



SHAPES

Smart and **H**ealthy **A**geing through **P**eople **E**ngaging in
supportive **S**ystems

D7.4: SHAPES Marketplace

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Table of Acronyms and Abbreviations

Table 3 Acronyms and Abbreviations

Acronym	Full Term
URL	Uniform Resource Locators
API	Application Programming Interface
ASAPA	SHAPES Authentication, Security and Privacy Assurance
Datalake	SHAPES Big Data Platform
SSO	Single-Sign-On
EU	European Commission
SHAPES	Smart and Healthy Ageing through People Engaging in Supportive Systems
GDPR	General Data Protection Regulation

ProACT	Integrated Technology Systems for ProACTIVE Patient Centred Care, EU-funded H2020 Project
B2C	Business-to-Consumer
B2B	Business-to-Business
EHR	Electronic Health Record
RPM	Remote Patient Monitoring
CDS	Clinical Decision Support
PHM	Population Health Management
IT	Information Technology
HIE	Health Information Exchange
RCM	Revenue Cycle Management

Keywords

Healthy ageing, market shaping, silver economy tailored solutions, silver economy, competitive advantage

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Executive Summary

The scope of this deliverable is to report on the activities concerning the status and progress of the design and development activities of the SHAPES Marketplace. Following, an introductory chapter presenting this document's rationale, key inputs and outputs, state-of-the-art analysis, and the structure of the document, the second chapter provides an overview of the SHAPES Marketplace, its terms and conditions, its accessibility features, the know-how regarding the deployment of the SHAPES Marketplace along with its technical implementation and requirements, a sub-chapter describing how to utilise the SHAPES Marketplace, its functionalities, and the mapping of the requirements that guided the development process stemming from Task 3.5 User Requirements for the SHAPES Platform and its deliverables (D3.7, D3.8, and D3.9(final version) and Task 8.3 Ethical Framework for SHAPES and its deliverables D8.4 and D8.14(final version). The third chapter consists of the SHAPES Marketplace interdependencies, and the remaining of the document includes a concluding chapter, the ethical requirements checklist chapter, and the appendix of the Terms and Conditions chapter. This deliverable is due on M42 (April 2023).

1 Introduction

1.1 Rationale and purpose of the deliverable

The scope of this report is to introduce the SHAPES Marketplace, which supports the SHAPES project's commercial model. The SHAPES project, at the time of authorship of this document, is on the 42th month of its overall lifetime. The development phase of the SHAPES Marketplace is at the end (M19-M42); Therefore, the SHAPES component is under final touches and corrections. This report aims to demonstrate the component's developed functionalities, utilisation of the SHAPES marketplace for monetization and to acquire SHAPES digital solutions, and overall achievements.

1.1.1 Deliverable Objectives

The deliverable 7.4 is intended to showcase the SHAPES marketplace component developed in Task 7.4, its relationship to other SHAPES applications and services (e.g., SHAPES Authentication, Security and Privacy Assurance (ASAPA), SHAPES Big Data Platform (Datalake)), and the marketplace's strategic purpose for SHAPES project business.

1.1.2 Key Inputs and Outputs

This deliverable incorporates the results from D5.4, the SHAPES Digital Solutions, as defined in Tasks T5.2, T5.3, T5.4 and the integration with the results from D4.5, the SHAPES ASAPA and the SHAPES (Datalake), as defined in Tasks T4.6 and T4.4 respectively.

1.1.3 State of the Art Analysis

There are several different marketplaces in the healthcare domain that offer various solutions such as Telemedicine, Electronic Health Records (EHRs), Remote Patient Monitoring (RPM), Clinical Decision Support (CDS) tools, Population Health Management (PHM), patient engagement solutions, and healthcare analytics. Some of these marketplaces namely are I) AppScript¹, II) Medigy², III) HealthXL³, IV) Elion⁴. While Appscript seems to provide virtual care platforms (remote consultations), EHR solutions, practice management software solutions, patient engagement tools, telemedicine solutions, and remote patient monitoring solutions, it is only available to the United States, the United Kingdom, and the United Arab Emirates.

¹ <https://www.appscript.net/>

² <https://www.medigy.com/>

³ <https://www.healthxl.com>

⁴ <https://www.elion.health/marketplace>

Furthermore, it seems that the AppScript marketplace is limited to specific solutions and not taking into consideration any accessibility features. Medigy, on the other hand, is a more generic platform providing information on healthcare related events, healthcare IT consulting, Health Information Exchange (HIE) solutions, EHR solutions, Telehealth solutions, patient engagement and education tools, and healthcare analytics and reporting, thus missing solutions tailored to the needs of their patients nor having any accessibility features within their platform to make it accessible to all. HealthXL, on the other hand, is not a traditional healthcare marketplace but a marketplace for “ideas” since it does not offer digital solutions or services for purchase, it does provide a platform for healthcare stakeholders to connect and collaborate on digital healthcare solutions. A marketplace for ideas and innovations that aids organisations to identify and evaluate innovative healthcare solutions and facilitates partnerships with the healthcare and technology sectors. Continuing, Elion Marketplace is a platform that offers healthcare solutions for medical practices, healthcare providers, and patients. Their solutions range from EHR systems, telemedicine platforms, and Revenue Cycle Management (RCM) software. However, Elion Marketplace seems to have a limited selection in terms of solutions as larger marketplaces, it lacks transparency in terms of vendor selection and quality control and has no ratings or reviews of the solutions hindering the evaluation process of a solution. In contradiction to some and complementary to some other marketplaces, the SHAPES Marketplace aims to be accessible by all, providing a more personalised approach to healthcare, transparency and bias control, tailored with the silver society in mind in terms of accessibility and usability, and to have a comprehensive set of solutions with integrated feedback mechanisms (user reviews and ratings).

1.2 Structure of the document

The deliverable is structured as follows: The 1st section (Introduction) introduces the SHAPES Marketplace deliverable and its scope.

The 2nd section (SHAPES Marketplace) provides a brief overview of the SHAPES Marketplace, its terms and conditions, accessibility features, and the SHAPES Marketplace 3rd party deployment know-how along with its requirements and the technical implementation. Additionally, the utilisation and functionalities of the SHAPES Marketplace are analysed and presented through use cases, namely I) Add a Product /Service, II) Updating a Product / Service, III) Purchase Products / Services, IV) Reviews/ User Engagement, V) Products / Services Validation and Approval. Lastly, the 2nd section contains the Requirements Mapping stemming from Task 3.5 User Requirements for the SHAPES Platform and its deliverables (D3.7, D3.8, and D3.9(final version) and Task 8.3 Ethical Framework for SHAPES and its deliverables D8.4 and D8.14(final version).

Section 3 (SHAPES Marketplace Interdependencies) presents the interdependencies between the SHAPES Marketplace and other internal SHAPES components. A description regarding the SHAPES Marketplace authentication/authorization module and the user verification process is provided, and a description of the integration with the SHAPES Big Data Platform (Datalake) deriving from T4.4.

Section 4 (Conclusion) concludes this report by presenting a short summary deriving from this report. Finally, within the document there is also Section 5 (The Ethical Requirements Checklist) and Section 6 (Appendix I: Draft of Terms and Conditions).

2 SHAPES Marketplace

2.1 *Brief Introduction on the SHAPES Marketplace*

The SHAPES Marketplace acts as the main accessway to the repository of knowledge, know-how, and informational resources produced within the SHAPES Project, including the vast amount of de-identified and aggregated data captured through the SHAPES large-scale pilot campaign. In addition, the tailored for the silver economy marketplace also serves as a *one-stop-shop* for digital solutions and services targeting the smart and healthy ageing and independent living markets.

Initially, the digital solutions and services that populated the SHAPES Marketplace originated from the SHAPES partners and third-parties associating with the SHAPES ecosystem through the SHAPES Open Calls. As the project evolved, device manufacturers, technology suppliers, and digital solutions providers were invited to join the SHAPES Marketplace and display their digital solutions and services. In fact, the SHAPES Marketplace was envisioned to deliver a dynamic catalogue of solutions and services, fostering a transparent expansion of market offers associated with goods and services for healthy and active ageing and independent living to a pan-European scale, preventing vendor lock and enhancing the agile competitiveness of the health and care industry, namely in Europe.

Directly connecting supply and demand, the SHAPES Marketplace brings benefits to both. For customers (or the demand), the Marketplace offers within a single platform trustworthy, secure and reliable digital solutions, and informational resources that have been carefully chosen and adapted to meet their real needs, sustained by SHAPES co-creation model, involving the users in every stage of the project's progress to learn from their experience and expertise. This approach is fundamental to establish trust in the quality of SHAPES results.

For industry and entrepreneurs (or the supply), participation in the SHAPES Marketplace provides a window to a large-scale customer base. Industry players in the market, including new entrants, will welcome the opportunity of early market entry and access to large new markets at reduced costs, rapidly bridging the gap between product development and European-wide market access. Importantly, they will benefit from SHAPES's outreach efforts in building reputation, trust, and a support community, considering the SHAPES stakeholders ecosystem, the dissemination and awareness campaigns of SHAPES results, the attraction of innovative solutions through the open calls, the validation through large-scale piloting activities that provide evidence that the SHAPES results are well-set to be adopted by users' actual practice, processes and procedures.

Contributing to harnessing the value of the SHAPES Marketplace is the opportunity brought forth by the last years' COVID-19 pandemic, during which the importance of information and communication technologies and digital solutions to support not only day-to-day activities but also human interaction became clear. In the specific scope of SHAPES, technological solutions have been instrumental to improve the quality of life of citizens, namely older individuals that were the most vulnerable group to the disease, but also to assure the quality-of-care service delivery, assisting in reducing the pressure at the traditional point of care such as primary care centres and hospitals. It is the SHAPES partner's expectation that also external factors may contribute to reinforce the opportunity for the SHAPES Marketplace and serve as an incentive for solutions providers to join.

Overall, the SHAPES Marketplace is instrumental to aid the expansion of the SHAPES Ecosystem, stakeholders, and digital solutions, building critical mass and achieving relevant economies of scale in the healthy and active ageing and independent living markets to support a high-quality and sustainable delivery of health and care services across Europe, through viable business and financing models.

2.2 Using the SHAPES Marketplace: Terms and Conditions

The terms and conditions are contributed by Delia, NUIM and LAUREA under Task T2.2 and they are depicted in Appendix I: Draft of Terms and Conditions. The terms and conditions are subject to change.

2.3 Accessibility of the SHAPES Marketplace

The online marketplace platform intends to be accessible for all, considering the accessibility needs and requirements of different groups of individuals with disabilities, with the cooperation and advice of The World Federation of the Deafblind (WFDB) and The European Union of the Deaf (EUD), consortium partners and representatives of the deafblind and deaf community.

WFDB has specifically provided insights on how to make the Marketplace platform and website accessible during the Task 7.4 online meetings. WFDB has stressed the importance of ensuring that digital accessibility is prioritised, following the project's commitment to inclusion and respect for the rights of persons with disabilities, which must include the right to "seek, receive and impart information and ideas on an equal basis with others", as stated

in the CRPD⁵. Efforts were made to ensure that the website's design and format were accessible to screen reader users and adapted to persons with low vision or visual impairments through discussions, including, among other things, alternative text to images, clear buttons, etc., and avoiding crowding the website with unnecessary elements such as flashing features, which could be distressing for many.

The general proposal was that because the target user will be older adults, including older people with disabilities and their interpreters, guide interpreters, and assistants the website should be designed with the goal of being as user-friendly and intuitive as feasible.

More specifically, the website has been made accessible by incorporating an accessibility plugin in the form of a button named “Accessibility Button”, which allows the user to make changes to the website in order to improve its accessibility, according to his/her preference. This button allows colour changes for people with colour blindness (e.g., people with protanopia, deuteranopia, etc.) and also includes dark mode which adds high contrast colours.

2.4 SHAPES Marketplace 3rd Party Deployment

Within this sub-chapter, the requirements for the deployment and technical implementation of the SHAPES Marketplace are described. While the Hellenic Mediterranean University (HMU) is committed to sustain the SHAPES Marketplace after the project's end, 3rd party deployment is available utilising two private repositories 1) SHAPES Marketplace Frontend⁶ and 2) SHAPES Marketplace Backend⁷. Moreover, the marketplace administrator should have a STRIPE⁸ account (payment connection).

2.4.1 Requirements

The requirements are metrics that were generated while stressing the SHAPES Marketplace internally on our premises and are the following:

⁵ Convention on the Rights of persons with Disabilities, art 21: <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/article-21-freedom-of-expression-and-opinion-and-access-to-information.html>

⁶ <https://github.com/SHAPES-H2020/Marketplace-Frontend.git>

⁷ <https://github.com/SHAPES-H2020/Marketplace-Backend.git>

⁸ <https://stripe.com/>

- Debian-based server or any container platform (e.g., Kubernetes) on AMD64 server architecture.
- At least 30GB of Storage.
- At least 2GB of RAM (4GB Recommended).
- At least 100Mbps Symmetric Network.

2.4.2 Technical Implementation

For the development of the SHAPES Marketplace, HMU opted for the latest, dynamic, and flexible technologies while adhering to D3.9 Final Draft User Requirements for the SHAPES Platform stemming from T3.5 User Requirements for the SHAPES Platform. The Marketplace consists of two (2) main components, namely I) The SHAPES Marketplace Frontend and II) The SHAPES Marketplace Backend. Both components were developed in JavaScript, utilising specialised frameworks and libraries to support various functionalities (i.e., Vue.js⁹, Node.js¹⁰, Express.js¹¹, Axios¹², etc.).

Both of these components utilised best practices according to standard versioning¹³ and conventional commits¹⁴. A Changelog.md file was also kept within the code files, tracking every change/commit performed for every version. Furthermore, the SHAPES Marketplace utilised the git¹⁵ protocol for sharing, saving, recovering, and coding. Finally, all the internal components were developed, tested, and automatically deployed via CI/CD pipelines¹⁶ (ie., Jenkins¹⁷, Gitlab¹⁸, ArgoCD¹⁹, Kubernetes²⁰, etc.), and the public exposure of both the main components to the internet utilised Trusted SSL Certificates²¹ (eg., TLS²², HTTPS²³, etc.)

⁹ <https://vuejs.org/>

¹⁰ <https://nodejs.org/en>

¹¹ <https://expressjs.com/>

¹² <https://axios-http.com/docs/intro>

¹³ <https://semver.org/>

¹⁴ <https://www.conventionalcommits.org/en/v1.0.0/>

¹⁵ <https://git-scm.com/>

¹⁶ <https://www.redhat.com/en/topics/devops/what-cicd-pipeline>

¹⁷ <https://www.jenkins.io/>

¹⁸ <https://about.gitlab.com/>

¹⁹ <https://argo-cd.readthedocs.io/>

²⁰ <https://kubernetes.io/>

²¹ <https://www.digicert.com/what-is-an-ssl-certificate>

²² https://en.wikipedia.org/wiki/Transport_Layer_Security

²³ <https://en.wikipedia.org/wiki/HTTPS>

2.4.2.1 SHAPES Marketplace Frontend

For the SHAPES Marketplace Frontend, we utilised the following technologies: Vue.js²⁴ (as the base framework), Vuetify²⁵ (for specialized framework components), Vue Router²⁶ (for UI routing), Axios²⁷ (for requests), VUEX²⁸ (for client-side storage), TipTap²⁹ library (for document editor), vue-i18n³⁰ library (for localization/translations), color-blind³¹ library (for changing color based accessibility settings), Moment.js³² library (for date and time formats and zones), json-translator³³ library (for automating most of translations) and Secure-Is³⁴ library (for client-side storage encryption). These are chosen mostly because of development and processing speed.

2.4.2.2 SHAPES Marketplace Backend

The SHAPES Marketplace Backend contains multiple sub-modules and internal remote connections with other services such as, remote connection with servers that utilize SMTP protocol³⁵ (for emails), Stripe³⁶ (for payments), Casbin³⁷ (for authentication/authorization), Redis³⁸ (for request/response caching), Node.js³⁹ server (for serving/exposing the code), Express.js⁴⁰ plugin (for RestAPI), Jest⁴¹ library (for automated testing of code), MongoDB⁴² (for data storage) and MinIO⁴³ (for file storage). Additionally, the SHAPES Marketplace Backend supports various integrations with other SHAPES partners, such as the SHAPES Datalake and its support can be expanded to other SHAPES partners, as needed.

Moreover, the SHAPES Marketplace Backend utilized few models for consistent component communication. The models are the following:

- Documentation
- Files

²⁴ <https://vuejs.org/>

²⁵ <https://vuetifyjs.com/en/>

²⁶ <https://router.vuejs.org/>

²⁷ <https://axios-http.com/docs/intro>

²⁸ <https://vuex.vuejs.org/>

²⁹ <https://tiptap.dev/>

³⁰ <https://github.com/kazupon/vue-i18n>

³¹ <https://www.npmjs.com/package/color-blind>

³² <https://momentjs.com/>

³³ <https://www.npmjs.com/package/@parvineyvazov/json-translator>

³⁴ <https://www.npmjs.com/package/secure-ls>

³⁵ https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol

³⁶ <https://stripe.com/>

³⁷ <https://casbin.org/>

³⁸ <https://redis.io/>

³⁹ <https://nodejs.org/en>

⁴⁰ <https://expressjs.com/>

⁴¹ <https://jestjs.io/>

⁴² <https://www.mongodb.com/>

⁴³ <https://min.io/>

- Orders
- Reviews
- Products
- Roles
- Users

2.5 Utilising the SHAPES Marketplace

To access and utilise the SHAPES Marketplace the end-users should have an account created with the ASAPA component. The ASAPA component provides a Single-Sign-On (SSO) solution, which exposes RESTful API interfaces for the authentication of the SHAPES ecosystem end-users. A tutorial for the registration with the ASAPA component of a SHAPES end-user was propagated to the respected partners.

2.6 SHAPES Marketplace Functionality

SHAPES marketplace functionality is organized around five customer-related use cases: adding and updating products as an owner, purchasing products as a customer, reviews and users' engagement, and finally products and services validation and approval. In addition, the chapters that follow define the management of the products, users, and information displayed in the SHAPES marketplace. Furthermore, the SHAPES Marketplace is populated with various digital solutions from every pilot.

2.6.1 Add a Product / Service

Adding new products to the SHAPES marketplace is a fairly simple process. Application or service providers can go to the main product list and click the "Add Product" button, located on the top right corner (Figure 1). Then, they are prompted (Figure 2) to enter some basic product information, such as the name, category, tags, description, details, and product images. Later, owners can add additional images, videos, licenses, and documentation, as detailed in the following chapter. Additionally, customers can easily edit product data / information.

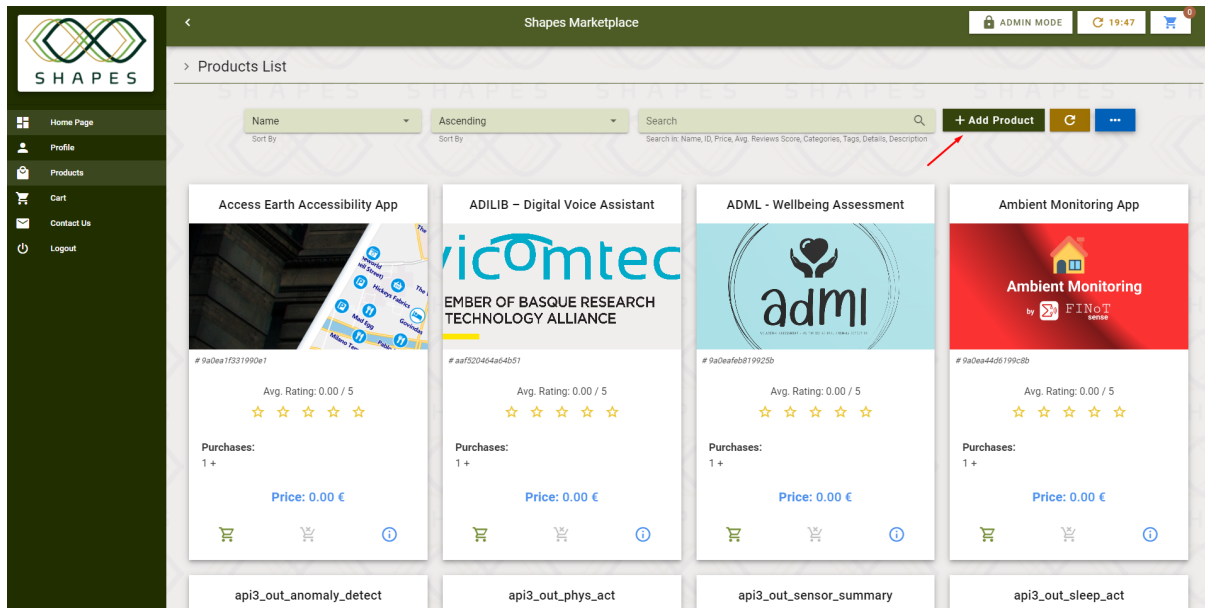


Figure 1 Add Products / Services button

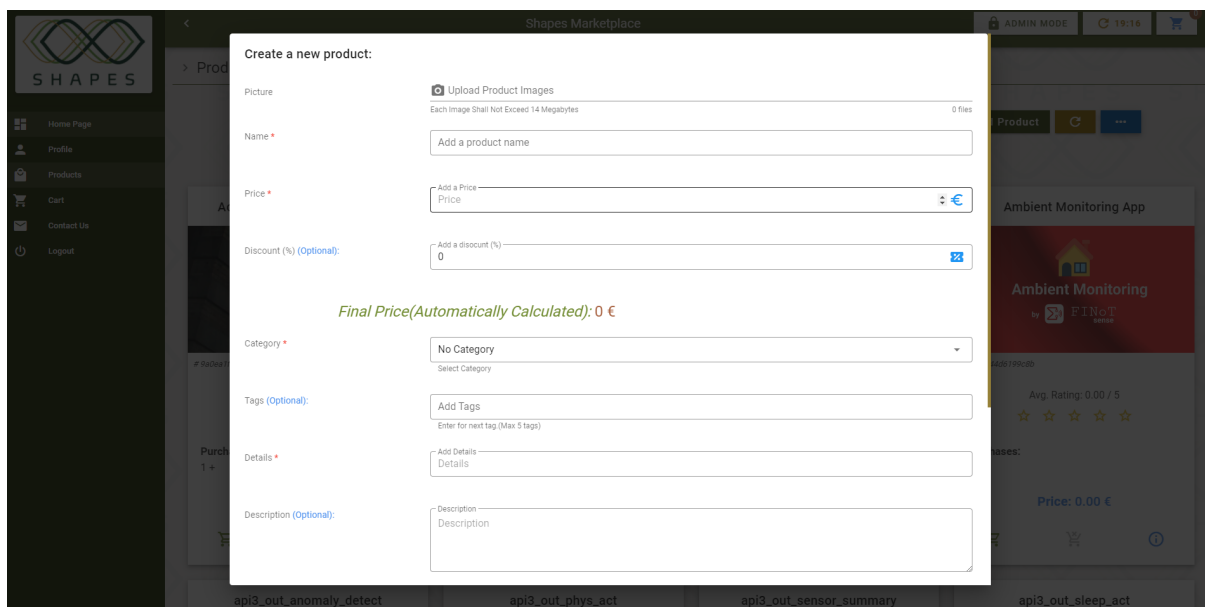


Figure 2 Add Products / Services Prompt Dialog

2.6.2 Updating a Product / Service

The process of updating products is described below, and it includes a description of how various product components such as product documentation, images, videos, licensing and other information are implemented.

2.6.2.1 Products Details / Documentation / Information

After a product has been created, the owner can edit various information and add product documentation, more details, and change the category, prices, or description. Figure 3 depicts all of the options available in the Product Edit Mode.

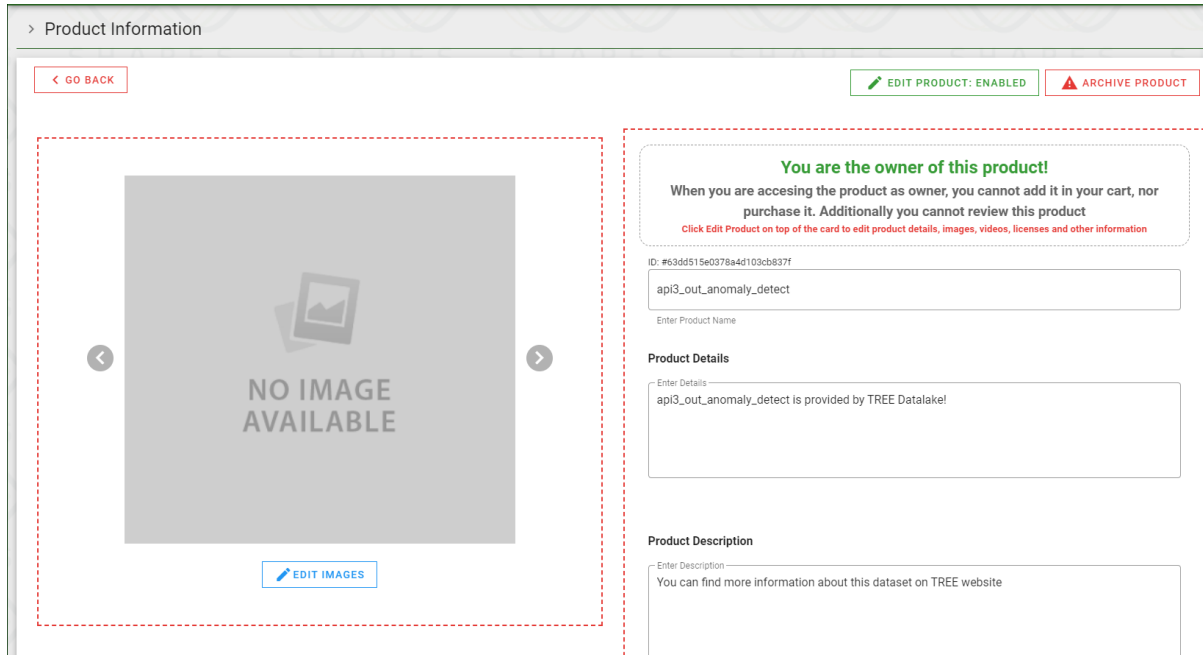


Figure 3 Products / Services Edit mode enabled

Furthermore, as shown in Figure 4, documentation can be created in a product as a PDF file or as custom text created using an online editor provided by the SHAPES marketplace. All PDF documentation files, and custom documentation text are available for download in product information page.



Figure 4 Products / Services Documentation List Preview

2.6.2.2 Products Images / Videos

Product images and videos can be uploaded at any time to the product by owners. Additionally, owners can set the default preview image of a product by double-clicking the image in Image Upload Dialog, as shown in Figure 6. SHAPES marketplace accepts a variety of image formats such as png, jpeg, svg, and others, as well as video formats such as avi, mp4, and others. It also supports videos, as shown in Figure 5, retrieved from remote sources via URLs. For resource management purposes, the maximum upload image and video size is limited to 14Mbytes per file.

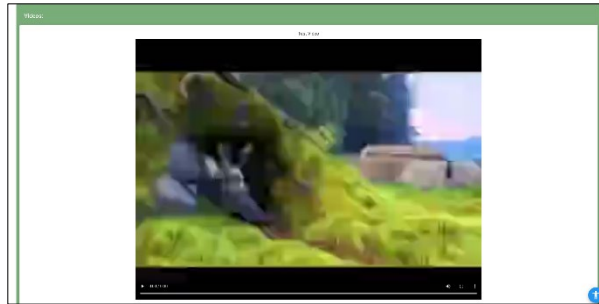


Figure 5 Products / Services Videos Preview

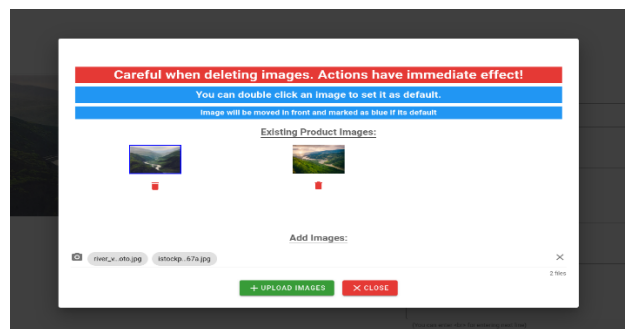


Figure 6 Products / Services Image Editing

2.6.2.3 Licensing

SHAPES marketplace offers the functionality to add multiple software licenses, as shown in Figure 7, in a product, by fetching remote RestAPI sources using an Application Programming Interface key (API key) and Uniform Resource Locators (URLs). Static keys in the form of a string can also be included by product providers.

After purchasing a product with a fully validated account customer account, users can see the licenses on the product information page and copy them with a single button next to each license.

Individual terms and conditions documentation for products or licenses can be uploaded in the documentation section described in section 2.6.2.1.



Figure 7 Products / Services Licensing Edit Mode

2.6.2.4 Archiving a Product

Application and service providers can limit the distribution of a product by archiving it. By pressing the “archive” button in edit mode a dialog appears that warns users, as shown in Figure 8. Upon a product’s archival, the product is no longer purchasable or editable, and previously purchased products are labelled as "Archived".

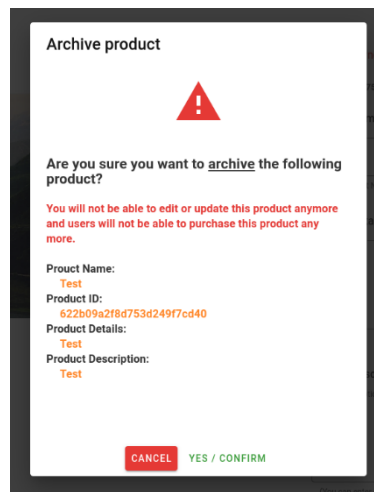


Figure 8 Product / Service Archive Warning

2.6.3 Purchase Products / Services

Users can purchase products or services through the SHAPES marketplace with a fully validated account and validated customer account. A button to add product in cart is shown on each product info card, as depicted in Figure 11. Upon addition to cart, users can see products by hovering and navigating to cart as shown in Figure 10. An integration of the billing platform Stripe is implemented, which enables support for credit/debit card payments and orders generation. For demonstration purposes and the current beta release of the SHAPES

marketplace, all purchases are completed with a Stripe development account, and thus no payments with real credit/debit cards are accepted as shown in Figure 9.

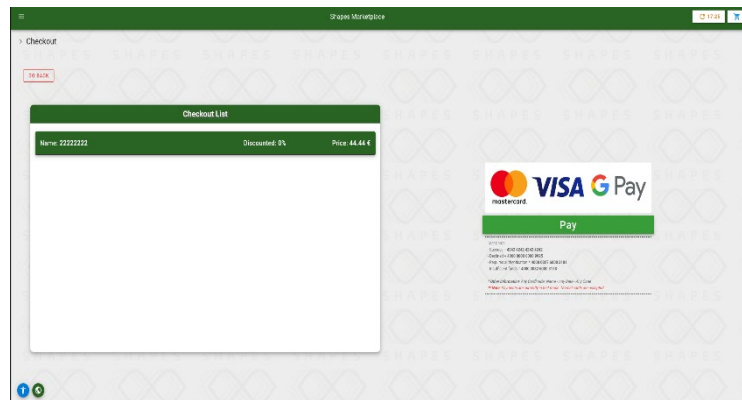


Figure 9 Checkout Page

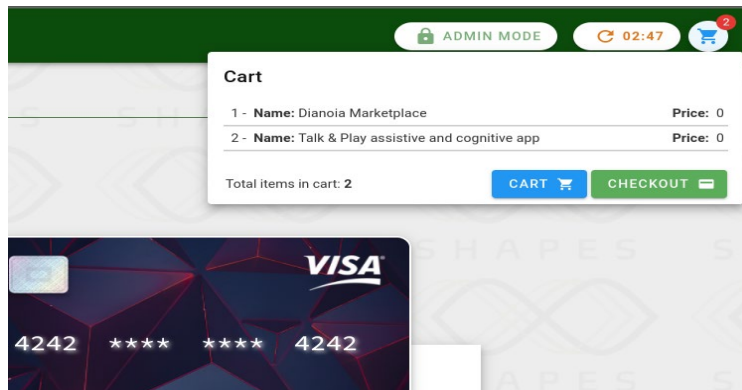


Figure 10 Cart Hover Functionality

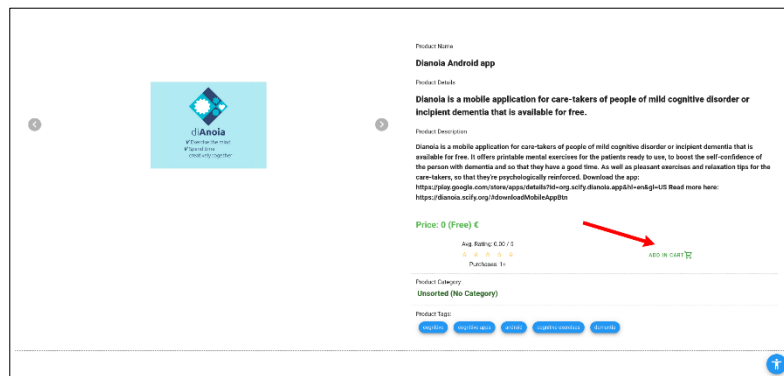


Figure 11 Add to cart button

2.6.4 Reviews / Users Engagement

After successfully purchasing a product, visitors are guided to the SHAPES marketplace's home page, where they can navigate to the product list page and locate the previously purchased product. Users can now contribute to the improvement of a purchased product by writing a review based on a 5-star grading system and leaving a brief comment as depicted in Figure 12. All users can see all ratings and reviews, and an average rate is displayed on all product information pages and product lists. Moreover, users can edit their reviews at any time, and the average review grade is instantly recalculated. Additionally, user engagement is increased when customers visit the home page, which displays the most recent and popular products.

The functionality of allowing the registered users to rate the products adds a significant value to the platform. Firstly, it serves as a filtering mechanism that will declutter the home page when the platform offers a big number of products. In addition, and as a future step of the platform, the search mechanism could also include filters that are relevant to the visiting user, for example the option to see products that they have rated with a high rate, or that the entire community has rated high, first.

User engagement in general is of high importance to the platform and the way it will grow. It is important to make the platform feel like a community and a crowd-sourcing hub to the visiting users, in order to offer the highest value possible.

The rating functionality can also be of great help to the platform administrators. They can be alerted of ratings that can pinpoint that a product they didn't thoroughly check violates a platform rule (for example a 1-star rating might also mean that the product includes inappropriate language or that it has licence issues).

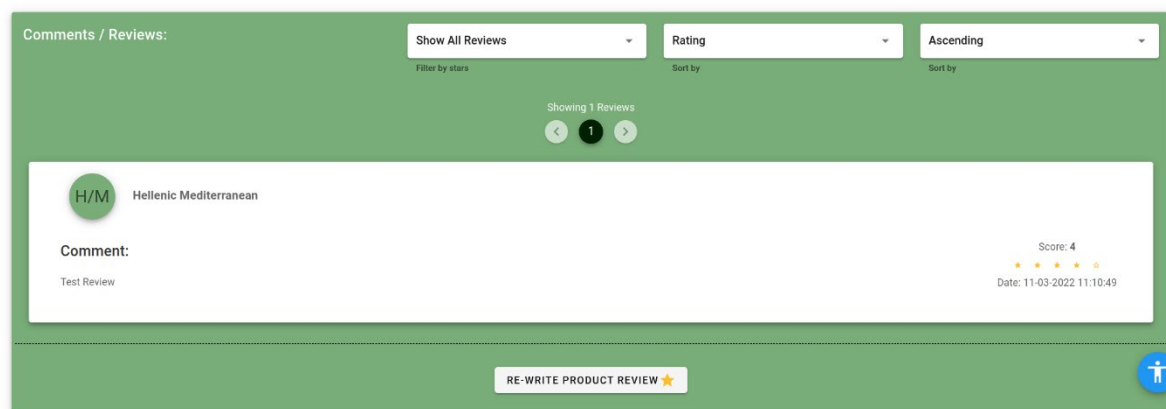


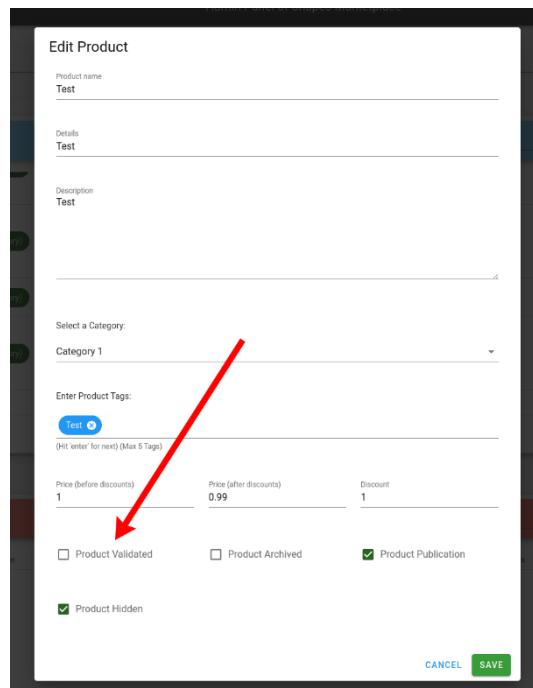
Figure 12 Reviews and Comments

2.6.5 Products / Services Validation and Approval Process

Application or Service providers can add a product to the SHAPES marketplace at any time. If the product is chosen for publication, it must be approved by a SHAPES marketplace administrator, through the SHAPES marketplace administration dashboard. Upon a product approval, the product is added to the SHAPES marketplace's public list, and it can be purchased by customers.

When product owners make a change to a product's details and information, the status of a product is reset to "Pending Approval". This security mechanism guards against undesired or malicious alterations to products. A product owner can also adjust a product's visibility by setting it to hidden, but this functionality does not hide the product to customers that already purchased the hidden product.

Moreover, all products have three distinct states that establish a product's visibility, validity, and purchase ability in the SHAPES marketplace. These are the three states: “published”, “hidden”, and “validated”. Except for the validated state, which can only be established by administrators, as shown in Figure 13 , the product owner can change all phases of a product at any time.



The screenshot shows the 'Edit Product' form with the following fields and options:

- Product name: Test
- Details: Test
- Description: Test
- Select a Category: Category 1
- Enter Product Tags: Test
- Price (before discounts): 1
- Price (after discounts): 0.99
- Discount: 1
- Product Validated: ☐ (indicated by a red arrow)
- Product Archived: ☐
- Product Publication: ☒
- Product Hidden: ☒
- Buttons: CANCEL, SAVE

Figure 13 Products / Services Validation

2.7 Requirements Mapping

The requirements depicted in Table 4 guided the development process of the SHAPES Marketplace. These requirements are stemming from Task 3.5 User Requirements for the SHAPES Platform and Task 8.3 Ethical Framework for SHAPES and their deliverables (D3.7,D3.8,D3.9,D8.4, and D8.14).

Table 4 Requirements Mapping Table

ID	Requirement Description	Implemented	Reference Code
SPS-001	The SHAPES Platform shall adopt a customer logic (B2C and B2B) in its design and development.	Yes	BR-CS-001 (D3.9)
SPS-002	The SHAPES Platform shall have its own Terms of Use and Services Policy	Yes	BR-CS-002 (D3.9)
SPS-003	The SHAPES Platform shall have its own Privacy Policy, observing applicable regulations, including the GDPR.	Yes	BR-CS-003 (D3.9)
SPS-004	The SHAPES Platform should implement a customer support service.	Yes – Email information in the log in page & Contact us Page	BR-CS-004 (D3.9)
SPS-005	The SHAPES Platform shall be cost-affordable based on the system's modularity and configurability	Yes – Marketplace offers modularity on products / services documentation, licensing, images, videos, etc.	BR-P-001 (D3.9)
SPS-006	The SHAPES Platform shall support various business models (e.g., direct sales, licensing, subscription, PaaS).	Yes – The Marketplace offers direct sales and licensing	BR-P-002 (D3.9)
SPS-007	The SHAPES Platform shall have an online marketplace.	Yes – Marketplace is exposed as an online application	BR-M-001 (D3.9)
SPS-008	The SHAPES Platform Marketplace shall support the registration of suppliers	Yes - Users can add products /	BR-M-002

	(supply) and of clients (demand).	services and purchase products / services	(D3.9)
SPS-009	The SHAPES Platform Marketplace shall select its suppliers based on their offer's effectiveness, affordability and added-value to the Platform.	Yes – Automated mechanisms select products / services to be displayed in Home Page, as latest and most popular products / services.	BR-M-003 (D3.9)
SPS-010	The SHAPES Platform Marketplace shall contribute to the Platform's monetisation (e.g., fee per transaction).	Yes	BR-M-004 (D3.9)
SPS-011	Suppliers in the SHAPES Platform Marketplace shall abide and follow the SHAPES Platform's Terms of Reference, privacy policy and ethics.	Yes	BR-M-005 (D3.9)
SPS-012	The SHAPES Platform Marketplace should encourage transparent competitiveness.	Yes – Automated product / service agnostic mechanisms select products / services to be displayed in Home Page, as latest and most popular products / services (based on purchases and views).	BR-M-006 (D3.9)
SPS-013	The SHAPES Platform Marketplace should contribute to building economies of scale (e.g., create supply chains).	Yes - 3rd party application providers can contribute by adding products / services to marketplace	BR-M-007 (D3.9)
SPS-014	The SHAPES Platform Marketplace should contribute to remove existing vendor locks.	Yes - refer to SPS-010 & SPS-013	BR-M-008 (D3.9)
SPS-015	The SHAPES Platform Marketplace should contribute to the dynamics of local economies (e.g., aggregation of offers	Yes - refer to SPS-014	BR-M-009 (D3.9)

	based on location and geographical reach).		
SPS-016	The SHAPES Platform shall observe universal accessibility policies (e.g., consider the public authorities' role with respect to subsidising schemes).	Yes	BR-S-002 (D3.9)
SPS-017	Different languages need to be provided	Yes – The SHAPES Marketplace supports 6 languages	FR-G-3 (D3.9)
SPS-018	Ensure equal and non-discriminatory access to technology and its support services by using well-designed user interfaces, instructions and authentication.	Yes	LER-PT-1 (D8.14)
SPS-019	Consider cultural diversity of users; for example, create avatars that represent different genders and cultures and let the user choose what to use. (TBD)	Yes – Marketplace supports custom image upload for avatars and public service Gravatar	LER-PT-2 (D8.14)
SPS-020	Create functionalities for the end-user to switch off/on various sensors and services whenever she/he want to do it	Yes – Accessibility functionalities	LER-PT-3 (D8.14)
SPS-021	Data subject rights: right to rectification – ensure that the data can be corrected in all places (incl. storage).	Yes – End-users can edit their information	LER-PT-5 (D8.14)
SPS-022	Data subject rights: right to be forgotten – build capabilities for deleting personal data.	Yes – Manage Profile Data	LER-PT-6 (D8.14)
SPS-023	Data subject rights: right to restriction – build a capability for restricting data processing.	N/A – Marketplace does not process data	LER-PT-7 (D8.14)
SPS-024	Data subject rights: information provided to third parties – create a functionality to get information about the third parties to whom data has been disclosed as part of robust data mapping and flows	N/A – Marketplace does not share information to third parties	LER-PT-8 (D8.14)
SPS-025	Data subject rights: right to data portability – create a capability to transmit data to the data subject/third party in a	Yes – JSON format	LER-PT-9 (D8.14)

	structured, commonly used and machine-readable format.		
SPS-026	Data protection principles: accuracy – ensure that the source of the data is recorded.	N/A	LER-PT-12 (D8.14)
SPS-027	Legal basis: a) ensure that there are sufficient capabilities for asking consent as part of the service and that the consent is documented properly (obligatory); b) build up a repository where consents can be collected centrally (optional – to be defined if it brings value to SHAPES).	Yes – Terms of Use, Consent Forms	LER-PT-13 (D8.14)
SPS-028	Automated decision making: Ensure that there's a capability to re-direct the decision to a manual process.	N/A	LER-PT-15 (D8.14)
SPS-029	Privacy by design and by default: implement needed privacy enhancing technologies.	Yes	LER-PT-16 (D8.14)
SPS-030	Technical and organisational security measures: ensure that users' access can be limited to certain categories of personal data and the need to restrict access to certain data is taken into consideration in SHAPES architecture	Yes	LER-PT-18 (D8.14)
SPS-031	Keep logs for personal data (who has seen/modified personal data and when).	Yes - Logs are only for internal use and debugging, tracking every request and process, and the user is not directly identifiable - meaning that it displays only IDs	LER-PT-19 (D8.14)
SPS-032	Allow and support the scaling up of tools, i.e., for example application within a whole country	Yes – The SHAPES Marketplace is implemented as a microservice	TS-SC-1 (D3.9)
SPS-033	Allow for different levels of complexity of the platform; develop a modular	Yes - Marketplace is implemented as	TS-SC-2 (D3.9)

	approach	a microservice	
SPS-034	Ensure critical service continuity 24/7 (acceptable downtime 2%)	Yes – Refer SPS-058 & SPS-059	TS-AB-1 (D3.9)
SPS-035	Allow for key word search	Yes	TS-US-3 (D3.9)
SPS-036	Follow the WCAG 2.1. Standards and Universal Design principles in designing and implementing process. Perform formative, summative, and continuous evaluations. Test throughout the project lifecycle and any time new content is added or code is updated.	Yes – Reference SPS-016	ET24 (D8.14)
SPS-037	Ensure the platform usage by using assistive technology (screen magnifiers, text-to-speech, color combinations with high contrast etc.)	Yes	ET26 (D8.14)
SPS-038	Easy to conduct updates via the platform	Yes – Marketplace is deployed in a Kubernetes cluster with update strategy capabilities (e.g., Canary)	TS-MN-1 (D3.9)
SPS-039	If the SHAPES platform or one of its sub-systems comes back online after scheduled or unscheduled downtime, the users should be able to see/do what they expect (system able to resume at the correct point)	Yes – Marketplace is deployed in a Kubernetes cluster with self-healing capabilities	TS-RB-1 (D3.9)
SPS-040	There should be a notification to stop working in case of technical problems.	Yes	TS-RB-2 (D3.9)
SPS-041	Allow for the use of mobile devices; Compatibility with IOS and android smartphones	Yes – Marketplace is accessible from both	TS-IO-3 (D3.9)
SPS-042	Compatibility with different browsers	Yes	TS-IO-7 (D3.9)

3 SHAPES Marketplace Interdependencies

3.1 SHAPES Marketplace Integration with SHAPES ASAPA

The SHAPES Marketplace utilises the authentication service developed in T4.6 through a login page, shown in Figure 14. From a technical perspective, the SHAPES Marketplace authentication module acts as a middleware, redirecting user requests to the SHAPES ASAPA service for authentication, and synchronizing authenticated users to its database through the ASAPA RestAPI. When someone tries to brute force their way into the SHAPES marketplace, a temporary ban is activated by locking the user for 24 hours after five unsuccessful and sequential logins with a specific email address, according to an authorization policy built in the SHAPES Marketplace. The user is notified of any malicious activity with an alert. In addition, through the marketplace administration dashboard, a SHAPES marketplace administrator can issue or retract a permanent or temporary ban for any chosen user, as depicted in Figure 15.

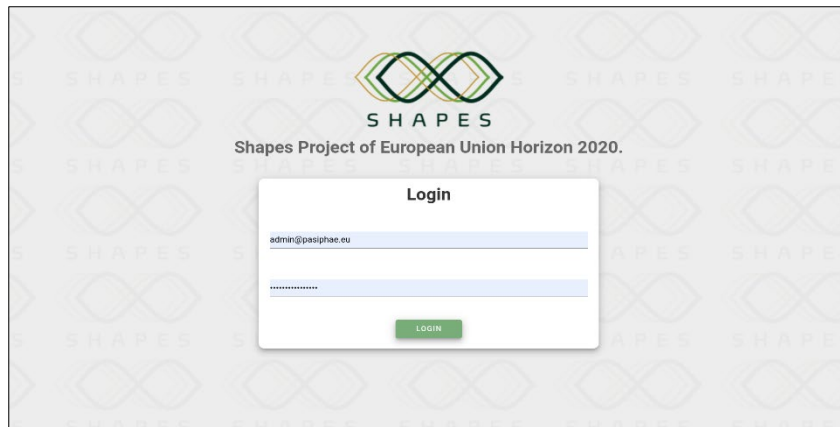


Figure 14 Marketplace Login Page

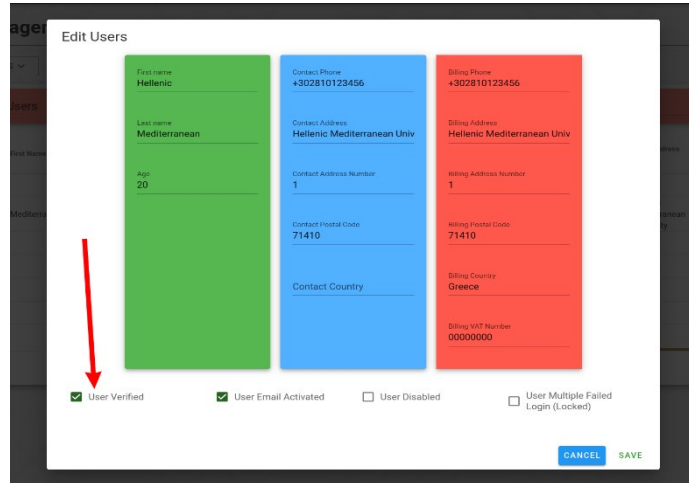


Figure 15 User Ban/Lock

3.1.1 User Verification and Approval Process

The user email verification process occurs during the user login phase, shown in Figure 14. While the user is not verified, an email is sent to the user from the SHAPES marketplace requesting that the user has to click on a link supplied for user verification. By clicking on the link, the user accepts the terms and conditions outlined in 2.2 of this deliverable. Furthermore, in the case that the automated email expires (expiration time of ten minutes), users can request a new email from their profile page.

Following a successful login, all users can edit their profile information via the profile page. After a user has provided all required profile details and verified the account via the email verification process, an administrator will have to manually validate the user as shown in Figure 16. Users with validated profiles gain full access to the functionalities of the SHAPES Marketplace, from uploading a digital solution, service, and dataset to purchasing them.



Edit Users

First name Hellenic	Contact Phone +302810123456	Billing Phone +302810123456
Last name Mediterranean	Contact Address Hellenic Mediterranean Univ	Billing Address Hellenic Mediterranean Univ
Age 20	Contact Address Number 1	Billing Address Number 1
	Contact Postal Code 71410	Billing Postal Code 71410
	Contact Country 	Billing Country Greece
		Billing VAT Number 00000000

☒ User Verified
 ☒ User Email Activated
 ☐ User Disabled
 ☐ User Multiple Failed Login (Locked)

CANCEL SAVE

Figure 16 Users Verification

3.2 SHAPES Marketplace Integration with SHAPES Big Data Platform

The marketplace integration with SHAPES Big Data Platform (Datalake) is provided by TREE. A secured API was built to manage the metadata (price, description, etc.) of datasets. The API consists of:

- A front-end that handles requests and integrates with an authenticator that uses ASAPA to validate user credentials.
- A controller to manage the execution of requests.
- A processing engine to execute queries on data and metadata, which integrates with the metadata catalogue and data from the Datalake.

Figure 17 depicts a schema of its structure.

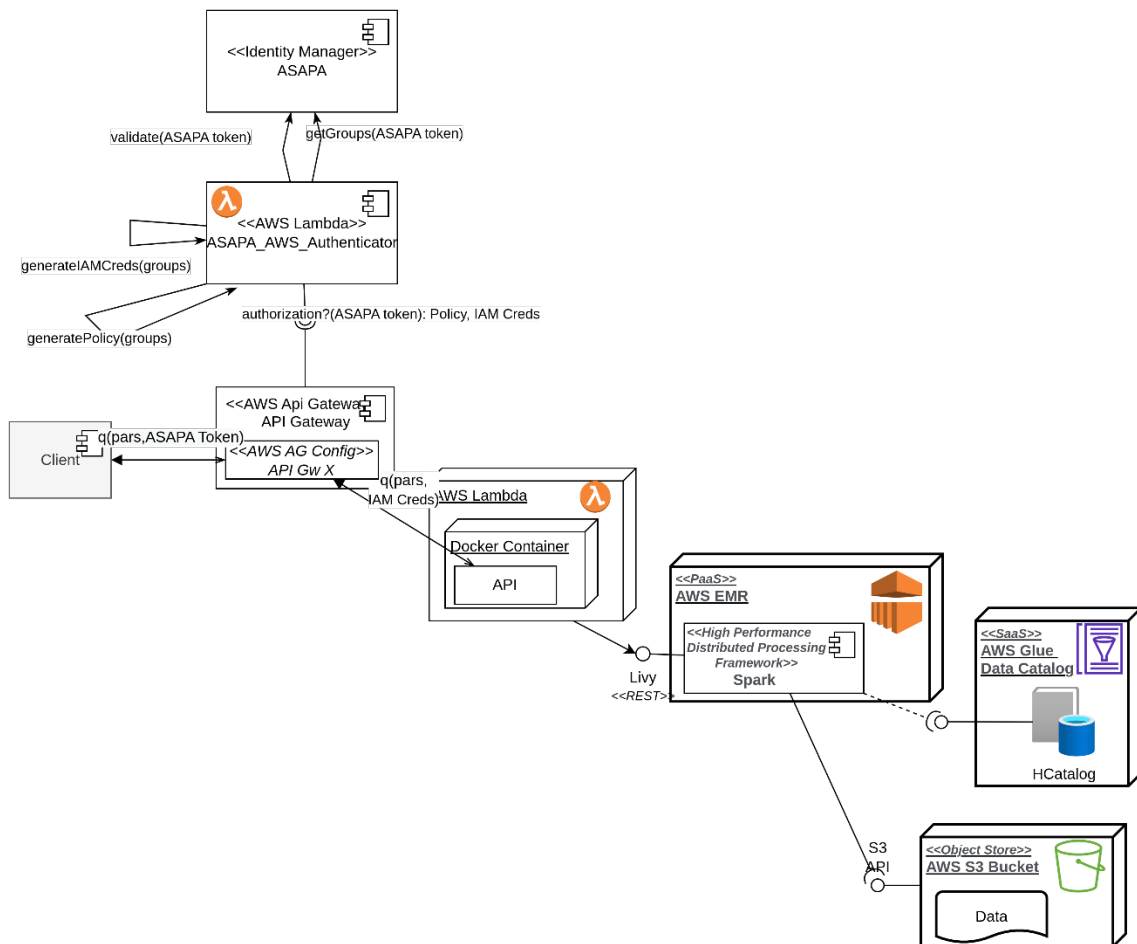


Figure 17 Structure of the API

The current integration environment API specification is represented below in Figure 18:

```
openapi: "3.0.1"

info:
  title: "marketplace_api_tst_gw"
  version: "0.1"

servers:
- url: "https://7z6wgq8rfh.execute-api.eu-west-1.amazonaws.com/{basePath}"

variables:
  basePath:
    default: "latest"

paths:
  /entity:
    get:
      responses:
        "200":
          description: "200 response"
          content: {}
```

Figure 18 API Specification

4 Conclusion

This deliverable summarises and details the work performed in Task 7.4 until M42. A state-of-the-art analysis was conducted to get an understanding of the marketplaces within the healthcare sector and what they offer. Moreover, all the internal parts of the SHAPES Marketplace were presented and explained along with the component's role within the SHAPES ecosystem. In addition, the accessibility features, functionalities, and interdependencies of the SHAPES Marketplace were described. The SHAPES Marketplace was populated with digital solutions and services stemming from the SHAPES partners and third-parties associating with the SHAPES ecosystem through the SHAPES Open Calls, while with the advancements of the project, device manufacturers, technology suppliers, and digital solution and services providers will be invited to join the marketplace and display their digital solutions and services. During the development phase of the SHAPES Marketplace, several key findings were identified I) Modular design: To effectively support a variety of business strategies, allowing for greater flexibility and adaptability in response to changing market needs and customer demands, II) Accessibility features: Providing a user-friendly experience for people with visual impairments and multilingual views, thus promoting inclusivity and reaching a wider audience within the silver society, and III) The SHAPES Marketplace provides a sustainable marketplace based on customers and digital solution/service providers. While the SHAPES Marketplace is at a mature stage and ready to accept new customers and providers alike, future recommendations were also identified to ensure the continuity of the project. The SHAPES Marketplace could I) Improve its user experience, sustainability features, and accessibility options taking into consideration customer and providers feedback as the project advances, and II) Extend its partnerships with more organisations, EU-funded projects, companies, etc., to increase the population of digital solutions and services offered and to simultaneously increase its visibility among the targeted audience. The SHAPES Marketplace component is at the end of its development phase (M19-M42).

5 Ethical Requirements Check

The focus of this compliance check is on the ethical requirements defined in D8.4 and having impact on the SHAPES solution (technology and related digital services, user processes and support, governance-, business- and ecosystem models). In the left column there are ethical issues identified and discussed in D8.4. (Corresponding D8.4 subsection in parenthesis). For each deliverable, report on how these requirements have been considered. If the requirement is not relevant for the deliverable, enter N / A in the right-hand column.

Ethical issue (corresponding number of D8.4 subsection in parenthesis)	How we have taken this into account in this deliverable (if relevant)
Fundamental Rights (3.1)	Fundamental rights are part of the Ethics Requirements of WP8 that also apply for the SHAPES Marketplace. Specific ethical requirements for the marketplace have been developed in close collaboration with WP8
Biomedical Ethics and Ethics of Care (3.2)	N/A
CRPD and supported decision-making (3.3)	The Shapes Marketplace is committed to upholding the principles of respect for inherent dignity, non-discrimination, full and effective participation and inclusion in society, respect for difference, equality of opportunity, accessibility, equality between all genders, and respect for the evolving capacities of children with disabilities and their right to preserve their identities.
Capabilities approach (3.4)	The SHAPES Marketplace aims to support older individuals to live independently and enjoy active and healthy life by offering in a tailored way digital solutions and services to them.
Sustainable Development and CSR (4.1)	The SHAPES Marketplace aims to support older individuals to live independently and enjoy active and healthy life by offering in a tailored way digital solutions and services to them.
Customer logic approach (4.2)	Customer-centric business logic has been a reference for the design and development of the SHAPES Marketplace brought to SHAPES.
Artificial intelligence (4.3)	N/A
Digital transformation (4.4)	Digital transformation goals are met by the SHAPES Marketplace, specifically addressing the use of the marketplace for citizen empowerment
Privacy and data protection (5)	Privacy and data protection are considered in the SHAPES System Specifications, being

	applicable in the design and development of the SHAPES Marketplace
Cyber security and resilience (6)	Cyber security and resilience are considered in the SHAPES System Specifications, being applicable in the design and development of the SHAPES Marketplace
Digital inclusion (7.1)	The Shapes Marketplace is designed to ensure digital inclusion for all, including the elderly, by providing user-friendly and elderly-tailored interfaces and accessible features that cater to their needs and enable them to easily navigate and participate in the SHAPES marketplace.
The moral division of labour (7.2)	SHAPES Marketplace supports citizen empowerment and person-centred care, by providing grounds for them to access the digital solutions and services, thus fostering the conditions to enable older individuals to be better informed and make informed responsible choices concerning their own health and care
Care givers and welfare technology (7.3)	Caregivers were addressed in this deliverable as customers (demand) within the SHAPES Marketplace
Movement of caregivers across Europe (7.4)	Caregivers were addressed in this deliverable as customers (demand) within the SHAPES Marketplace

6 Appendix I: Draft of Terms and Conditions

Introduction

This summary document offers a baseline overview of the suggested terms and conditions for access to the SHAPES platform. It is envisioned that digital users of the SHAPES platform must agree to the proposed terms and conditions prior to gaining access to the service. As the structure, purpose and parameters of the Platform are clarified and modified, the terms and conditions will be altered to reflect the final version of the Platform. It is also important to note that this document supplements and should be read in connection with the ethical requirements defined in D8.4. The purpose of this document is to specify the general terms and conditions that digital users must signify their unconditional acceptance of to access the SHAPES platform.

Unacceptable behaviour

Project partners will have to agree on what behaviour they consider to be unacceptable and not suitable for the Platform. At this stage, we would suggest that users must obtain a SHAPES login account to access all or certain sections of the Platform.

The onus is placed on the digital users to guarantee that the information provided is accurate and complete. Digital users should be responsible for safeguarding their confidentiality and security, and ensuring their appropriate use (i.e., protecting their user names and passwords). However, the SHAPES Project, will be responsible for verifying the accuracy and validity of the information provided. The terms and conditions must specifically state that users are responsible for their user names and passwords, and must undertake all precautions to prevent any unauthorized third party from gaining knowledge and making use thereof. Users must agree that they will not transfer or sell their means of access to third parties. If the SHAPES project has any reason to suspect that the confidentiality or security of the means of access has been breached or that platform is being misused, the Project Partners, without prior notice may suspend or refuse access.

Additional things to consider;
if it is possible for users to put any content available, list what kind of content is not acceptable
-> e.g., posting comments, reviews on service
-> service has the license to use, reproduce, edit etc comments

- obtaining unauthorised access
- violating laws, impersonating persons or entities, interfering or disrupting the services
- termination clause
- > service reserves the right to decide whether the terms have been violated and if a user's access should be terminated
- > copyrights / rights on intellectual property when uploading media content (images, audio, documents)

Jurisdiction clause

It is important to note that users must agree to use the Platform in accordance with the Terms and Conditions, all applicable national legislation and, in general, in a responsible manner, and only for professional purposes and without breach of the rights of third parties.

The Terms and Conditions may include a specific clause on the law applicable and the jurisdiction responsible in case of any dispute arising from the use of the Platform.

Limits on liability

This document suggests that digital users should not be permitted to make changes to the Platform, unless specifically provided for in set sections. In line with this;

Users may not:

(a) download, send or disseminate data containing viruses, worms, spyware, malware or other similar malicious programs;

(b) carry out calculations, operations or transactions that may interrupt, destroy or restrict the functionality of the operation of the Platform or any program, computer or means of telecommunications; or

(c) submit information or materials that infringe third party rights, are libellous, obscene, threatening or otherwise unlawful.

Users are fully and unconditionally responsible for any use of the Platform (including misuse of their means of access), and for any detrimental consequences that may arise directly or indirectly therefrom.

Users are liable for — and will indemnify and hold harmless the SHAPES project and the European Commission against — any damage that results from:

-changes made to the Platform or

-use of the Platform in a manner that does not correspond with these Terms and Conditions.

**(Note, this is the wording currently used by Horizon2020).*

Protect IPR

This section will need to be discussed in detail with the Project Partners, at this early stage, this document suggests that the intellectual and industrial property rights and know-how associated with the Platform belong exclusively to the SHAPES Project and the European Commission.

In this regard, only the SHAPES Project Partners have the right to correct errors.

Without prejudice to the rights of users under the legislation relating to the protection of computer programs (which cannot be contractually denied), users may not in any way:

(a) modify, translate or adapt the Platform;

(b) decompile or disassemble the Platform;

(c) copy the Platform (or parts of it);

(d) pass on, dispose of, grant as a sub-licence, lease, lend or distribute the Platform or Platform documentation to third parties;

(e) create any product or service substantially similar to the Platform; or

(f) copy any ideas, characteristics or functions of the Platform. (I'm not sure about this section).

Warranty disclaimer clause

Digital users of the Platform must expressly accept that the SHAPES Project is not responsible for any losses incurred while users engage with your platform or service and that; services provided "as is" and "as available" to the extent permitted by law without warranties of any kind etc.

Contact information

-Details of the owner of the website/app to be clearly stated.

Payment information

If a payment option is required, it must be clearly outlined how the payment system works.

Third party content clause

The Project Partners must agree to the extent of available third-party content on the Platform as liability for third party content must be restricted. However, it is possible for third party content to be accessed on the Platform provided that the content is not

(a) is not in any way deceptive; (b) does not falsely imply sponsorship, endorsement or approval of the linking party and its products and/or services; and (c) fits within the context of the linking party's site."

Other useful clauses

If the Platform includes any content on medical information, it must be clarified that such information cannot be interpreted as medical advice.

- This is the current SHAPES Privacy Policy which should be updated and re-used for the Platform.

SHAPES Privacy Policy

SHAPES H2020 operates the SHAPES H2020 website (the "Service").

This page informs you of our policies regarding the collection, use and disclosure of Personal Information when you use our Service.

We will not use or share your information with anyone except as described in this Privacy Policy.

We use your Personal Information for providing and improving the Service. By using the Service, you agree to the collection and use of information in accordance with this policy. Unless otherwise defined in this Privacy Policy, terms used in this Privacy Policy have the same meanings as in our Terms and Conditions, accessible at <https://shapes2020.eu>

Consent

By using our website, you hereby consent to our Privacy Policy and agree to its terms. Consent in the meaning of Article 6(1)(a) GDPR is the legal basis of our processing.

Information Collection and Use

While using our Service, we may ask you to provide us with certain personally identifiable information that can be used to contact or identify you. Personally, identifiable information ("Personal Information") may include, but is not limited to:

- Name
- Email address

We will retain your personal information only for as long as is necessary for the purposes set out in this Privacy Policy. We will retain and use your information to the extent necessary to comply with our legal obligations, resolve disputes, and enforce our policies.

Data subject's rights

In certain circumstances, you have the following data protection rights:

- > The right to access, update or to delete the information we have on you.
- > The right of rectification.
- > The right to object.
- > The right of restriction.
- > The right to data portability
- > The right to withdraw consent

Note that the rights listed above apply to the extent that we as are able to identify you. They apply as well if you as a data subject provide additional information enabling us to identify you.

Log Data

We collect information that your browser sends whenever you visit our Service (“Log Data”). This Log Data may include information such as your computer’s Internet Protocol (“IP”) address, browser type, browser version, the pages of our Service that you visit, the time and date of your visit, the time spent on those pages and other statistics.

Cookies

Cookies are files with small amount of data, which may include an anonymous unique identifier. Cookies are sent to your browser from a web site and stored on your computer’s hard drive.

We use “cookies” to collect information. You can instruct your browser to refuse all cookies or to indicate when a cookie is being sent. However, if you do not accept cookies, you may not be able to use some portions of our Service.

Service Providers

We may employ third party companies and individuals to facilitate our Service, to provide the Service on our behalf, to perform Service-related services or to assist us in analyzing how our Service is used.

These third parties have access to your Personal Information only to perform these tasks on our behalf and are obligated not to disclose or use it for any other purpose.

Security

The security of your Personal Information is important to us, but remember that no method of transmission over the Internet, or method of electronic storage is 100% secure. While we strive to use commercially acceptable means to protect your Personal Information, we cannot guarantee its absolute security.

Links to Other Sites

Our Service may contain links to other sites that are not operated by us. If you click on a third-party link, you will be directed to that third party’s site. We strongly advise you to review the Privacy Policy of every site you visit.

We have no control over, and assume no responsibility for the content, privacy policies or practices of any third-party sites or services.

Children’s Privacy

Our Service does not address anyone under the age of 18 (“Children”).

We do not knowingly collect personally identifiable information from children under 18. If you are a parent or guardian and you are aware that your child has provided us with Personal Information, please contact us. If we discover that a child under 18 has provided us with Personal Information, we will delete such information from our servers immediately.

Compliance with Laws

We will disclose your Personal Information where required to do so by law or subpoena.

Changes to This Privacy Policy

We may update our Privacy Policy from time to time. We will notify you of any changes by posting the new Privacy Policy on this page.

You are advised to review this Privacy Policy periodically for any changes. Changes to this Privacy Policy are effective when they are posted on this page.

END OF APPENDIX I: Draft of terms and conditions