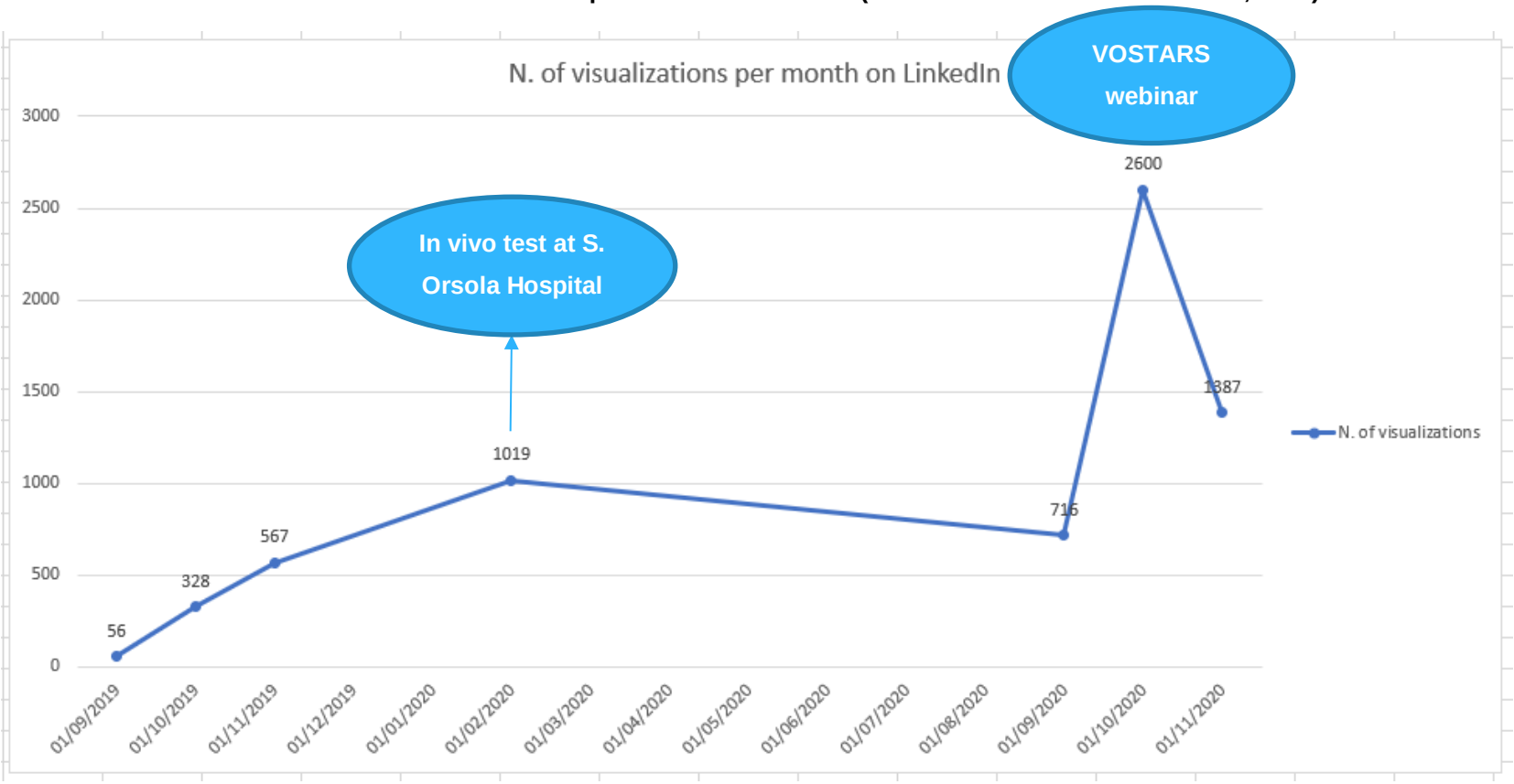


Table 8: Number of visualizations per month on LinkedIn (Data collected till November 24th, 2020)



The peaks are related to some important activities and achievements of the development and trial phase, in details:

- From January to March: **the first IN VIVO tests** made by Dr. Giovanni Badiali in the OT (operating theatre) at S. Orsola University Hospital in Bologna, just before the first lockdown, imposed by the pandemic situation. This activity created a lot of interest between surgeons in the device and its applications.

- On November: the **WEBINAR** organized in collaboration with Dr. Giovanni Badiali (S. Orsola University Hospital in Bologna) and Prof. Ing. Vincenzo Ferrari (University of Pisa) to spread the knowledge about VOSTARS System between the Maxillofacial Surgeons, world-wide.

Instagram

Our Instagram channel reached a total of 66 followers (updated @end December 10th 2020).

Each post manages to obtain a mean of 10 likes, 30 reach and 35 impressions.

Once the project started sharing results of the trial phase, through images and video contents of the final prototypes at work, the general public demonstrated interest and the VOSTARS profile reached a growing trend.

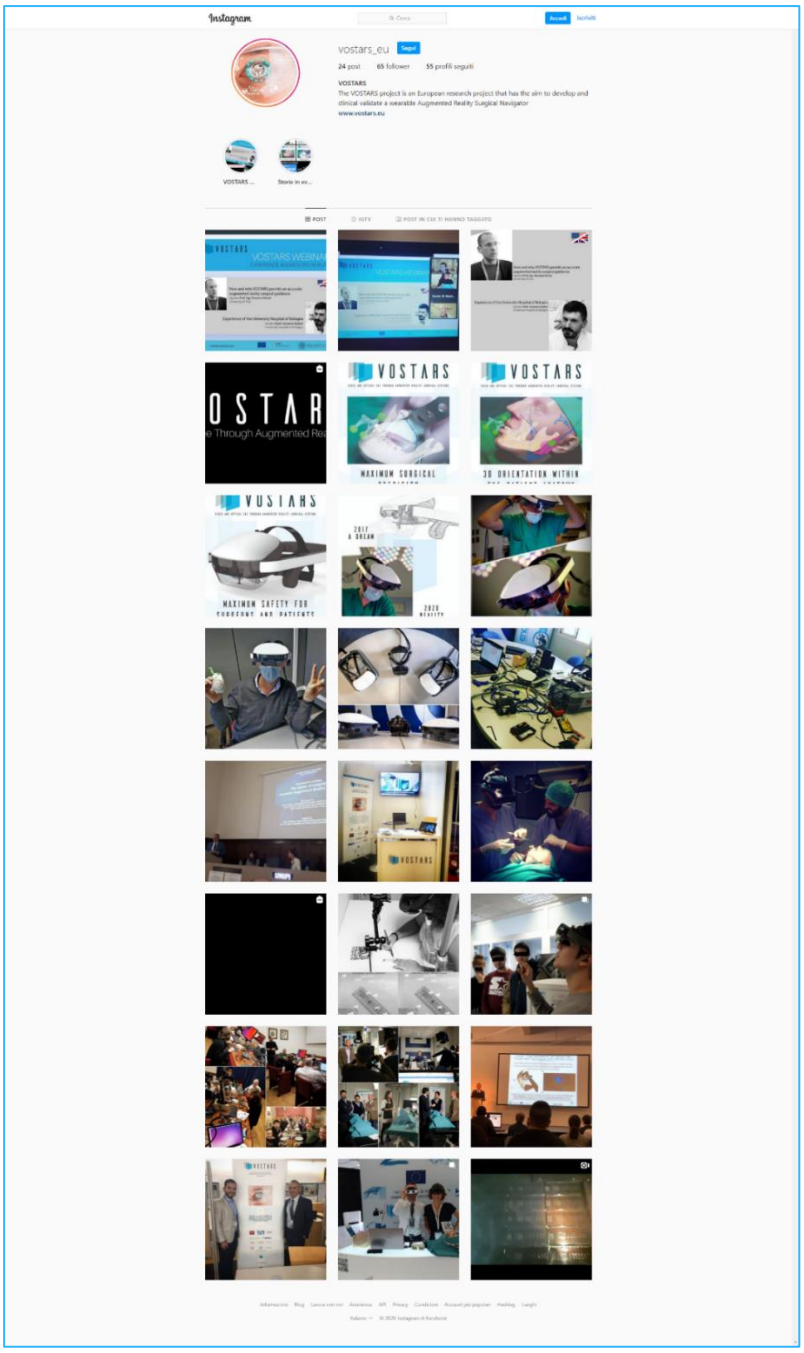


Figure 10: VOSTARS Instagram profile

Twitter

The Twitter channel reached a total of 52 followers (updated at end of November 2020).

We registered a growing trend once the project started to obtain results sharing images and video contents of the final prototype appealing for the general public.

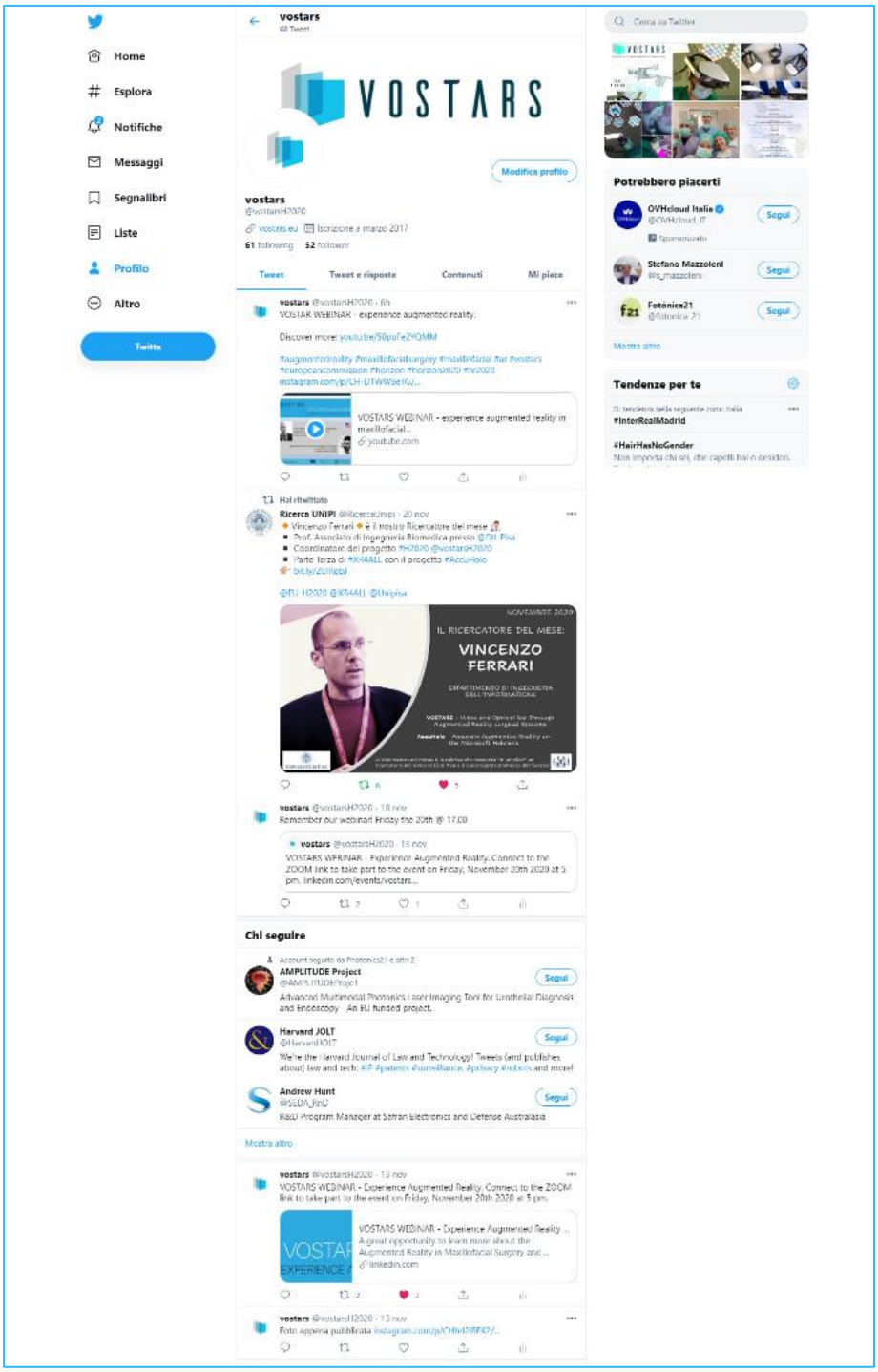


Figure 11: VOSTARS Twitter profile (1/2)

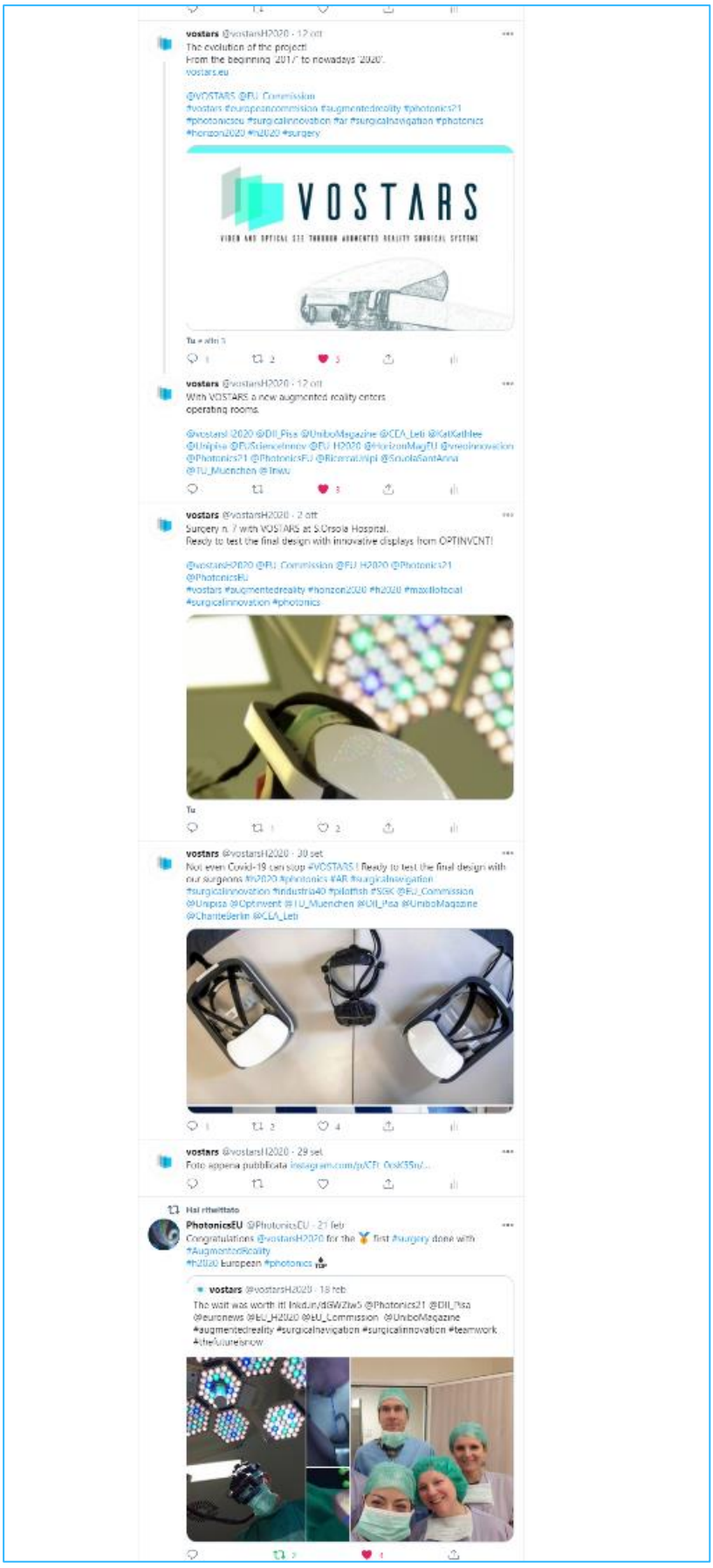


Figure 12: VOSTARS twitter profile (2/2)

YouTube channel

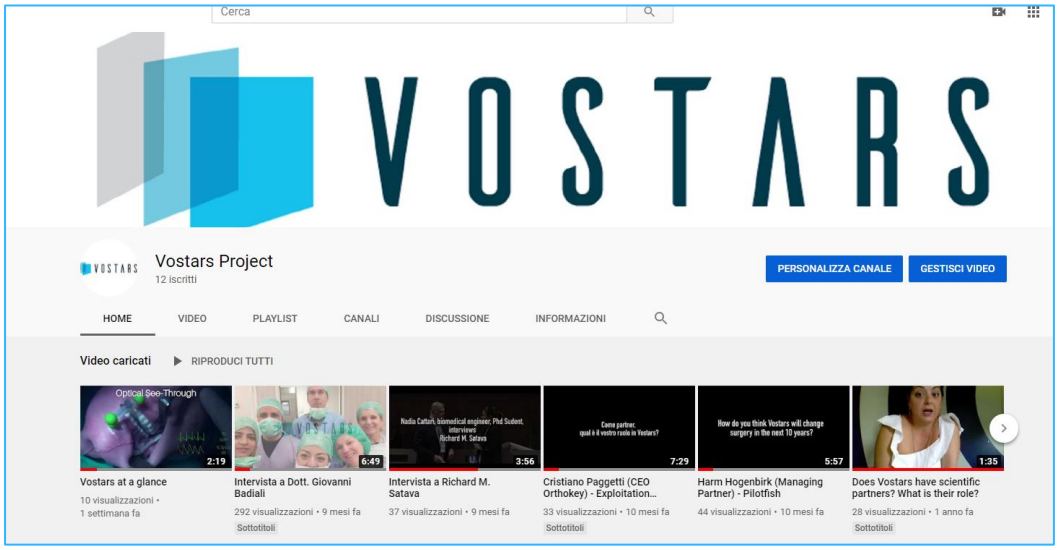


Figure 13: VOSTARS You Tube channel

2.3 Communication and dissemination materials

At M48 of project implementation, different communication and dissemination material were realised:

Animated Videos

The video animation was showed during each event since May 2019. And shared through the YouTube VOSTARS channels, website and social media. https://www.vostars.eu/en/

Demo Videos

Demo videos showcase how VOSTARS works in the different medical fields. For the time being we have started to record **video on phantom in maxillofacial surgery and neurosurgery**.

"Vostars at a glance" describing the OST/VST modalities: https://www.youtube.com/watch?v=nkG1GR5ppRU&feature=youtu.be

Video Interviews

Video interviews to the **project partners** were realised and available at the link: https://www.vostars.eu/project-and-partners/

Video interview performed to Dr. Richard M. Satava - Professor Emeritus of Surgery at University of Washington - Seattle, Washington, United State

https://www.youtube.com/watch?v=7RcnDlCQiYo&t=134s

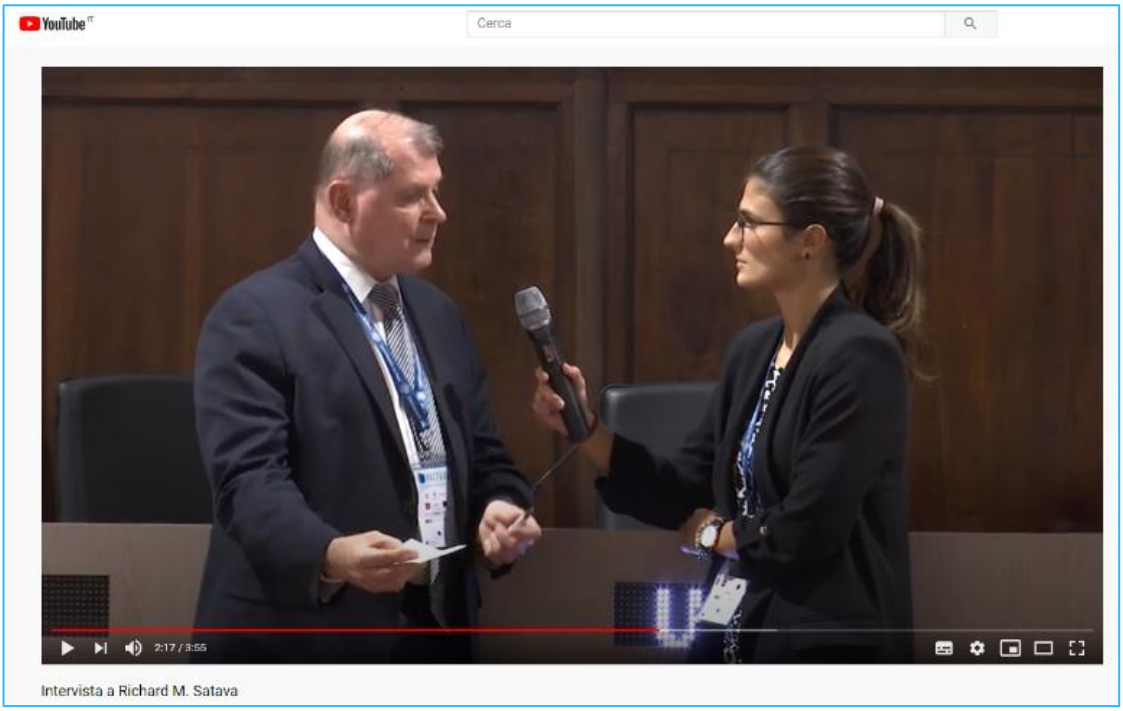


Figure 14: Richard Satava video interview frame

Video recorded during the event: “The future of surgery: Wearable Augmented Reality Systems”.

It was a round table between surgeons concerning the evaluation of all surgical applications possibly performed with VOSTARS system, in addition to the applications already tested and evaluated.

https://drive.google.com/file/d/1gBdaQKEZmKrBxYX7UiHS5vgDbEr4uup5/view

Figure 15: «The future of surgery: Wearable Augmented Reality Systems» video frame

2.4 Dissemination events

In the time period from M37 to M48 of the project implementation, the VOSTARS project couldn't be presented to any of the live forecasted events.

In alternative, VOSTARS was presented in an online seminar at the **Western University of London CANADA** in a seminar organized by the Robarts Research Centre:

Western University - London, Canada.

Seminar Series, Prof Vincenzo Ferrari presented a seminar titled: **"AR for Surgical Guidance: a deepening in HMDs up to the VOSTARS project**".

The seminar was addressed to biomedical engineers and the objective was to present technical features and advancements of the VOSTARS system with respect to the state of the art in AR for surgical guidance.

Figure 16: Western University seminar

Prof. Vincenzo Ferrari presented another online seminar organized at the beginning of December 2020 by the Engineering University of Palermo: **Augmented Reality & Virtual Reality: Industry 4.0**, where

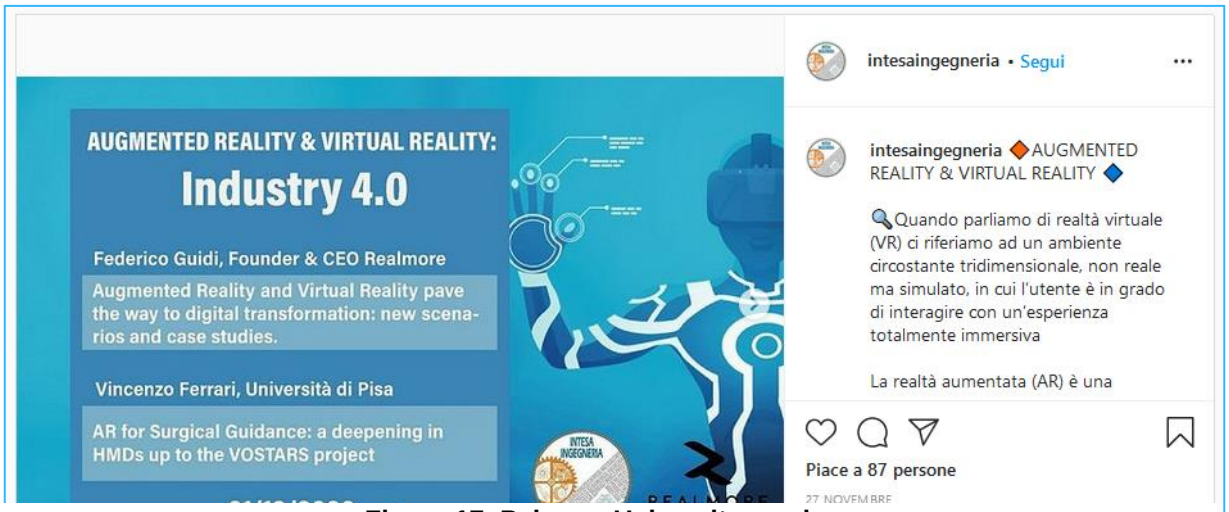


Figure 17: Palermo University seminar

spoke about: “**AR for Surgical Guidance: a deepening in HDMs up to the VOSTARS project”.**

Radio interviews:

In July 2020 the VOSTARS project coordinator, prof. Vincenzo Ferrari, was on air with a radio interview from one of the most important Italian radio stations. You can find the podcast of the interview at the following link Realtà aumentata in chirurgia | Radio 24

Other Radio interviews after the first intervention:

- Radio 24: http://bancadati.datavideo.it/media/20200219/20200219-RADIO_24-OBIETTIVO_SALUTE_1210-124541213m.mp4
- Radio Capital: http://bancadati.datavideo.it/media/20200219/20200219-RADIO_CAPITAL-GR_RADIO_CAPITAL_1300-141659298m.mp4

2.4.1 Online activities organised by the VOSTARS Consortium

VOSTARS WEBINAR – Experience Augmented Reality

This Webinar was a great opportunity to learn more about the Augmented Reality in Maxillofacial Surgery and discuss indications, tips and tricks directly with the experts involved: Prof. Ing. Vincenzo Ferrari (University of Pisa) and Dr. Giovanni Badiali (S. Orsola University Hospital of Bologna).

This activity was hold on Friday, November 20th 2020 on ZOOM platform and the official language was English.

Prof. Claudio Marchetti (S.Orsola University Hospital in Bologna) was the chairman of the event and made a brief introduction to the audience.

Figure 18: VOSTARS webinar program

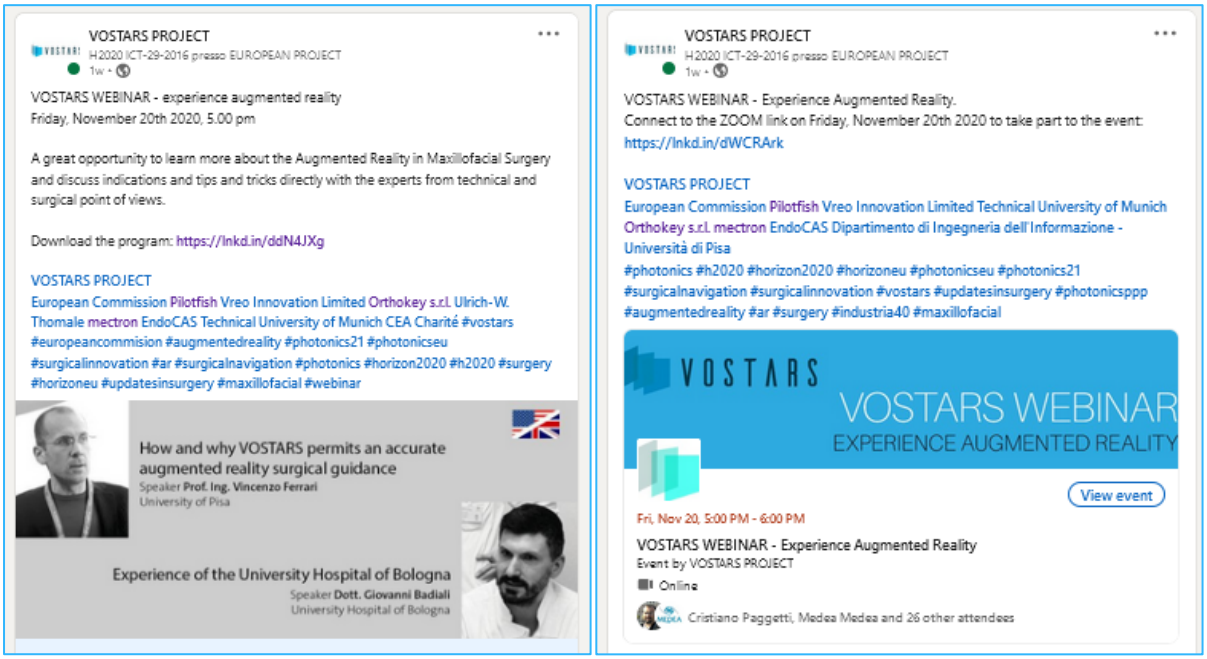
A really great activity and even well-organized was done to launch and promote the Webinar on the Website and on the Social Media platforms.

Organic posts and newsletters were published and sent weekly to all Maxillofacial Surgeons and Engineers.

The program was also shared with the European Associations of Cranio and Maxillofacial Surgeons (EACMFS), thanks to the involvement of Dr. Manlio Galiè (Maxillofacial Surgeon at the Hospital of Ferrara (Italy) and next President of the EACMFS).

The webinar was promoted on the VOSTARS social media as reported below:

LinkedIn



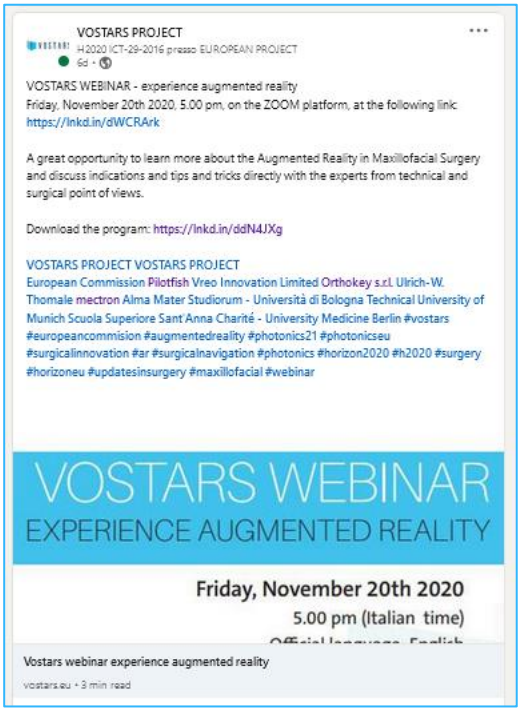


Figure 19: Linkedin post

Instagram

Figure 20: Instagram post

Twitter

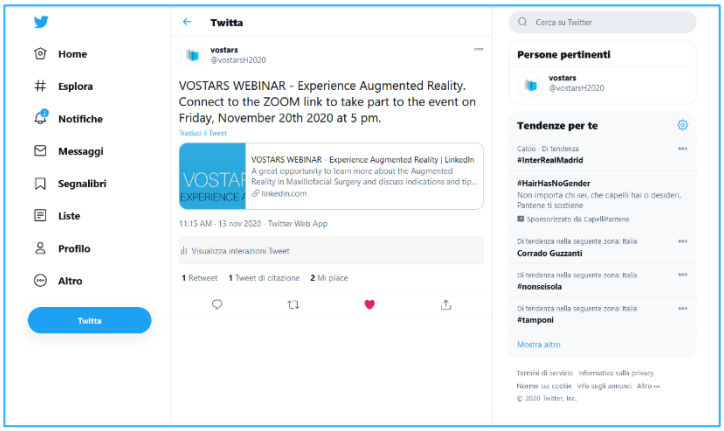


Figure 21: Twitter post

Newsletter

A newsletter was sent to all Maxillofacial Surgeons and Engineers contacts of the Consortium, involving them in a more personal and active way.

Results

81 participants took part at the event, showing a great interest in the topics and doing many questions at the speakers at the end of the presentations.

The audience was international.

All the webinar was recorded so to be shared with the participants and with the general public through the Social Media channels (such as: YouTube, LinkedIn, Instagram and Twitter).

Figure 22: VOSTARS webinar participants, first comments and brochure

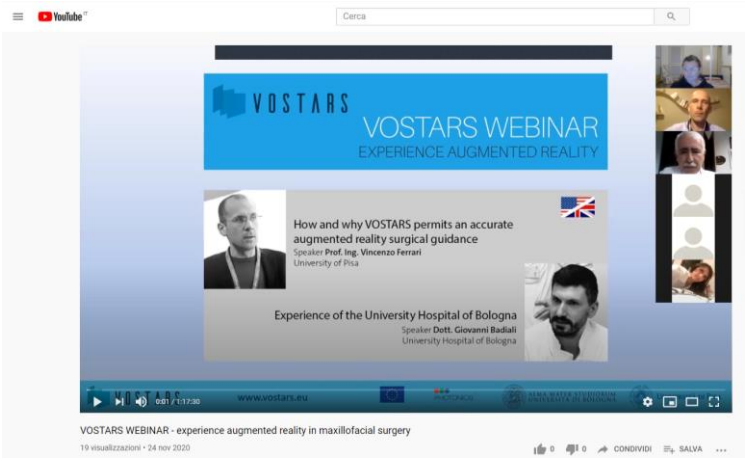


Figure 23: VOSTARS webinar on YouTube

LinkedIn

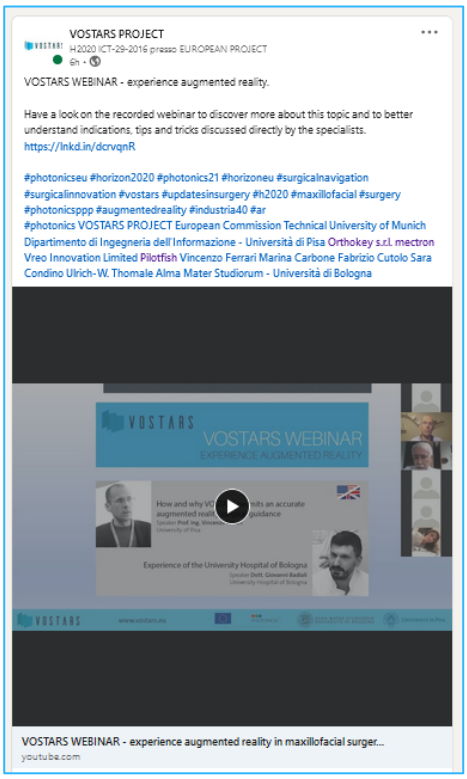


Figure 24: VOSTARS webinar video on LinkedIn

Instagram

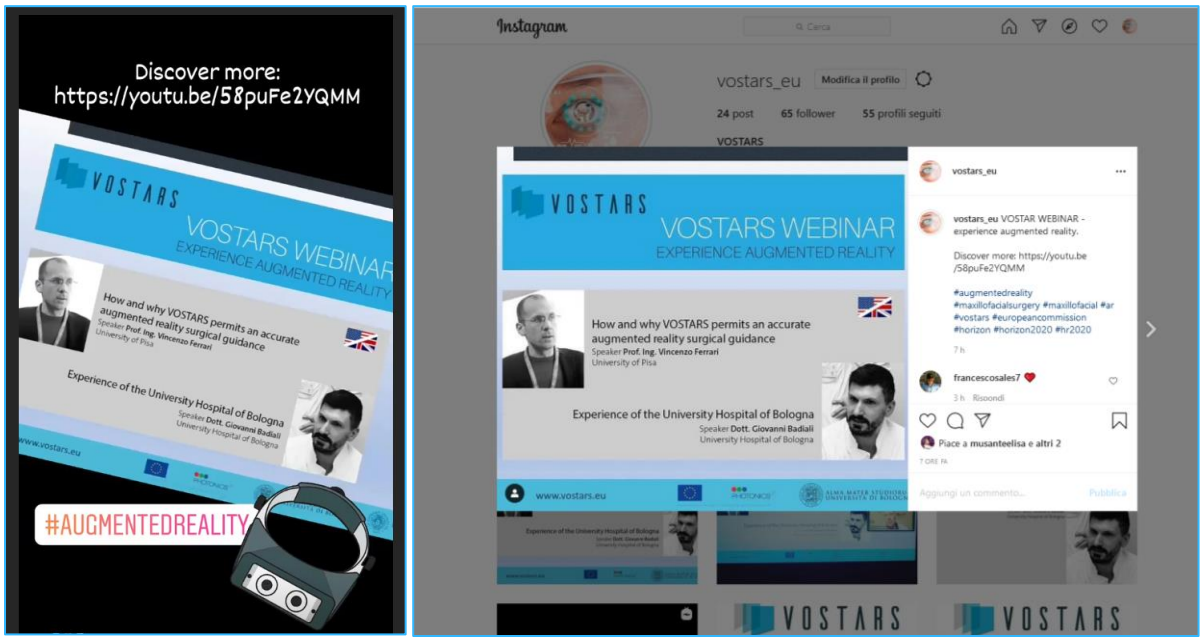


Figure 25: VOSTARS webinar video on Instagram

Twitter

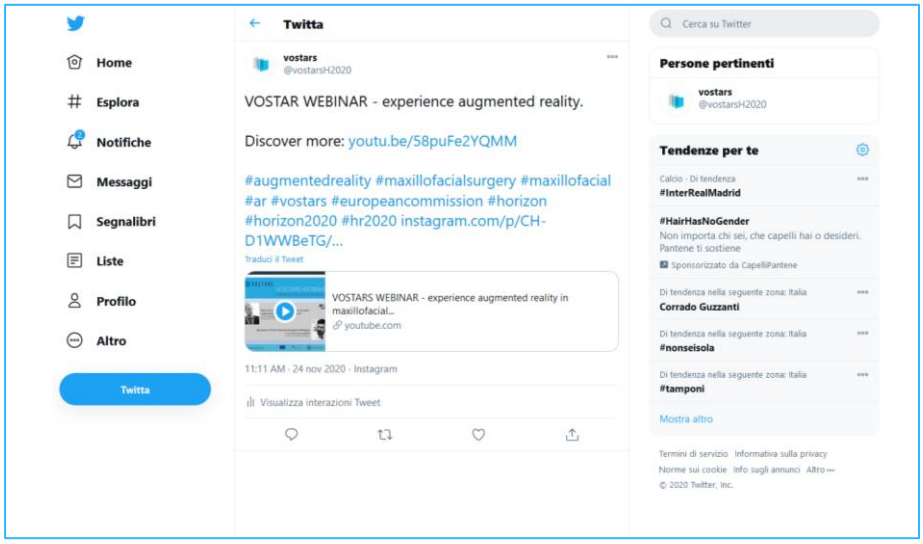


Figure 26: VOSTARS webinar video on twitter

Newsletter

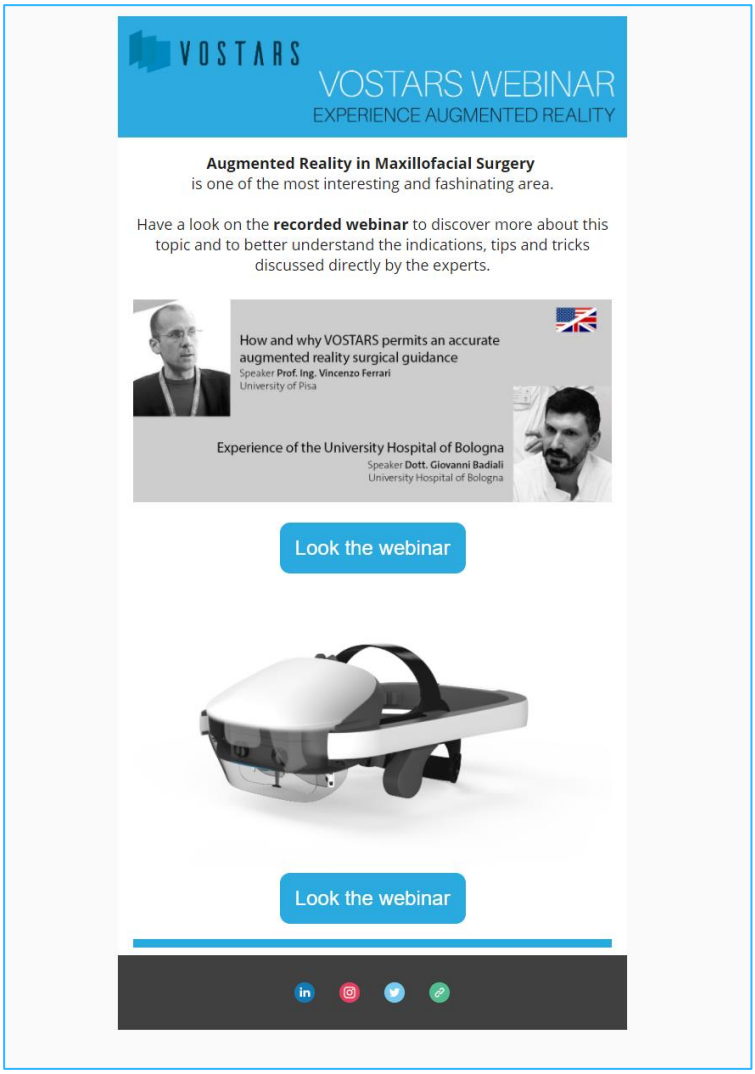


Figure 27: VOSTARS webinar video newsletter

2.5 Networking and synergies with other EC projects and initiatives

Objective of this kind of initiatives is to find synergies among EU initiatives and projects in order to maximise the impact of project results and strategies for future development.

In the time period M37-48 the VOSTARS project participated at the Health.E lighthouse support initiative

Event title and description	Objective	Date and Location	Involved Partner
HEALTH.E LIGHTHOUSE SUPPORT INITIATIVE H2020-EU.2.1.1.7 "1ST "VISION" WORKSHOP	Present potential impact on applications and markets such as healthcare	26th August 2020 Teleconference	**UNIPI Orthokey**

Health.E initiative will accelerate the innovation in medical devices and systems by stimulating the development of open technology platforms and standards, thereby moving away from the inflexible and costly point solutions that presently dominate electronic medical device manufacturing. VOSTARS is one of the invited projects to participate at the initiative. Objective of the workshop was to collect input and contributions for the publication of a position paper about smart bioelectronics future applications.

2.6 Scientific publications

At M48, n. **31 high impact original scientific publications were submitted** (of whom 28 from UNIPI and 3 from CEA). Even if we are talking about a limited time and considering that they are all very recent as publications (11 were published in 2020) with **a total of 105 citations** and a **mean field citation index over 3.22** this scientific production underlines the huge scientific advance that this project is bringing to the state of the art in head mounted displays, augmented reality and photonics in general.

The updated list, also available in the website dedicated page, is reported in the table below.

No.	Type	Title	Authors	Title of the Journal/Proc./Book	Citation #	Field Weighted Citation Impact	Partner
1	Article in Journal	A new head-mounted display-based augmented reality system in neurosurgical oncology: a study on phantom	Fabrizio Cutolo, Antonio Meola, Marina Carbone, Sara Sinceri, Federico Cagnazzo, Ennio Denaro, Nicola Esposito, Mauro Ferrari, Vincenzo Ferrari	Computer Assisted Surgery	33	5.99	UNIPI
2	Conference proceedings	[POSTER] Hybrid Video/Optical See-Through HMD	Fabrizio Cutolo, Umberto Fontana, Marina Carbone, Renzo D'Amato, Vincenzo Ferrari	2017 IEEE International Symposium on Mixed and Augmented Reality (ISMAR-Adjunct)	12	3.5	UNIPI
3	Article in Journal	Perspective Preserving Solution for Quasi-Orthoscopic Video See-Through HMDs	Fabrizio Cutolo, Umberto Fontana ,Vincenzo Ferrari	Technologies	12	-	UNIPI
4	Conference proceedings	Proof of Concept: Wearable Augmented Reality Video See-Through Display for Neuro-Endoscopy	Marina Carbone, Sara Condino, Fabrizio Cutolo, Rosanna Maria Viglialoro, Oliver Kaschke, Ulrich W. Thomale, Vincenzo Ferrari	Lecture Notes in Computer Science	3	1.52	UNIPI
5	Conference proceedings	A Microsoft HoloLens Mixed Reality Surgical Simulator for Patient-Specific Hip Arthroplasty Training	Giuseppe Turini, Sara Condino, Paolo Domenico Parchi, Rosanna Maria Viglialoro, Nicola Piolanti, Marco Gesi, Mauro Ferrari, Vincenzo Ferrari	Lecture Notes in Computer Science	8	3.55	UNIPI
6	Article in Journal	Augmented reality in open surgery	Benish Fida, Fabrizio Cutolo, Gregorio di Franco, Mauro Ferrari, Vincenzo Ferrari	Updates in Surgery	23	4.19	UNIPI
7	Conference proceedings	Closed – Loop Calibration for Optical See-Through Near Eye Display with Infinity Focus	Umberto Fontana, Fabrizio Cutolo, Nadia Cattari, Vincenzo Ferrari	2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)	6	2.89	UNIPI
8	Conference proceedings	InGaN/GaN µLEDS for display applications Optical and electrical characteristics spread comprehension	A. Daami, F. Olivier, D. Sarrasin, L. Dupré, F. Templier	Proceedings of the 2017 International conference on Solid State Devices and Materials	-	-	CEA
9	Article in Journal	The Role of Camera Convergence in Stereoscopic Video See-through Augmented Reality Displays	Fabrizio Cutolo, Vincenzo Ferrari	International Journal of Advanced Computer Science and Applications	5	0.93	UNIPI
10	Article in Journal	Letter to the Editor on “Augmented Reality Based Navigation for Computer Assisted Hip Resurfacing: A Proof of Concept Study”	Fabrizio Cutolo	Annals of Biomedical Engineering	6	0.79	UNIPI

11	Conference proceedings	InGaN/GaN µLEDS for display applications Optical and electrical characteristics spread comprehension	A. Daami, F. Olivier, D. Sarrasin, L. Dupré, F. Templier	Extended Abstracts of the 2017 International Conference on Solid State Devices and Materials	2	-	CEA
12	Article in Journal	Commercially Available Head-Mounted Displays Are Unsuitable for Augmented Reality Surgical Guidance: A Call for Focused Research for Surgical Applications	Marina Carbone, Roberta Piazza, Sara Condino	Surgical Innovation	4	4.58	UNIPI
13	Article in Journal	Review on Augmented Reality in Oral and Cranio-Maxillofacial Surgery: Toward "Surgery-Specific" Head-Up Displays	Giovanni Badiali, Laura Cercenelli, Salvatore Battaglia, Emanuela Marcelli, Claudio Marchetti, Vincenzo Ferrari, Fabrizio Cutolo	IEEE Access	2	0.82	UNIPI
14	Article in Journal	The VOSTARS project: a new wearable hybrid video and optical see-through augmented reality surgical system for maxillofacial surgery	G. Badiali, F. Cutolo, L. Cercenelli, M. Carbone, R. D'Amato, V. Ferrari, C. Marchetti	International Journal of Oral and Maxillofacial Surgery			UNIPI
15	Article in Journal	Ambiguity-Free Optical–Inertial Tracking for Augmented Reality Headsets	Fabrizio Cutolo, Virginia Mamone, Nicola Carbonaro, Vincenzo Ferrari, Alessandro Tognetti	Sensors	2	1.48	UNIPI
16	Article in Journal	Parallax Free Registration for Augmented Reality Optical See-through Displays in the Peripersonal Space	Vincenzo Ferrari, Nadia Cattari, Umberto Fontana, Fabrizio Cutolo	IEEE Transactions on Visualization and Computer Graphics	0	0	UNIPI
17	Conference proceedings	InGaN/GaN µLED SPICE modelling with size-dependent ABC model integration	Anis Daami, Francois Olivier	Physics and Simulation of Optoelectronic Devices XXVII	1	0	CEA
18	Conference proceedings	Green InGaN/GaN based LEDs: high luminance and blue shift	Anis Daami, François Olivier, Ludovic Dupré, Christophe Licitra, Franck Henry, François Templier, Stéphanie Le Calvez	Gallium Nitride Materials and Devices XIV			UNIPI
19	Article in Journal	The Wearable VOSTARS System for Augmented Reality-Guided Surgery: Preclinical Phantom Evaluation for High-Precision Maxillofacial Tasks	Laura Cercenelli, Marina Carbone, Sara Condino, Fabrizio Cutolo, Emanuela Marcelli, Achille Tarsitano, Claudio Marchetti, Vincenzo Ferrari, Giovanni Badiali	Journal of Clinical Medicine	0	0	UNIPI
20	Article in Journal	Toed-in vs Parallel Displays in Video See-Through Head-Mounted Displays for Close-Up View	Nadia Cattari, Fabrizio Cutolo, Renzo D'amato, Umberto Fontana, Vincenzo Ferrari	IEEE Access			UNIPI
21	Article in Journal	Are augmented reality headsets in surgery a dead end?	Vincenzo Ferrari, Marina Carbone, Sara Condino, Fabrizio Cutolo	Expert Review of Medical Devices	2	2	UNIPI
22	Article in Journal	Off-Line Camera-Based Calibration for Optical See-Through Head-Mounted Displays	Fabrizio Cutolo, Umberto Fontana, Nadia Cattari, Vincenzo Ferrari	Applied Sciences			UNIPI
23	Article in Journal	Wearable Augmented Reality Platform for Aiding Complex 3D Trajectory Tracing	Sara Condino, Benish Fida, Marina Carbone, Laura Cercenelli, Giovanni Badiali, Vincenzo Ferrari, Fabrizio Cutolo	Sensors	1	1.48	UNIPI
24	Article in Journal	How to Build a Patient-Specific Hybrid Simulator for Orthopaedic Open Surgery: Benefits and Limits of Mixed-Reality Using the Microsoft HoloLens	Sara Condino, Giuseppe Turini, Paolo D. Parchi, Rosanna M. Viglialoro, Nicola Piolanti, Marco Gesi, Mauro Ferrari, Vincenzo Ferrari	Journal of Healthcare Engineering	17	2.86	UNIPI
25	Conference	Towards a Wearable Augmented Reality Visor for High-Precision Manual Tasks	Cattari Nadia; Piazza Roberta; D'Amato Renzo; Fida, Benish; Carbone Marina; Condino Sara; Cutolo,	2020 IEEE International	0	0	UNIPI

	proceedings		Fabrizio; Ferrari, Vincenzo	Symposium on Medical Measurements and Applications (MeMeA)			
26	Article in Journal	Software Framework for Customized Augmented Reality Headsets in Medicine	Fabrizio Cutolo, Benish Fida, Nadia Cattari, Vincenzo Ferrari	IEEE Access	6	8.59	UNIPI
27	Article in Journal	Projected Augmented Reality to Drive Osteotomy Surgery: Implementation and Comparison With Video See-Through Technology	Virginia Mamone; Vincenzo Ferrari; Sara Condino; Fabrizio Cutolo	IEEE Access	0	-	UNIPI
28	Article in Journal	Wearable Augmented Reality Application for Shoulder Rehabilitation	Sara Condino, Giuseppe Turini, Rosanna Viglialoro, Marco Gesi, Vincenzo Ferrari	Electronics	6	1.19	UNIPI
29	Article in Journal	AUGMENTED REALITY TO IMPROVE SURGICAL SIMULATION. LESSONS LEARNED TOWARDS THE DESIGN OF A HYBRID LAPAROSCOPIC SIMULATOR FOR CHOLECYSTECTOMY	Viglialoro R. M., Esposito N., Condino S., Cutolo F., Guadagni S., Gesi M., Ferrari M., Ferrari V.	IEEE Transactions on Biomedical Engineering	7	2.20	UNIPI
30	Article in Journal	Review of the Augmented Reality Systems for Shoulder Rehabilitation	Rosanna Maria Viglialoro, Sara Condino, Giuseppe Turini, Marina Carbone, Vincenzo Ferrari, Marco Gesi	Information	9	1.07	UNIPI
31	Article in Journal	Perceptual Limits of Optical See-Through Visors for Augmented Reality Guidance of Manual Tasks	Sara Condino, Marina Carbone, Roberta Piazza, Mauro Ferrari, Vincenzo Ferrari	IEEE Transactions on Biomedical Engineering	25	6.92	UNIPI

2.7 Communication and dissemination outcomes and KPIs monitoring

Objective of the communication and dissemination of VOSTARS project results during the project lifespan was to present VOSTARS concept and benefits especially towards:

- the **general public** to spread VOSTARS project outcomes and raise awareness in patients and general public about benefits of AR applications in the surgery domain.

Expected outcome: inform about potential benefits and project progression.

Expected impact: to spread VOSTARS project outcomes and raise awareness in patients and general public about benefits of AR applications in the surgery domain.

Results: an intense activity was implemented towards the general public, a huge number of press articles and social media activities were implemented.

Related KPIs: N. 33.000 web site visits, N. 243 followers on social media, N. 117 press articles, N. 6 video on the You Tube channel (including VOSTARS webinar).

- the **final users** (surgeons) in order to increase visibility and awareness of VOSTARS solution towards a real adoption in clinical practice.

Expected outcome of this activity is collect feedback and understanding on how to properly raise the value of the VOSTARS system in terms of acceptability, usability and about possible new surgical applications.

Expected impact of this activity is raising willingness to try and adopt final system directly in the Operating Theatre, as well as communicate the potential benefits of VOSTARS system.

Results: as result of this activity the consortium received useful indication about possible VOSTARS applications, and interest of a certain number of surgeons to test the VOSTARS system.

KPIs: N. 99 direct contact with surgeons and collection of feedback through questionnaire administration; N. 6 publications on medical journals; N. 7 papers and VOSTARS public presentations to medical congresses. N. 5 a video concepts for the VOSTARS surgical applications.

- **Academy, industry and technology developers**

Objective: to disseminate knowledge and results to the scientific and industrial community. Expected **Outcome:** to encourage and foster future technological developments beyond current state of the art.

Expected impact: to create a network for advancements around AR in surgery.

Results: the VOSTARS researchers were invited for technical speech and seminars in order to present VOSTARS technological advancement with respect to the state of the art, besides contacts with companies and possible investors.

KPIs: N. 20 publications on technological/scientific magazines; N. 6 articles on commercial magazines; N. 6 papers and VOSTARS public presentations at technical congresses.

- **European Union Institutions**

Objective: keep EU institutions informed of project progress and results and sharing on future strategy. **Expected outcome:** tap into the EC communication and dissemination channels to reach a wider audience.

Expected impact: raise the profile of the project at an institutional level and generate the basis for a VOSTARS 2 initiative.

KPIs: presence at N. 2 EC networking events.

Following a synthesis of communication and dissemination KPIs monitoring. Deviations are mainly given to the Sars Cov 2 pandemic impact on in presence events.

KPIs monitoring at M48

KPI	Description	Target	M36 Monitoring	M48 monitoring	Note
Dissemination KPIs					
DKPI1	N. of direct contact with surgeons and collection of feedback on technology acceptance, application and usability, through questionnaire administration.	200 or more	**72**	**99**	Non achievement of the objective is due to the cancellation of in presence events
DKPI2	N. of papers and speech at medical congresses	7 or more	**5**	**7**	
DKPI3	N. of scientific publications on medical journals	3 (at least)	**2**	**6**	Publications repository on the EU platform
DKPI4	N. of direct contact with healthcare managers and collection of feedback through questionnaire administration	25 or more	**0** Administration foreseen for the forthcoming months	**0**	It was decided not to administer questionnaires to the healthcare managers
DKPI5	N. of presence on the EC dissemination channels and events.	1 x year	**1**	**1 per year**	Dissemination report on repository
DKPI6	N. of publications on technological/scientific magazines;	4 x year (at least)	**12**	**20**	Publications repository on the EU platform
DKPI7	N. of articles on commercial magazines	1 x year	**1**	**6**	Press review on the website

DKPI8	N. of papers and VOSTARS public presentations at technical congresses;	3 x year	**4**	**6**	Dissemination report on repository
DKPI9	N. of video concept	4 (one per each application + 1 concept)	**3** (2 application + 1 concept)	**5**	Dissemination repository YouTube channel
Communication KPIs					
CKPI1	N. of website visits	150/month	**23,829**	**33,000 total**	Google analytics/ARUBA statistics
CKPI2	N. of downloads (videos / press kits /brochures)	30/month	**Not available**	**Not available**	Google analytics / ARUBA statistics
CKPI3	N. of posts (LinkedIn, Instagram) and tweet (twitter)	3/month	**0.7**	**2/month**	Linkedin, Twitter, Instagram registry
CKPI4	N. of followers (LinkedIn, Instagram, twitter)	300	**104**	**243**	Linkedin, Twitter, Instagram registry
CKPI5	N. of general media presence	30	**15**	**67**	Newspaper, radio, TV
CKPI6	N. of leaflets, gadgets and other communication material	1000 per surgical application	**500** (maxillo) **250** (neuro) General gadgets/material **>1000**	**Prepared but not printed due to COVID***	Supply order

3 Conclusion

The communication and dissemination activities reached the expected audience of the VOSTARS project raising interest in project implementation and achievements. Interest in the project achievements and results grew once the trial phase started. The most important results are related to the interest of surgeons to test the VOSTARS system. In the forthcoming months the consortium will go on promoting the VOSTARS project results towards general public, clinicians, academy and investors.

4 Abbreviations

AR	Augmented Reality
CKPI	Communication Key Performance Indicator
DOA	Description of Action
DKPI	Dissemination Key Performance Indicator
ENT	Ear Nose Throat
HMD	Head Mounted Display
HTA	Health Technology Assessment
IGS	Image Guided Surgery
KET	Key Enabling Technology
KOLs	Key Opinion Leaders
KPIs	Key Performance Indicators
M	Month
OST	Optical See Through
TRL	Technology Readiness Level
VR	Virtual Reality
VST	Video See Through
WP	Work Package