FURNIT-SAVER

Smart Augmented and Virtual Reality Marketplace for Furniture Customisation

D5.4 White Paper

Use of Information and Communication Technologies to increase the customer satisfaction in the European furniture sector

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Scope of the document

This White Paper is intends to offer to the furniture sector and to anyone interested the vision and some of the conclusions and insights gathered from the FurnIT-SAVER project consortium with respect to the definition, use and adoption of ICT technologies in the selling process of furniture pieces and designs through the FurnIT-SAVER platform.

The conclusions addresses both the purchase of furniture from domestic users (from a single furniture pieces to a whole room configuration) as well as from professional users, the so called *contract channel* (hotels, restaurants, offices and other business facilities). The document offers the different points of view from the involved stakeholders, represented by the consortium or interviewed during the project lifetime, that is:

- Domestic customer
- Professional user
- Furniture salesperson
- Furniture manufacturer

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1 Executive Summary

In most of the cases, when a customer enters a furniture shop, the technology used by the seller to show how the furniture will be located in its final location is paper and pencil. Usually, the seller draws in the paper the furniture the customer wants, taking special attention to the measures. It is not easy to imagine the furniture in the new environment using a piece of paper. But, in very few cases, the furniture sellers are supported by technological applications like Home Planners that can help (more than paper and a pencil) the customers to visualise the furniture pieces.

The objective of the project is to integrate already existing Information and Communication Technologies to enhance the customer experience and increase their final satisfaction in the European furniture sector. One of the factors that helps to improve the purchasing experience and overall satisfaction is to provide the customers the capability of realistically visualizing the furniture they need in the exact place they want.

This progress made possible by the FurnIT-SAVER project by combining 3 main existing technologies: Virtual Reality, Augmented Reality and Recommender engines.

Using these technologies, the customers can define the room layout to be furnished using the Virtual Reality Environment, add the furniture pieces in the location they want, do the necessary changes they need depending on their preferences, receive additional recommendations from the recommender engine based on artificial intelligence, assign markers to the furniture pieces and save all the furniture combinations they need.

The customers use a mobile device (tablet, smartphone) to see the furniture pieces at home. They print the assigned markers in the Virtual Reality Environment and place them in the exact location they want to see the furniture. They use the Augmented Reality App to see virtual furniture at home.

From the visualisation point of view, the project has many advantages compared to the current paper and pencil methods.

FurnIT-SAVER's users can be of a multiple profiles and background: they can be domestic customers that wants to buy some furniture pieces for home, salespersons that work in furniture shops to help their customers and professional clients working in the "contract channel" such as designers, architects, home interior designers, ... that carry out projects for community equipment like hotels, schools, offices, etc.

The feedback of the customers that have seen demonstrations of the virtual and augmented reality environments is very promising. Most of them think that the project developments are very useful to helping them buy furniture because they will have a very good idea about how the furniture will look at the final location, avoiding returning products and increasing their satisfaction.

2 How it works

The FurnIT-SAVER project makes use of innovative ICT solutions based on a combination of Virtual and Augmented Reality (VR/AR) technologies and recommendation engines to produce a smart marketplace for furniture customisation.

Customers will be able to select among an extensive furniture catalogue and properties and virtually try the selected pieces in their rooms with three very simple steps:

- Creating an accurate 3D virtual representation of their place drawing it in the personal computer environment using the Virtual Reality Environment.

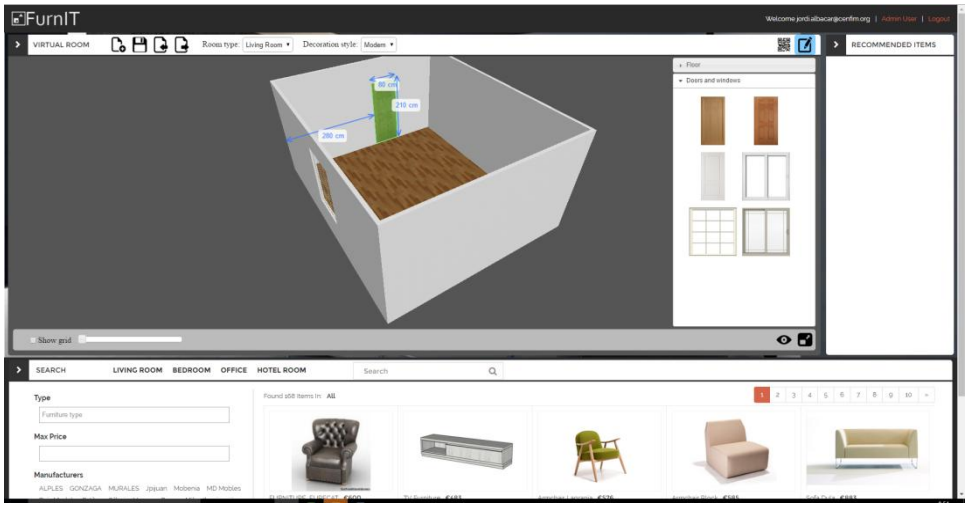


Figure 1: FurnIT-SAVER's 3D room planner

- Trying furniture in this virtual scenario and get recommendations according to their preferences and similar user preferences of a wide range of properties and pieces.

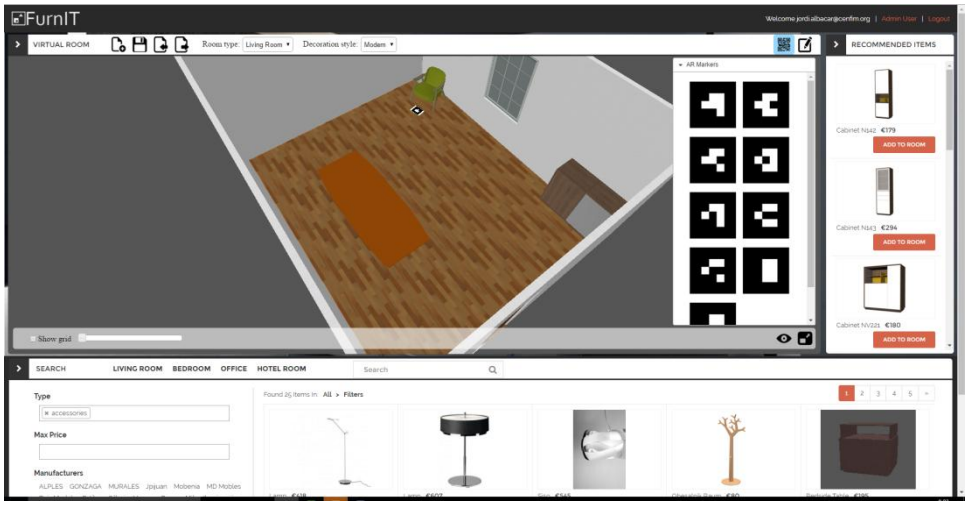


Figure 2: FurnIT-SAVER's VR environment and recommender engine

- Visualizing the fit of the chosen products in their place using Augmented Reality App.

Figure 3: FurnIT-SAVER's AR environment

2.1 Devices and interfaces

The following devices and interfaces can be used to access the platform and perform the different actions:

- Desktop computer, laptop (PC) or tablet, for the Virtual Reality Environment.
- Mobile devices (Smartphone, Tablet), for running the Augmented Reality App.

2.2 Type of users

2.2.1 Domestic customer

Individuals, usually buying home furniture pieces, who can use FurnIT-SAVER to visualize and make the purchase process easier while reducing uncertainty. These domestic customers can use the FurnIT-SAVER tools in different ways:

- Using all the tools at home experimenting with their creativity.
- With the support of a furniture salesperson in a physical store, helping them to furnish the room. The domestic customers can start using the virtual reality environment before going to the furniture shop or not. After going to the furniture shop, they can use the Augmented Reality App to see the final furniture combination at home

2.2.2 Professional clients

The professional clients are designers, architects, home interior designers, etc, offering services in the "contract" channel (hotels, schools, hospitals, offices...). They benefit from the same innovations than the domestic customers, in addition to the advantage that they can optimize the design process by reusing digital designs from room to room.

For example, different hotel rooms can have different layouts, but they usually have the same furniture pieces. Another big advantage is that they have a set of furniture providers all available in a single platform that should cover all their needs.

2.2.3 Furniture Salespersons

Salespersons who sell furniture in furniture shops (retailers). They help the furniture purchasers to define the room layout where to place the furniture and/or explaining the "domestic customers" how to use the virtual and augmented reality environments.

They have the added value of the knowledge and experience in the furniture sector. FurnIT-SAVER helps them save time in the sales process, while giving their clients more reassurance.

2.2.4 Furniture manufacturers

Manufacturers providing their furniture pieces to the Virtual Reality platform. They have the ability to upload into the FurnIT-SAVER database their furniture pieces and associated attributes (type, colours, finishes, materials, ...) in an easy way, so that the customers (domestic, professionals and salespersons) will be able to select and visualize them in the virtual and augmented reality environments.

3 Project Technologies

This project aims to take advantage of existing, market ready ICT technologies to increase productivity and to stimulate international competitiveness. It does so by providing an integrated online platform which allows furniture customers to visualize in Virtual Reality their home environment before selecting and being recommended appropriate furniture from many SME furniture suppliers to fit this environment and their personal tastes. They are then able to modify the furniture according to certain options set by the manufacturer. Once they are happy with their selection of products and the modifications, they are able to visualise, using Augmented Reality, this collection of products in the exact location where they intend to place the furniture. Retailers will also be able to assist customers in viewing the furniture using the same tools.

3.1 Virtual reality

From the furniture sector use point of view, the Virtual Reality platform has 2 main type of users and functionalities:

- Allow the furniture manufacturers to upload their models with the associated attributes, that can be used be the Virtual Reality Platform users. The platform provides an easy wizard approach to ingest new furniture in the platform and avoids common mistakes like correct orientation, size and material appearance.
- Allow domestic customers, furniture salespersons and professional clients to define the room layout to be furnished, design and visualise in 3D their furniture combinations and save them in their personal area. The platform provides an intuitive layout generation tool that enables the user to draw the layout directly in the web browser providing measurements and doors/windows locations.

The FurnIT-SAVER Server web client follows the WebGL guideline https://www.khronos.org/webgl/. The WebGL framework is supported by almost all the actual web browser including also the mobile platforms.

3.1.1 Manufacturers

The project allows SME furniture manufacturers to easily submit their furniture catalogue in a way which can be visualized in 3D and characterised by means of a list of attributes and rules about modifications.

The furniture ingestion procedure covers the following aspects:

- Upload 3D models complete of textures;
- Adjust the orientation;
- Adjust the scaling;
- Definition of metadata (name, colour, tags, prices, ...);
- Definition of different configurations;

To upload the 3D models into the Virtual Reality Platform, it is necessary to follow several guidelines:

3.1.1.1 Geometric guidelines

- The 3D format supported for the automatic model import are .3DS file format or .DAE file format.
- To guarantee a smooth user experience the number of vertices for a model should not exceed 20K. The importer will give a warning if this threshold is reached but lets the user decide whether to continue or not.
- The 3D reference system shall be the one shown in the following figure. The importer provides the capability of rotating the model until the correct orientation is obtained.

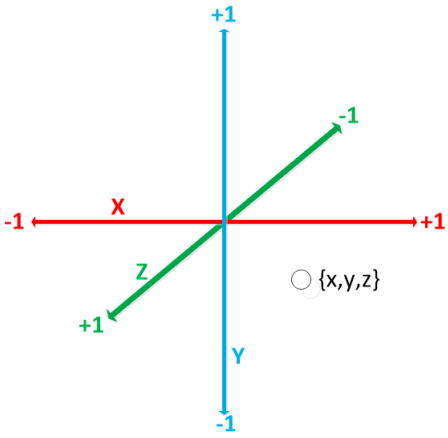


Fig. 1 – WebGL Reference Axis

- The 3D model metrical unit is centimeters. Scale can be adjusted from the importer wizard.
- The 3D model shall be composed of polygons. Parametric or functional geometry, like nurbs, are not supported.
- Each vertex must have normal component to interact with the shading engine.

3.1.1.2 Material guidelines

- The model shall define a material for each of the different model parts (e.g. for a table one material assigned to the legs geometries and one material assigned to the table surface geometry). The importer allows to configure the properties for such materials (i.e. color, shininess, transparency, etc)
- Textural geometries shall contain the texture coordinates. The importer allows to assign/replace textures for each material, only if the corresponding geometries provide texture coordinates at each vertex. Only one texture coordinate is supported.
- No bump or reflection mapping is supported by the importer.

3.1.1.3 Textures guidelines

- The texture file formats supported are .png, .jpeg, .bmp, .gif

- The maximum texture size (for each dimension) is: 1024. The importer will automatically resize textures of bigger dimensions.
- The texture size for each dimension (width and height) must be power of two (ex. 16, 32, 256, …). The importer will automatically resize all textures to the nearest power of two.
- Texture can contain transparent areas (coded in the image alpha channel)

3.1.2 Domestic customers, professionals clients and salespersons

The other main group of Virtual Reality Platform users are the domestic customers (from home or at the furniture shop), the furniture salespersons, and the professional clients such as architects or interior designers that usually work for contract channel: high-volume clients like offices and hotels.

This diversity of users utilize the Virtual Reality Platform to design, personalize and visualize the furniture combinations depending on their preferences. They have the possibility to define the room layout of the space to be furnished in a very easy way or load any combination already saved in their personal area.

The users can add new furniture pieces or remove the existing ones in the room layout, be recommended with some other furniture and accessories that meets their needs and tastes and move and change the furniture models to different room locations.

There are a lot of possibilities for visualising the room, from most of the angles and axis, even staying inside the room to be furnished.

Once the design and personalization is finished, the user can add a marker to the furniture combination that want to see at the final location. This marker must be downloaded and printed because it will be necessary for the Augmented Reality App.

As many combinations as the users think necessaries could be saved in their personal area.

From the users (domestic customers, salespersons and professional clients) point of view, the Virtual Reality Environment allow them to define and personalise many different furniture combinations in order to find the one that best fits with their preferences. Having the opportunity of adding, moving, changing attributes of the furniture and decoration accessories and visualising in multiple combinations in the Virtual Reality Environment, increases users satisfaction and reduces uncertainty and subsequent product returns.

3.1.3 Virtual Reality Capabilities

The capabilities of the Virtual Reality environment allow to design complex spaces and go for a walk inside the room.

Figure 4: FurnIT-SAVER Virtual Reality Environment allows to design complex spaces

Figure 5: Using the FurnIT-SAVER Virtual Reality Environment is possible to “go for a walk” in the room

3.2 Augmented reality

The augmented reality feature adds virtual elements (furniture and decoration accessories, in case of the FurnIT-SAVER project) in the real environment to create a mixed between real images and virtual objects.

The combination of a virtual element with the real world allows the users to have a more intuitive idea about how the furniture fits in the physical location, assuring the users that the selected furniture combination match with their expectations, and an overall improved purchasing experience.

The FurnIT-SAVER framework provides a mobile app to display virtual furniture representation synched with the smartphone movements using camera and accelerometers, the effect is to have the virtual furniture presents in the real user room.

The correlation between the virtual and real environment is realized using markers, the web virtual reality section provides a functionality to virtually locate the markers in the virtual room layout (and also provide to print functionality). Then the user has to place the printed markers in the real room so that the mobile app can retrieve this spatial reference and draw the virtual furniture.

3.3 Recommender engine

Recommender engines are essential today in any successful online marketing strategy. Discovering the user preferences, learning from experience, following and using the user behavior for offering better options, while improving user experience and reducing search times.

First recommender engines follow a basic market model where recommender work based on distances and similitude measures between the characteristics of the products and the user preferences. One of the first basic approaches used in recommender engines was the *collaborative filtering,* since the mid 90's.

From the beginning to our days, research on recommendation algorithms has become prolific and extensive. This is mainly due to the many possibilities that recommenders can offer, from making suggestions to potential customers, to selecting investment strategies or trend topics for get public attention. Moreover, many online shops have incorporated recommender engines in their e-commerce services.

3.3.1 Recommender engine architecture

Taking in account both the wide set of possibilities that can offer recommender engines and also the continuous algorithm improvements that we can expect, the implemented recommender engine was built following a growing-enabled strategy based on the split of the engine in several functional modules:

- Data Structure: Handles definition of entity relations. This module allows changing the structure of the data handled: classes of elements, attributes and relationships.
- Data Capture: Handles real data capture. This module takes the definitions of data structure provided through the previous module and adapts the definitions for creating a working interface specific for the data injection and retrieval.
- Structure Analysis: Constructs dynamic queries based on the classes relations defined in the Data Structure module. This module exhaustively searches the open dependency paths between element classes and attributes. The result of these analyses is a set of operational queries that may be used for determining the relationships among objects.
- Capture Analysis: It is the core of recommender. This module uses the Data Capture values and the Structure Analysis queries for doing specific recommendations.
- Query interface: human-like interface using human-like expression language. Taking in account the Data Structure definitions, this module provides a language structure and rules for expressing queries to the recommender.

These modules were designed following SOLID principles (object oriented programming and design). The goal was to design a flexible architecture whose internal subsystem interfaces abstracts the implementation details for each module.

3.3.2 Innovations

The presented development offers two novelties as regarding its architecture:

- As of creating an internal and rich set of resources for the recommender algorithm (Capture Analysis) enables the possibility for modifying or improving this recommender algorithm in an isolated manner. The ability of changing the data structures allows to continuously applying the acquired experience to improve the recommendations quality.
- As of combining Structure Analysis and human-like querying expressions (Query Interface) allowing to apply the recommender engine power to unplanned queries. This may be, for example, used for suggest users for some article promotion, colours for products of manufacturers selling in a particular country, etc. The recommender could be used for investigate on unpredicted relations in a consistent manner.

Furthermore, as the implemented recommender is designed with an open interface (based in REST) it allows changing the data model definitions (structure and relationships) andit is not restricted for the use in any closed domain. The benefits from this flexibility come both by allowing the use of the recommender in several contexts and by enabling the improvement of the model on the basis of the accumulated experience by its usage.

4 The relevance and challenge of customisation

The customisation and mass-customisation of furniture hold the potential to become a significant growth and differentiation factor for manufacturing SMEs in the sector. One of the core values of the FurnIT-SAVER platform was to empower customers to request such customisations and adaptations.

Currently, the platform allows manufacturers to determine, based on product safety, available materials and machinery, the limitations of product adaptations when uploading furniture designs. However, our approach has revealed an important technological gap that needs to be bridged before furniture manufacturing SMEs could truly move towards cost- and design-efficient product customisation in a VR/AR environment. Current standard design formats (.DAE and .3DS) do not permit parametric modifications in VR/AR environments. Nonetheless, these file formats are the most widely used 3D formats in the industry and excluding them would have greatly lowered FurnIT-SAVER's usability and projected market acceptance. The result is that our platform is accessible and useful for the majority of manufacturers; yet, it does not support automatic parameter-based furniture modification in the VR/AR environment.

In our market research we have identified a number of companies who have, to a certain extent, addressed this challenge. However, these companies have either created a proprietary file format, which is incompatible with standard 3D files used in the industry, or have created, in a labour-intensive process, parametric modifications for a limited number of product on their catalogue. At this time, we do not believe that these offerings are coming close to solving this challenge.

We therefore call on future initiatives to focus resources on solving this challenge by either transferring solutions from other markets or by developing a tailored solution for the furniture industry.

5 Integration with eCommerce Platforms

One of the advantages of using the technologies integrated in the FurnIT-SAVER project is that the customer who wants to buy furniture and decoration accessories could use these tools without any help. For this reason, any eCommerce Platform and/or manufacturer web-site could include these tools for helping the users in their buying processes.

5.1 Advantages

5.1.1 Customers

It makes the online shopping experience more fun and secure. Fun because the customers can play and see more options and secure because as long as the customers see more in detail the product they want to purchase. They have less possibilities to make a wrong decision.

It is especially important when the product to buy is big or expensive, because the customers need to be very sure about their decision (for example when talking about furniture).

5.1.2 People

The project will help to reduce the technological gap between people, because the pre-existing knowledge to use the virtual and augmented reality environments is near zero. Then, no-technological profile people can manage and use these technology environments very easily and with no effort.

Thanks to these technologies more and more people will buy online reducing the technological gap.

5.1.3 Furniture sector

For eCommerce platforms, one of the biggest entry barriers is that people are concerned that the product they are buying may not fit what they see on the screen. In that sense, all the technology (as the virtual and augmented reality) that helps the people to better visualize the product they are searching, will greatly benefit the eCommerce industry.

Another advantage for the furniture sector, and for the eCommerce platforms in particular, is that the level of product returns will decrease. People see the product more in detail visualizing in the real location, and comparing it with all the other existing furniture. This pre-test before buying the product increases the probability that when the customers receive the furniture, they will not need to return it.

5.2 Disadvantages

People must have access to an internet connection and devices such PCs, smartphones and tablets. This means a very small portion of the population may not have access to or

knowledge of these technologies. This is solved, to a certain extent by allowing them to use these tools at the shop with the salesperson assistance.

While we may think that the perfect target users are tech-savvy young people, our validation activities, carried out with real users (ageing 24-58) in furniture shops, reveal that age and profession are not determining factor on the users' view of the platform. In fact, many of our older users reported to have used the internet before to search for furniture. All, regardless of age, were pleased with FurnIT-SAVER and would recommend it to a friend.

Another disadvantage is that technologies usually are expensive for the company enterprises (including eCommerce platforms), and require time and changes to implement them. For example, a furniture shop may have to invest in purchasing some tablets and additional PCs so that they have enough working stations where salespeople can access FurnIT-SAVER together with clients. In addition, nowadays there are many free open source eCommerce platforms that allow a business to quickly and easily set up and online shop. FurnIT-SAVER plans to provide its tools as addons on the main platforms (such as PrestaShop), so as to increase its outreach and impact on the furniture sector.

Finally, technologies need to be user friendly if we want people to use them and that needs a lot of development and research. During our validations, we have learnt that while domestic end-users are quite pleased with the level of usability, manufacturers and retailers still report some usability issues that would need to be addressed in the product development stage, prior to any commercial release.

6 Benefits of sharing the FurnIT-SAVER platform between manufacturers

The general opinion among manufacturers and their salespeople is that FurnIT-SAVER could be a good additional tool for attracting customers and providing them with new ways to visualise the products. Especially, AR is very interesting for them.

Another valued FurnIT-SAVER feature is the possibility to share furniture combinations between sales person and customers online (currently it is possible to export and import furniture combinations). Also, manufacturers are able to build up their own catalogues online and then share access with purchasers and stores to use in their selling process.

A group of companies may, with the FurnIT-SAVER VR/AR platform, create a common promotional channel. Another valued possibility is that a client has at their disposal 3D furniture/catalogues of different manufacturers in the same VR/AR platform. This is an especially desirable feature in cases where furniture manufacturers are complementary with each other (as in the case of manufacturers collaborating in the same showroom).

FurnIT-SAVER platform at this stage mainly represents the promotional channel, but can also be upgraded into first point of on-line sales process, if we add an option to create (export) orders to a manufacturer or furniture shops. As this requires quite a sophisticated system that allows businesses a clear order, oversight of complete the order, to provide the necessary time to manufacture and complete delivery, payment, complaints, perhaps a more simple solution is to integrate it with an OS e-shop that already supports these options.

Also interesting is the possibility that companies organize online 3D catalogues of furniture that can be shared with its existing furniture stores. Thus, the manufacturer’s catalogues are always centrally organized and up to date and printing and distribution are not necessary because everything is on-line.

The companies may use FurnIT-SAVER platform also as a strong incentive to move to 3D (virtual) product development. Quality 3D models are the basis not only for VR / AR but also for visualization and Internet sales. It that way FurnIT-SAVER promote faster and cheaper product development, manufacturing, promotion and sale (Industry 4.0).

7 Use the FurnIT-SAVER platform for increasing the sales – GONZAGA partner experience

Manufacturer using FurnIT-SAVER for VR/AR visualization of their products, can potentially speed up and simplify the sales process. For individual and professional customers, the procedures of space/room measurement, and then fitting the furniture platform, will be significantly shortened by using FurnIT-SAVER.

Salespeople using PC and tablet can directly prepare the visualization of a space with the client, until the client is satisfied, and then place an order. This process can also take place remotely, which is also very useful as it brings manufacturers closer to their clients. The use of this technology is also an additional marketing asset and a useful tool for reducing the cost of sales.

GONZAGA's experience from its participation in the project is quite positive. The project provides the possibility to network and collaborate with like-minded companies with similar idea across Europe. Access to finance is another important aspect as without the EC contribution, furniture manufacturers and retailers would not have been able to finance and push forward this concept. On another hand, project participation adds some administrative overhead and discussions between partners may be time-consuming.

We believe the true motivation for companies to enter projects such as FurnIT-SAVER should not be the short term finances, but the belief in the project ideas and its long term strategic importance for the company. It is also crucial that, especially in first project participations, companies receive assistance in entering into international consortiums and in project administration. To truly gain real benefits from the project and its results, a company must be an active partner and also to build up own network, which can open the way for commercialisation and a new business cooperation.

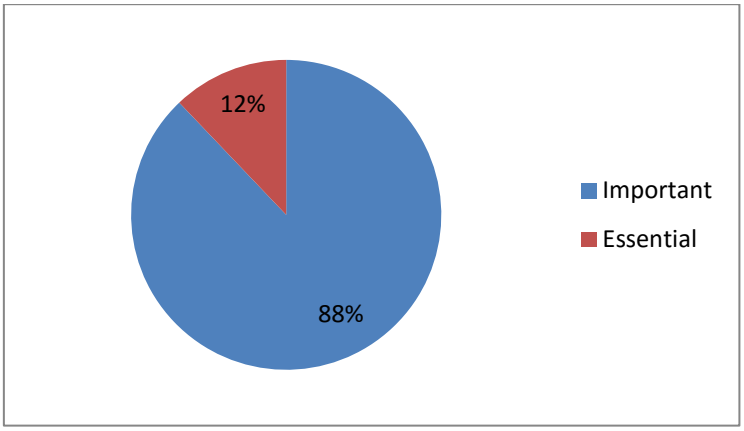
8 Market validation - Feedback from users

8.1 Domestic customers

The project feedback was collected from interviews to domestic customers in furniture shops, professionals of "contract channel", manufacturers and salespersons.

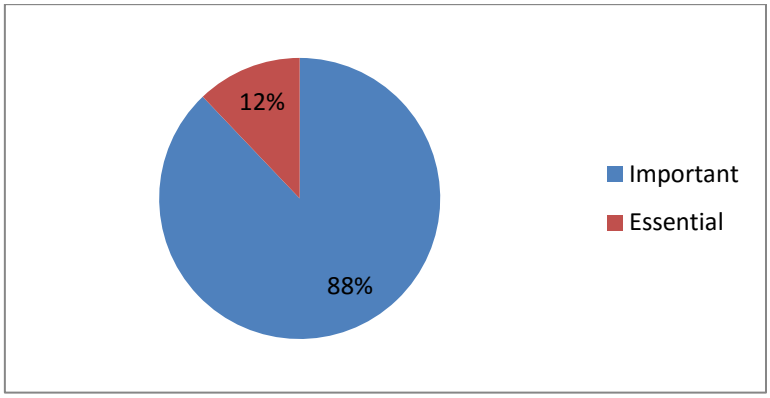
Taking into consideration that the most important feedback is about increasing the customer satisfaction, the following graphics and numbers show the customers answers.

Q1: Do you consider important visualizing the furniture in the Virtual Reality Environment for your purchasing process?



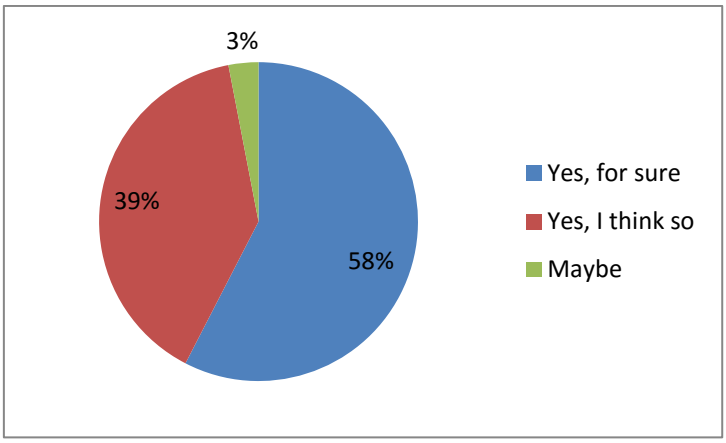
Most of the customers answer "important" and nobody had chosen other options like "So so" and "No" when the question was about the importance of the Virtual Reality Environment. This is one of the main factors to think that the project developments are positive for the furniture purchasers.

Q2:Do you consider important visualizing the furniture in the Augmented Reality application for your purchasing process?



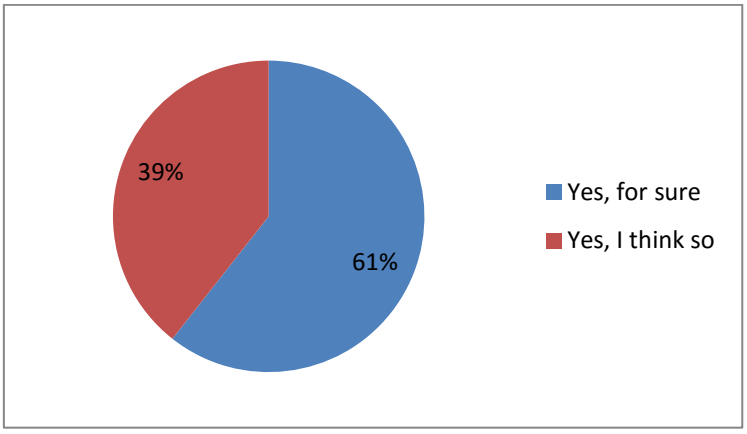
In the same line than with the previous question about Virtual Reality Environment, in case of the Augmented Reality App nobody had chosen the options "So so" and "No".

Q3: Would you use the FurnIT-SAVER platform in the future?



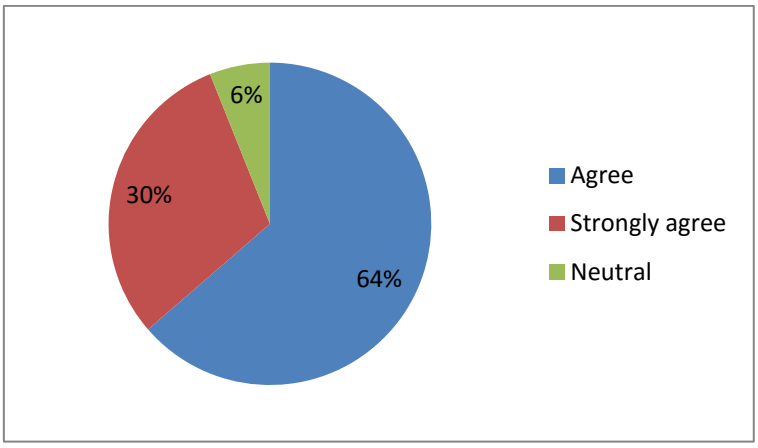
A very big percentage of the users will use in the future the platform if they can. Nobody choose the “No” option, and the “Yes” set of options is almost 100%

Q4: Would you recommend the FurnIT-SAVER platform?



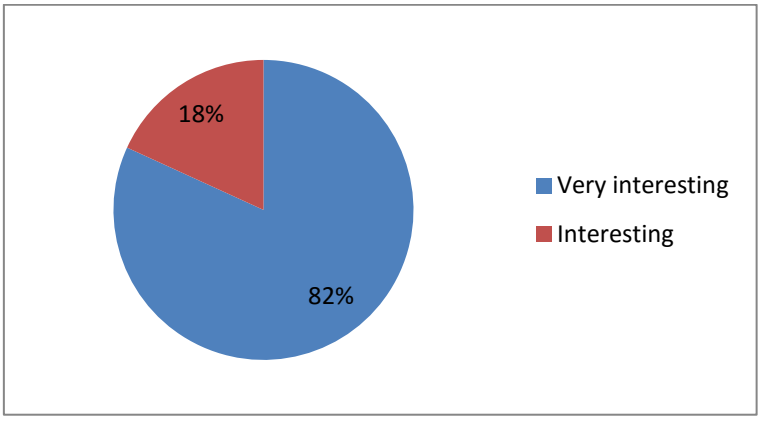
100% of the interviewed users select YES to this question. In this case, nobody choose “Maybe” and “No” options.

Q5: Using FurnIT-SAVER I will be more confident when buying a furniture and less likely to return it." To which degree do you agree or disagree with this statement?



The answers of the domestic customers is very clear: they will be more confident using the FurnIT-SAVER project developments, increasing, obviously, their satisfaction.

Q6: What is your general opinion of the FurnIT-SAVER platform?

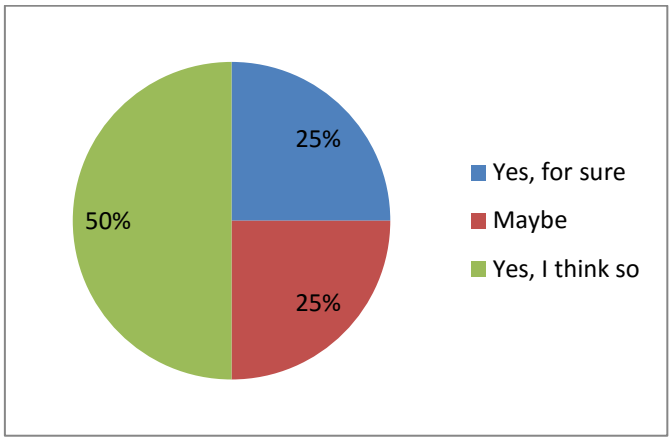


This question could be used as a summary of the customers feedback, where 82% of the customers answer that the platform is very interesting. Nobody says “Not much interesting” or “Not interesting at all”.

Most of the interviewed says that the best of the platform is to be able to visualize the furniture "in situ" in the place where they will be located, and most of them couldn’t say what is the worst of the platform.

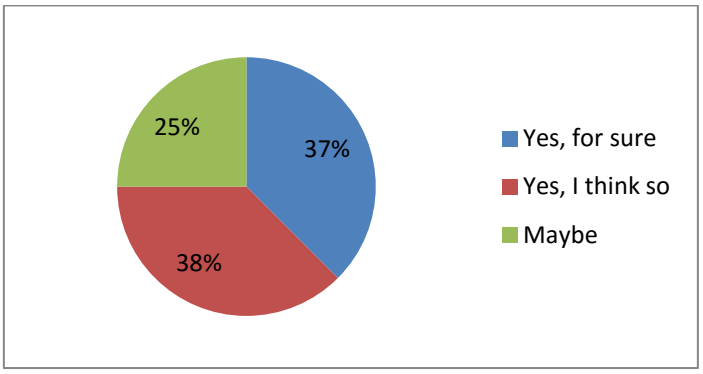
8.2 Manufacturers

Q1: Do you think that the FurnIT-SAVER Platform would help you in the sales process?



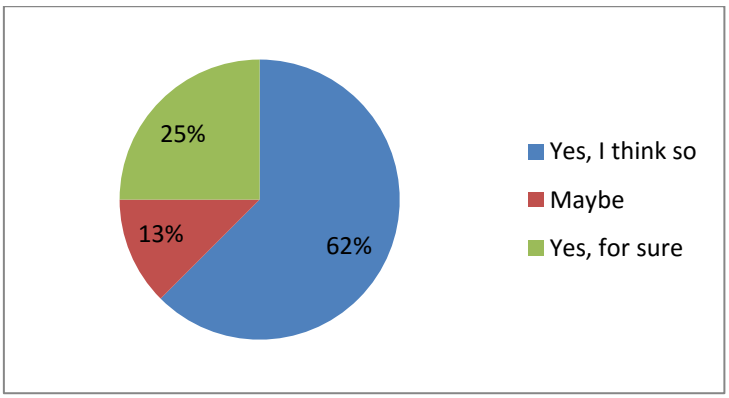
75% of the interviewed manufacturers say “Yes”, and none of them say “No”

Q2: Do you think that the FurnIT-SAVER Platform would help your retailers (stores) in the sales process?



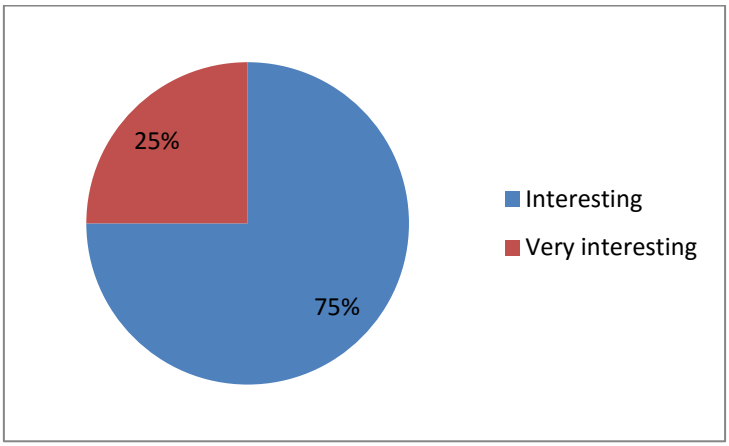
In the same way, all the manufacturers think that the platform will help the retailers and architects and home interior designers in their work.

Q3: Would you recommend the FurnIT-SAVER platform to your clients/retail channel (stores)?



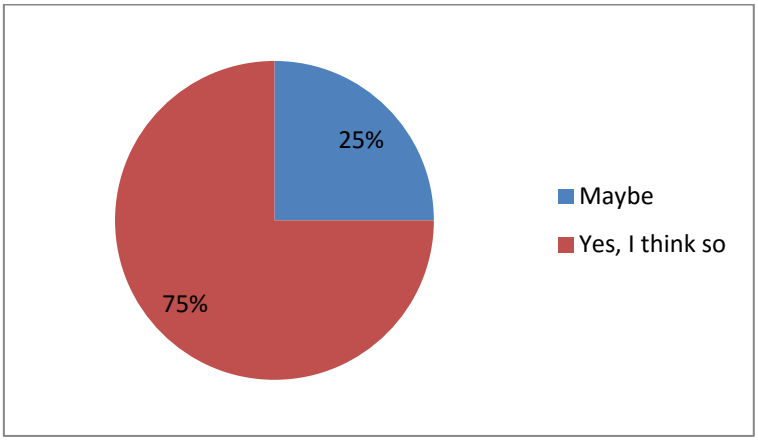
Almost 90% answer the group of “Yes”

Q4: What is you general opinion of the FurnIT-SAVER platform?

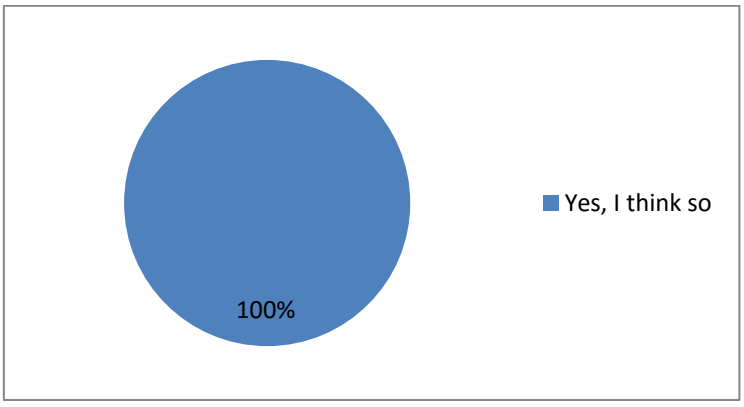


100% of the manufacturers have a positive impression of the FurnIT-SAVER platform

Q5: Would you use the FurnIT-SAVER platform in the future?



Q6: Would you recommend the FurnIT-SAVER platform?



The main difference between domestic customers interviews (scenario 2) is that most of the manufactures have already seen or know ICT solutions for the sector, and this is why they are a little bit more conservative.

In any case, most of them agree that the combined solution Virtual and Augmented Reality is good for the furniture sector because will help the purchaser to avoid errors and have more confidence when buying. The furniture visualisation in both environments is a very positive aspect that all of them agree.

9 Conclusions

Taking into consideration that one of the objectives was to make easier the furniture buying process, our validations and interaction with different stakeholder groups confirm that the visualizing tools will help enormously to reduce the existing gap with the current paper and pencil.

The feedback collected from the domestic customers shows that 100% answer that the project developments are interesting or very interesting.

On the other hand, some of the interviewed manufacturers working in the "contract channel", mainly furnishing hotels, ask the consortium about using the prototype to present their projects to hotel owners and architects. The current way to work of these manufacturers is to start the project showing renders of the proposed furniture to their clients (hotel owners). The effort that they have to do to develop the renders is more or less the same as uploading these renders in the FurnIT-SAVER Virtual Reality environment. But, once their furniture are in the Virtual Reality Environment, they can play with different combinations in order to fully satisfy their clients. To show the virtual furniture selected in the virtual reality environment in the exact place using the Augmented Reality App is the step that they need for helping them to sign the contract with their clients.

Then, from the business model point of view, the project developments could be integrated in eCommerce platforms for making easy the online buying process, in manufacturers web-sites to allow their clients to visualize their furniture, and/or create an online eCommerce furniture platform where many furniture SMEs can upload their furniture pieces and share a new sales channel, allowing the clients to combine furniture pieces from different furniture manufacturers.

To include several entities of the furniture sector in the consortium with different points of view and with different roles was very successful in terms of requirements and application scenarios definition and for validation and exploitation purposes.

In any case, we have demonstrated that the project developments are very useful for the European Furniture Sector and we hereby encourage the industry to consider our results and make full use of our tools.