Methodology for Business Value Analysis of Innovative IT in a Business Sector. The Case of the Material Supply Chain

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***Abstract*— Identifying the business value of innovative Information Technology (IT) solutions for a business sector remains a challenge, given the diverse needs and perspectives of multiple stakeholders. This paper proposes a methodology for the analysis of the business value of IT innovations targeting a specific sector, integrating consolidated governance frameworks such as ISO 38500, COBIT (Control Objectives for Information and Related Technologies), Bedell's method and IIRA (Industrial Internet Reference Architecture). The methodology is structured in two main phases: Firstly, time planning determines in which phases throughout the innovation lifecycle the value analyses will be carried out. Secondly, conducting these business value analyses, following a structured approach. The guideline addresses three key dimensions: (i) the potential interest and benefits that the innovation can bring to the sector, (ii) the organizational and technical difficulties that may hinder its implementation and (iii) the alignment of the solution with strategic objectives and sector needs. To validate the approach, the methodology was applied in the DIMAT Project, aimed at developing digital tools for small and medium-sized enterprises (SMEs) in the materials supply chain. The results highlight the importance of iteratively incorporating feedback from key stakeholders during development to improve solution relevance, mitigate adoption barriers, and ensure greater alignment with business expectations and industry demands.**

Keywords—Business Value, Innovative IT, Business Sector, IT Government, Alignment

I. INTRODUCTION

Competitive advantage in the digital era is often intricately tied to an organization's ability to swiftly and effectively embrace new technologies [1]. Businesses that excel in seamlessly integrating cutting-edge technology into their business models are poised to capture market share more rapidly than their competitors [2], [3]. Digital transformation refers to the fundamental changes in how organizations or businesses use digital technology to alter the way they operate, interact with customers, and achieve their goals [4]. Successful organizations in digital transformation are often more flexible in adopting changes and mastering new technologies. Additionally, they can collaborate with business partners or external parties to create more innovative solutions [5].

The idea management process is essentially based on generating new concepts by combining the organization's knowledge and collective intelligence, aligned with the organization's contextual factors (strategy, goals, needs...). However, the innovation management life cycle covers all the innovation activities from insight to use. Thus, the innovation management life cycle requires not only the implementation stage of this idea but also an exploitation stage, where the aim is to generate value added [6].

Therefore, the identification of the added value of the idea for its commercialization, in the form of a product, service, or innovative process, is fundamental to completing the innovation cycle. In the case of innovative IT, it is necessary to consider the impact of the project's result on the product or service added value [7].

IT companies that develop innovative IT solutions for a specific business sector must identify and strive to increase the added value that their solution brings to that sector. To achieve this, firms should improve their ability to absorb and utilize users' knowledge by promoting user participation [8]. Various IT innovation frameworks highlight the role of the user from the early stages [6], [9].

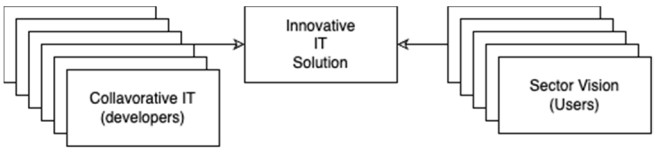

Fig. 1. Main Stakeholders around a Sectorial Innovative IT Solution. Sector companies and IT development companies of the solution.

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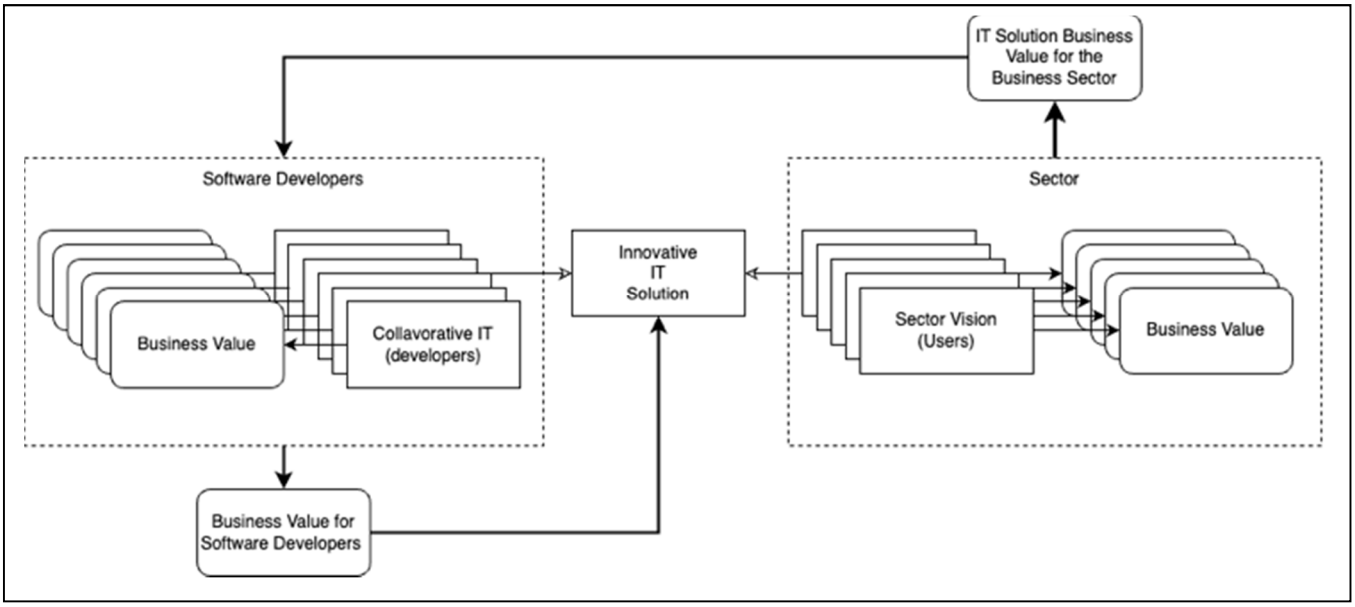

Fig. 2. Business Value for Stakeholders about an Innovative IT Solution. Sector companies and IT development companies of the solution.

Identifying business value in innovation projects focused on a specific sector is complex, as it may have different "value" for the various participating organizations. This complexity increases in collaborative innovation projects, where a group of organizations works together to create a solution useful for a given sector (Figure 1). Collaborative IT innovations aimed at providing cutting-edge software solutions to sectoral problems can be promoted by the public sector (CEE Europe, National Projects, Chambers of Commerce…) or the private sector (initiatives for collaborative IT innovation among companies).

The client/user acceptability assessment of the IT innovation during the planning and development phases, prior to its full-scale deployment, is fundamental [9]. This evaluation ensures that user expectations, operational requirements, and potential adoption barriers are identified early in the process. Mattei [10] highlights the design and pre-production stages, where value analysis plays a key role.

Thus, companies developing an IT innovation in this context must consistently monitor the business value of the IT solution for their clients throughout the various stages of the innovation life cycle (Figure 2). This paper proposes a methodology for identifying the business value of an innovative IT solution for a business sector in the early stages.

II. IT Business Value

IT Governance involves the creation and protection of IT business value [11]. IT business value research is aimed at understanding how and to what extent the use of IT contributes to organizational performance [12]. Business/IT alignment appears to be, as an intermediate variable, an important catalyst of IT business value. However, it remains a challenge to demonstrate the achievement of IT business value [11].

Companies must manage the increasing technological complexities accrued while they generate added value to business processes through the strategic alignment between business and Information Systems/Technologies[13]. According to the MIT90 model [14], for an organization to fully capture IT value, IT should be aligned with business strategy, structure, management processes, as well as with individuals and roles.

According to Sreenivasan and Suresh [15] agility, adaptability and alignment are effective tactics for dealing with difficulties like rising demand and supplier uncertainties, shortened technology and product cycle, having several outsourced collaborators and harmonizing all their objectives and demands. The continued alignment of business and IT in a rapidly changing environment is a major challenge for today's businesses. The ability to react timeously to continuous and unexpected change is called agility and is an essential quality of the modern enterprise. Being agile has consequences for the engineering of enterprises and enterprise information systems [16] (Figure 3).

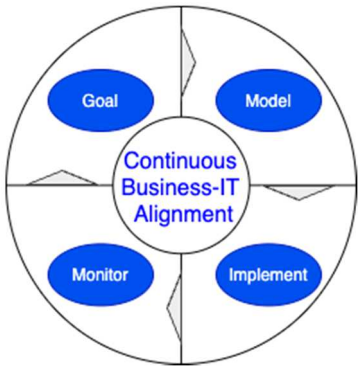

Fig. 3. Continuous Alignment Process adaptaded from [16]

Alignment in new organizational forms (networks of companies) is more complex, since it must consider the degree of alignment between the objectives and individual interests of an organization with that of one or more other partners.

Alignment encapsulates the scope to which the firm cooperates with its stakeholders to meet its performance targets [17]. Alignment aims to increase customer value [18]. Customer value is defined as a balance between the benefits a customer obtains from a service or product and the effort, or the challenges they confront in using or receiving the product or service in question [19], [20].

Value Drivers for adoption of new IT innovation include Competitive Position, Real Opportunities and Cost saving/added revenues [21]. From a general perspective, Jerab [22] differentiates internal and external business value drivers. Internal business value drivers can vary depending on the industry and specific business (e.g. revenue growth, operational efficiency or customer satisfaction). External business value drivers are beyond the control of the organization (e.g. industry trends, competitive landscape or technological advancements).

Bedell's method links business value to information systems in a systematic and transparent approach. The method is intended for decision support for new Information System (IS) investments. The most important principle of the method is that the level of effectiveness of the information systems should ideally be approximately equal to their level of strategic importance. The method provides an IS effectiveness/importance-portfolio for three organizational levels: (i) the entire organization, (ii) its set of business processes, and (iii) the individual activities within each process [23].

The optimisation of the value of investments in Information Technology largely depends on IT governance, which ensures alignment between business strategy and technological initiatives. In this context, COBIT emerges as a reference framework, as it provides processes, principles, and control objectives that allow for effective supervision and evaluation of IT performance [24]. Through COBIT, organisations can define clear metrics (Key Performance Indicators-KPIs), assign responsibilities, and systematically manage risks, ensuring that IT projects generate measurable results and contribute to value creation at the corporate level.

Similarly, the ISO 38500 standard establishes the guiding principles for corporate IT governance, focusing on responsibility, strategy, acquisition, and the performance of technological resources [25]. This international standard promotes a global vision of governance by proposing guidelines for ethical decision-making and the continuous supervision of IT use within the organisation. Additionally, it reinforces the need to involve senior management and relevant stakeholders so that IT investments, whether in digitalisation projects, cloud migrations, or the implementation of new systems, concretely contribute to achieving business objectives and strengthening the company's competitiveness.

Regarding value creation within more specific industrial environments, as in the case of the Reference Architectural Model Industrie 4.0 (RAMI 4.0) [26], a key element is the integration of physical and digital assets throughout the entire product or service lifecycle. This vision allows for identifying different opportunities for the business, whether to reduce costs (optimisation of material use, reduction of downtime, etc.), improve quality, or personalise the offering. Thanks to the data obtained from these assets, new business models become possible. For the organisation to benefit from these industry-associated data, adjustments in governance structure and corporate culture are required. On one hand, there must be a decision-making and monitoring body (for example, a digital transformation committee) that aligns all initiatives with the corporate strategy. On the other hand, fostering interdisciplinary collaboration between production, IT, and finance areas is key, supported by training programmes aimed at adopting digital tools.

Also, the business and organisational perspective presented by IIRA (Industrial Internet Reference Architecture) [27] is a key perspective to developing these industrial systems. This methodology places the business viewpoint at the core around which all other elements of the architecture are built. This positions the user at the centre of development. In this perspective, strategic objectives, success KPIs, and the expectations of all stakeholders are clearly defined, ensuring that Industrial Internet of Things (IIoT) solutions truly provide tangible value. Likewise, risk assessment and data monetisation plans are addressed from the outset, allowing each industrial initiative to be prioritised and designed with a clear focus on profitability and the creation of competitive advantages. At the organisational level, IIRA proposes a classification of roles that ranges from business owners to IT teams and external partners, fostering collaboration and transparent assignment of responsibilities. The adoption of concrete Use Cases drives early validation of the technical and economic feasibility of each project, facilitating decision-making based on metrics and evidence.

III. CRITICAL ANALISYS

Based on the previous analysis regarding value generation in IT innovation and its governance, a series of gaps have been identified that require detailed examination.

The first gap identified lies in the difference in value perception between a developer company and the sector in which it operates when identifying the value of IT innovation. COBIT, Bedell or ISO 38500 includes the value perspective of the innovation for a company, however, they do not consider a global perspective of a group of companies. While a company evaluates the value of an IT solution in terms of its own performance, efficiency, and competitive advantages, the sector may consider broader aspects such as standardisation or interoperability. It is also essential to highlight the sector's different needs, as these may be more oriented towards overall evolution, whereas a company may be more focused on the application of a specific solution. This difference in approach can create barriers to the adoption of innovations since a company may regard an IT solution as highly valuable for its business, but if there is no sector-wide adoption, its impact may be limited.

Secondly, another issue arises in that the value of IT innovation projects varies depending on the nature of the project. Evaluating or conducting a value analysis for an already tested IT solution, such as an ERP (Enterprise Resource Planning) or CRM (Customer Relationship Management), is not the same as introducing a completely new IT innovation for a specific sector. In the first case, the value may lead to optimising a company's operations, but the solution itself has already been tested and validated in the market. However, when dealing with an innovative solution, the value is uncertain and depends on multiple factors such as end-user acceptance, integration with existing systems, or stability within the organisation's system. Here, the difference between levels of innovation is fundamental for proper acceptance, as a company may be innovating with existing technologies within its own context or introducing entirely new technologies for its sector, requiring different validation and adoption strategies.

Finally, reference frameworks such as COBIT, ISO 38500, IIRA, or RAMI 4.0 do not provide a clear methodology that specifically guides the interaction between

IT solution developers and the sector in which these solutions are implemented. For example, both RAMI 4.0 and IIRA barely mention the concept of IT governance for sectoral innovation, despite being frameworks that offer a structured vision for implementing new technologies. However, it is worth noting that IIRA places the user and business objectives at the centre of IIoT (Industrial Internet of Things) solution design, providing an approach based on use cases and defined roles. In contrast, though, there has been little exploration of how this architecture can be applied in analysing the value of IT innovation in specific sectors.

In this sense, it is necessary to develop a methodology that structures the identification and analysis of IT innovation value in specific sectors, considering both business and sectoral perspectives while focusing on the differences between various types of IT innovation. The development of this methodology will reduce uncertainty in IT innovation adoption, facilitate its alignment with sectoral needs, and improve efficiency in value creation for companies participating in collaborative innovation projects.

IV. Business Value Analysis Proposal

The development of innovative IT applications aimed at a business sector requires adequate identification of the value that their implementation has for the business. In this process, it is necessary to consider the value/interest/benefits for the business of the new functionalities provided by the applications, as well as the difficulties of their implementation. The process of adjusting innovative IT proposals presents a higher level of complexity when is aimed at a business sector where many companies participate. That is why the role of IT government in these contexts is fundamental for the development of innovative solutions that truly respond to the majority interest of the companies involved.

Therefore, this proposal attempts to answer the following questions: (i) Is the solution of interest to the business? (ii) Are there difficulties in implementing the solution in the business? (iii) How to align the solution to the needs of the sector?

In accordance with the ISO 38500 standard, monitoring phases (Evaluate and Monitor) examine the relevance of the solution for the company and anticipate the difficulties of its implementation, providing answers to the first two questions. The direction phase guides the definition of strategies and the adaptation of the solution to the specific needs of the sector, answering the third question and promoting alignment with business objectives. Thus, the analysis proposal is structured in 3 steps:

1. Analysis of interest/benefits for the business
2. Analysis of the difficulties for its implementation
3. Alignment analysis

1) *Analysis of Interest/Benefits for the business:*

For this analysis, it is necessary to identify the potential benefits of using the innovative IT solution brings to the business sector in which it will be implemented. This involves contextualising these benefits within the business environment, precisely identifying the business processes that will be improved, and determining the specific value that this solution adds to the organizations involved.

Since the impact of a sector-wide solution may vary depending on the characteristics of each organization within the sector, the perceived benefits may also differ. Some companies may find significant value in optimizing operational processes, while others may prioritize improving decision-making or enhancing adaptability to new technological environments.

To carry out this analysis, it is proposed to adapt the Bedell's Method to identify the interest of the IT solution for the sector. Thus, the following aspects has been proposed to be analysed.

IMPORTANCE: How important for your business are the processes that are impacted by the innovative IT solution?

This dimension analyses the degree of relevance of the business processes impacted by the IT solution within the strategy and operations of companies in the sector. A highly important process is one whose improvement or transformation can significantly impact the competitiveness and sustainability of the business.

EFFICIENCY: How much can the processes be improved by implementing the innovative IT solution?

This evaluates the extent to which the implementation of the innovative IT solution can improve existing processes. This includes reducing operational costs, increasing productivity, improving data accuracy, or optimizing the execution time of key tasks.

Also, the aggregation levels in the Bedell Method have been adapted for this proposal. Traditionally, the Bedell model structures the relationship between an organization and its processes in the following hierarchy:

Organization (1) → Business Processes (N) → Activities (N)

Each organization has multiple business processes, and each of these processes consists of various specific activities.

In the guideline presented in this paper, the analysis structure is modified to address the IT solution from a sectoral perspective:

Sector (1) → Subsectors (N) → Business process involved with the innovative IT solution (N)

Within a given sector, multiple subsectors may be affected at different levels by the proposed IT solution. Each of these subsectors, in turn, presents specific business processes that directly interact with the new technology.

This structure makes it possible to determine the importance and efficiency of the solution for the different subsectors and for the sector as a whole.

2) *Implementation difficulties*

The implementation of an innovative IT solution in an organisation involves a series of challenges that must be assessed to understand the effort required for its adoption. In this article, it is proposed to examine the difficulties of its implementation from two perspectives: (i) The business perspective, focused on the vision of business decision-makers, and (ii) the technical perspective, focused on the vision of technology leaders. This difference is based on an adaptation derived from the IIRA architecture framework, specifically from the business viewpoint section, which distinguishes technological factors from business factors.

Based on this approach, the main difficulties that may arise during the implementation of the solution are identified.

ORGANIZATIONAL DIFFICULTIES: What organizational difficulties could your company have when implementing the innovative IT Solution?

Organizational difficulties refer to internal obstacles that may hinder the deployment of the solution within the company. One of the main challenges is change management since the introduction of new technologies can generate resistance among employees and executives. The lack of familiarity with the solution, fear of disruption to established processes, and uncertainty about its impact can slow down its adoption. To mitigate this risk, it is essential to establish a clear communication and change management strategy that ensures the acceptance and commitment of all involved parties.

Another important challenge is staff capability, as depending on the complexity of the solution, the company will need to invest in training to ensure that employees can use the new technology efficiently. Likewise, the implementation of the solution could involve changes in the organizational structure, reassignment of responsibilities, or redefinition of key processes, which requires a detailed analysis to minimize negative impacts. Moreover, it is crucial that the solution is aligned with the company's strategic objectives. If its implementation does not fit the business vision and needs, it could create more obstacles than benefits.

Finally, the decision-making process and acceptance at different levels of the organization can pose a significant challenge. This is due to the lack of consensus among different departments or uncertainty about the return on investment, which can delay implementation and affect the viability of the project.

TECHNICAL DIFFICULTIES: What technical difficulties could your company have when implementing the innovative IT Solution?

Technical difficulties, on the other hand, are related to the integration of the solution within the company's technological ecosystem. It is possible that some organizations operating with legacy infrastructures may not be compatible with the new solution, requiring additional efforts in terms of interface development, API integration, or system updates. Considering this, data migration can be a complex process, especially if there are large volumes of information that need to be adapted to the new system without compromising their integrity and security.

Technological infrastructure also plays an important role in implementation, as some solutions require investments in new servers, devices, or networks to ensure their proper functioning. Security is another fundamental aspect since incorporating new technology may increase the attack surface and expose the company to new risks. Nonetheless, solutions must comply with applicable security and privacy regulations, such as GDPR, and include strong protection measures to prevent unauthorized access or data loss. Additionally, the performance and scalability of the solution must be considered from the outset to avoid future issues. A solution that cannot handle the company's operational load or is not scalable can generate additional costs and impact business continuity.

Finally, the need for customization and specific adjustments for the company can prolong implementation times and increase the required investment, which must be considered in project planning. The identification and mitigation of these difficulties are necessary to ensure a successful implementation. The combination of an organizational strategy and a solid technical approach will help reduce risks and maximize the value of the solution for the company.

3) Alignment analysis

In this section we analyse the alignment that arises between the innovative IT solution, the strategic business objectives and the technological infrastructure that supports it, to correctly apply the principles of ISO 38500 and EGM COBIT. From this point of view, we will obtain additional information that allows us to better understand the functionalities of the solution that can generate value and at the same time, avoid imbalances in its development.

To do this, it is proposed to follow one of the Business and IT alignment perspectives proposed by Henderson and Venkatraman [13]. Specifically, this perspective is addressing the competitive potential and is concerned with the harnessing of emerging IT capabilities to impact new products and services (i.e. business scope). The specific role of the top management to make this perspective succeed is that of the business visionary, who articulates how the emerging IT competences and functionality would impact the business strategy.

Under this approach, the analysis is oriented to identifying possible improvements that boost its impact on the business strategies.

ADDED VALUE PROPOSALS: What improvement or changes would you introduce to the innovative IT solution that could provide greater value for your organization?

This question allows to gather concrete ideas on how to optimize the solution to effectively respond to the needs of the different interest groups, thus providing an environment for a constructive discussion to unite both the technological and the business vision. In this way, the alignment analysis considers the compatibility between processes and systems, adding the vision of those who use or will use the innovative solution. Ultimately, the final objective is to be able to guarantee that the solution (apart from being technologically sound) contributes to the requirements defined by the organizations, so that they create real and sustainable value in the sector.

V. Methodology for Business Value Analysis of Innovative IT in a Business Sector

The proposed methodology is structured in two main phases. The first phase focuses on planning the business value analysis by determining the key moments in the innovation process where the assessment will take place. Identifying these moments ensures that the evaluation is aligned with critical decision points. For example, if the analysis is conducted in the early stages of the innovation, it helps ensure that technological innovations remain closely connected to the real needs of the sector, preventing misalignment between solutions and their intended users. On the other hand, if the analysis takes place in later stages such as prototyping, it serves to validate the actual business impact of the innovation and identify potential adjustments needed.

The second phase consists of conducting the business value analysis itself, following a structured approach. This includes: (i) Identifying the relevant stakeholders within the innovation ecosystem, (ii) Defining the key value aspects to be analyzed, (iii) Preparing and executing the process to collect stakeholders' perceptions and expectations, (iv) Analyzing the collected data, and providing recommendations to developers to help them refine their solutions and maximize their business value.

A. Business Value Analysis Plannnig

The innovation life cycle goes through several stages, from the generation of the initial idea to its final exploitation. During this journey, it is essential to identify and enhance the added value that the solution provides at each moment. Therefore, it is essential to establish a time plan that defines in which phases the value analysis will be carried out. This plan should take into account risk factors, such as delays in the schedule, or—more critically—the identification that the proposed solution provides insufficient business value to the stakeholders. In all cases, appropriate contingency measures should be defined from the outset.

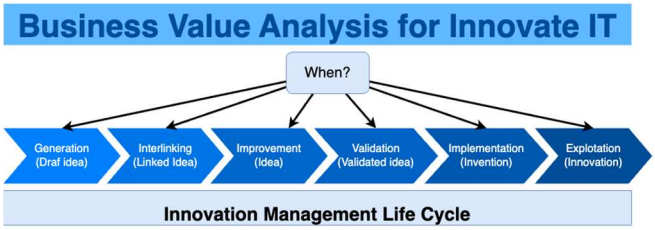

Fig. 4. Business Value Analysis Planning

Figure 4 illustrates key stages in the innovation process, from idea generation to exploitation, and indicates the decision point for determining when Business Value Analysis should be performed. This planning ensures that assessments are timed according to the maturity of the innovation, enabling alignment with stakeholder expectations, product evolution, and market dynamics.

In this way, each business value analysis is tailored to the specific characteristics of the innovation at the corresponding stage, considering both the evolution of the product or service and the participation of different key actors. This progressive approach allows for a more precise and realistic view of the impact that the innovation can generate in the business environment, facilitating decision-making and optimising the alignment of the solution with the real needs of the sector. Thus, once the plan has been established (first phase), each analysis must be conducted with the following steps (second phase):

B. Identification of relevant stakeholders within the innovation ecosystem

The proposed methodology considers three main sets of stakeholders, each playing a distinct role in the innovation ecosystem:

1. **Users** – Organizations or companies within the business sector that are potential adopters of the solution. Their feedback is essential in assessing the innovation's relevance, usability, and alignment with industry needs.
2. **Developers** – IT organizations or companies responsible for the technical development and implementation of the solution. Their involvement ensures that business value considerations are integrated into the innovation development.
3. **IT Government Managers** – Organizations or companies overseeing the design, conceptualization, and alignment of the solution. This group may involve research centers, regulatory bodies, developers, users and experts in software architecture or business strategy, among others. Their role is important in establishing the foundation upon which developers will build the final solution.

As previously mentioned, the composition of stakeholders may be different in the different stages of the innovation process. Therefore, it is essential to review and update the stakeholder set each time a business value analysis is conducted. In addition, in IT-driven innovations focused on a specific business sector, the group of potential users can be highly diverse, including various types of companies with different needs, priorities and expectations regarding the innovation.

Therefore, it is necessary to carefully select the participants that will be involved in the data collection process, ensuring that the analysis captures a representative sample of the sector and provides meaningful insights.

C. Preparation for the data capture and definition of value aspects to be analyzed

The business value analysis proposed previously in section IV must be adapted to the specific stage of the innovation process. As the IT solution evolves, and different stakeholders become involved, the aspects to be analyzed and the data collection methods may need to be adjusted.

The key value aspects to be analyzed should be related to three main areas: 1) the potential interest and benefits of the innovation for the business sector, 2) the challenges and difficulties associated with its implementation, and 3) the alignment of the innovation with industry needs and expectations. To effectively conduct these analyses, three key elements must be considered:

1. Providing clear and structured information about the product or idea at its current stage to the selected stakeholders.
2. Defining the most appropriate data collection methods, such as interviews, surveys, or structured questionnaires, depending on the context.
3. Adapting the questions and format of data collection to the target audience to ensure relevant and useful information.

By adjusting the analysis approach based on the maturity of the innovation and the composition of stakeholders at each stage, the business value assessment remains precise, practical, and aligned with real sector conditions. Therefore, the three key elements indicated must be formulated at this stage to be implemented in the following step.

D. Implementation of the process to collect stakeholders' perceptions and expectations

This step is divided into two main phases:

1. Preparation for data collection: Before collecting input from stakeholders, it is essential to prepare and structure both the materials and the mechanism for data collection. This preparation involves:

- Developing relevant information about the innovation. Stakeholders must have a clear understanding of the idea or project being developed to provide informed responses. The format for delivering this information can vary, including written documents, online materials, personalized meetings, or informative videos.
- Preparing the data collection system. If using surveys, this includes preparing the questionnaire, defining question types, and ensuring clarity and relevance. If using interviews or focus groups, this involves structuring the questions and defining the interview format.
- Coordinating stakeholder participation. To ensure participation, it is necessary to coordinate how stakeholders will be invited and how they will access the data collection process. This can include sending invitations, setting up appointments for interviews, or distributing survey links.

2. Execution of data collection: Once the preparation is complete, the data collection process must be managed efficiently:
   - Providing stakeholders with access to the data collection system. Clear instructions must be given to facilitate participation independently of the method employed (e.g. questionnaire on a sheet of paper or on a web page).
   - Defining deadlines for responses. Establishing a response period ensures timely feedback and allows for proper data analysis planning.
   - Encouraging stakeholder participation. This can involve follow-up communications, reminders, or incentives to encourage responses from key participants.

E. Data Analysis and Recommendations

The data analysis step focuses on processing and interpreting the collected data. Since the business value of an IT innovation can vary depending on the different stakeholders involved, it is crucial to examine the data from multiple perspectives, considering the needs, expectations, and challenges identified by each group.

By systematically analyzing survey responses, interview feedback, or other data sources, it is possible to identify common trends, key concerns, and opportunities for improvement. This process helps to understand stakeholder perceptions, highlighting both strengths and necessary adjustments to the innovation.

Once the data has been analyzed, the next step is to generate recommendations to improve the design and development of the innovation. These recommendations should aim to address critical issues or limitations identified during the analysis, improve functionalities to better meet user needs, or adapt specific features to improve usability, feasibility, or business impact. By refining the solution based on stakeholders' feedback, developers can ensure that the innovation remains relevant and aligned with sector and industry requirements, and delivers tangible business value.

VI. The Case of the Material Supply Chain

The proposed methodology has been implemented in the DIMAT Project (Digital Modelling and Simulation for Design, Processing and Manufacturing of Advanced Materials) [28], an initiative funded by the European Union under the Horizon Europe program. The main objective of DIMAT is to develop open digital tools that enable small and medium-sized enterprises of the material supply chain in Europe to model, simulate, and optimize materials at every stage of their value chain: design, processing, and manufacturing. These tools aim to improve the quality, sustainability, efficiency, and competitiveness of materials produced in Europe, driving technological innovation across the entire supply chain.

The project is structured into three integrated suites (Data and Assessment Suite, Modelling and Design Suite, and Simulation and Optimization Suite), each composed of three toolkits. Data and assessment suite: i) Cloud material database, ii) Knowledge acquisition framework and iii) Material environmental and cost life cycle assessment toolkits. Modelling and design suite: i) Materials design framework, ii) Materials modeler, and iii) Material designer toolkits. And simulation and optimisation suite: i) Materials mechanical properties simulator, ii) Materials Processing simulator and iii) Digital twin for process control toolkits. These toolkits offer targeted digital functionalities across different stages of the advanced materials value chain, supporting technical decision-making in sectors such as textiles, composites, glass, and graphite processing.

The effectiveness of these suites will be demonstrated through their application in different types of materials supply chains: textiles, composites, glass, and graphite. Additionally, multiple academic and non-academic partners participate in the conceptualization, design, and development of the tools that compose each suite.

As part of the **Business Value Analysis Planning,** two assessments were scheduled at different stages of the innovation process.

The first analysis took place in the early stages of the project, when the toolkits were still being conceptualized. At this point, the objective was to align the vision of developers and IT governance managers with business needs, such as reducing production downtime, improving traceability, minimizing raw material waste, and increasing responsiveness to customer-specific material properties—challenges commonly faced by SMEs in the advanced materials sector.

The second analysis was conducted once the first prototype of the digital tools was developed. This evaluation focused on validating the business impact of the proposed solutions and identifying potential improvements.

The **identification of stakeholders** for the Business Value Analysis was based on the roles defined within the consortium and the need to engage relevant industry participants. These roles included Users (technical experts in material science from companies within the sector), Developers (software development companies) and IT Government Managers (R&D managers, process engineers, IT integration staff, and innovation officers from four research centers, two development companies of the innovative solution and four pilot companies in the material sector). Their role is important

in establishing the foundation upon which developers will build the final solution.

However, identifying potential users within the materials supply chain was more complex due to the wide range of possible stakeholders. The first analysis focused on gathering feedback from the four pilot companies collaborating on the project. These companies provided initial input on the conceptualized solutions, including technical needs (e.g., process data integration, simulation accuracy), conceptual expectations (e.g., modular design, scalability), and informatics-related concerns (e.g., compatibility with existing IT infrastructure and data security). This helped refine the design of the solution and increase the relevance to real business needs.

In the second analysis, the evaluation was extended to a larger number of companies from the sector. This helped validate the business impact of the developed prototypes and provided a more detailed assessment of their applicability, feasibility, and potential adoption by the sector.

The **definition of value aspects to be analyzed** was adapted to the specific objectives of each analysis. In the first business value analysis the focus was on evaluating the innovation concept from the perspective of potential users. The analysis considered aspects such as the relevance and potential benefits of the proposed toolkits for companies in the materials sector, their alignment with industry needs, and the feasibility and perceived difficulties in adopting the proposed digital solutions.

In the second Business Value Analysis, the evaluation focused on validating the business value of the developed toolkits, assessing practical challenges related to implementation such as organizational and technical barriers, and identifying expected improvements in terms of operational efficiency (e.g., perceived reduction in process time and scrap rates), profitability (e.g., expected margin improvements), and competitiveness (e.g., capacity to respond faster to customer demands or customize products). These were measured using self-reported estimations and confidence levels rated by company representatives.

The **implementation of the process to collect stakeholders' perceptions** was adapted for the two Business Value Analyses, considering the specific objectives of each evaluation: in the first, to validate the conceptual fit of the toolkits with sectoral needs and refine their scope; in the second, to assess the readiness, perceived value, and adoption potential of the working prototypes.

In the first Business Value Analysis, a physical seminar was organized where the innovation concept (defined as the use of modular, open-access digital toolkits tailored to simulate, model, and optimize material properties and manufacturing processes in SMEs) was presented to representatives of the pilot companies. Following the seminar, a web-based questionnaire was made available for a week, allowing participants to provide structured feedback on the proposed solutions. The questionnaires were structured according with the proposal (analysis of interest/benefits for the business; analysis of the difficulties for its implementation and alignment analysis)

For the second Business Value Analysis, a webinar was held to present the toolkits, followed by additional dissemination through a recorded YouTube session and email campaigns targeting relevant companies in the sector. To facilitate participation, a web-based survey remained open for 30 days, allowing stakeholders to provide input asynchronously. This survey received 34 responses collected from different companies of the material sector.

The **data analysis** derived from the two Business Value Analysis provided valuable insights into the perceived benefits, challenges, and adoption potential of the digital toolkits developed in DIMAT. Quantitative data were analyzed using descriptive statistics (mean, standard deviation) to rank toolkits across benefit categories. Qualitative data were coded thematically using inductive content analysis to identify patterns in concerns, expectations, and strategic alignment.

In the first Business Value Analysis, the results obtained from the questionnaire confirmed that companies in the materials sector recognised the potential benefits of digital toolkits in improving operational efficiency and competitiveness. However, concerns were raised regarding feasibility and integration into existing workflows, particularly in relation to technical complexity and organizational adaptation. These findings helped refine the innovation, aligning its design with practical industry requirements. The main results helped identify the toolkits with the greatest potential for use in companies within the sector. Moreover, this made it possible to assess the challenges that may arise during the implementation of the solutions in companies within the sector.

The second Business Value Analysis results indicated that the *Simulation and Optimization* Suite demonstrated the strongest alignment between expected improvements and business importance, particularly in areas such as operational efficiency, profitability, and risk management. However, some companies highlighted concerns about implementation challenges, including insufficient budget, lack of training, and resistance to change, which could affect adoption rates. In response, the project consortium proposed additional dissemination and training activities, recommended phased deployment strategies, and planned the development of user manuals and helpdesk support mechanisms.

Based on these insights, specific **recommendations** were made to enhance the toolkits and improve their business value The analysis and recommendations were documented in two project deliverables, which have served as a guide for developers and IT governance managers in the following stages of the innovation process.

VII. Conclusions

The proposed methodology for business value analysis of innovative IT solutions for a business sector provides a structured approach to assess their impact, feasibility, and alignment with industry needs throughout the innovation lifecycle. By addressing the three key dimensions, business interest and benefits, implementation difficulties, and alignment with sectoral needs, the Business Value Analysis proposed ensures a comprehensive evaluation of the solution's value.

A key aspect of this proposal is the importance of integrating multiple perspectives when evaluating IT innovation (interest/benefits for the business, difficulties for its implementation, and alignment with the business) from a sectoral point of view.

Furthermore, the methodology and the business value analysis proposed take into consideration IT Governance frameworks and standards such as ISO 38500, COBIT, Bedell's method or IIRA.

The application of this approach in the DIMAT project demonstrated its effectiveness, by enabling iterative refinement of the toolkits, informed by real-time stakeholder feedback, and leading to measurable increases in stakeholder interest, tool alignment with needs, and readiness for pilot deployment.

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