In the following we explain how we identified the different ecosystem's constructs and discuss how they change as AM adoption level progresses.

Actors

As discussed, under this construct we pinpointed the various stakeholders needed to engage within the ecosystem in order to support AM adoption in the defense sector. From the analysis of the countermeasures suggested by the practitioners (cf. Table 8), it was possible to identify six main actors: (i) governmental bodies, (ii) legal and regulatory bodies, (iii) Higher Education Institutions (HEIs) and research entities, (iv) Original Equipment Manufacturers (OEMs), (v) AM technology and material providers, and (vi) defense and military organizations. These actors were indeed suggested as the responsible actors to overcome the different challenges identified.

Interestingly, these six actors are common between the two groups of practitioners, but, as we will better describe later, their role shifts as AM adoption progresses.

Resources

Resources encompass the tangible and intangible assets that actors need to deliver on the ecosystem’s value proposition. According to both “Early-Stage Adopters” and “Advanced-Stage Adopters”, governmental bodies should put in place different types of economic support measures as countermeasures to challenges like “Lack of Supplier” (C1), “High Investment Costs” (C2), “Material Limitation” (C7), etc. However, as shown in Table 9, “Early‑Stage Adopters” tend to view these economic measures as indispensable to address such challenges. “Advanced‑Stage Adopters”, by contrast, argue that while these incentives can definitely support AM adoption, they are not indispensable as such challenges can be tackled leveraging internal resources. Interestingly, governmental bodies are required to put in place the resource “Communication & Outreach Programs” only according to “Early‑Stage Adopters”, so only when the AM adoption level is low. Indeed, this resource is linked to the countermeasure “AM benefits campaigns – governmental bodies should develop awareness campaigns on AM benefits”, which was not considered required anymore when AM adoption level is high as AM benefits are considered already known and there is no longer any need to describe AM benefits to win the reluctancy of managers and/or staff members.

The resources required by legal and regulatory bodies are all those connected to the development of IP licensing agreements, guidelines, and standards, so their legal expertise and their staff. Notably, these resources do not change as AM adoption level progresses. This is also the case for OEMs and AM technology and material providers, which have the same unchanging resource requirements across all adoption stages: in addition to core assets (knowledge on AM, skilled workforce/staff, and AM machines), OEMs must share IP rights, while AM technology and material providers must contribute with R&D capabilities. However, as we will see later (cf. activities), how the resources of OEMs and AM technology and material providers are used differs as AM adoption progresses.

Then, dealing with HEIs and research entities, both groups of practitioners agree that, besides the obvious knowledge on AM, and skilled workforce/staff, this actor should allocate research facilities and equipment to support the development of countermeasures requiring advanced R&D activities (e.g., R&D activities to develop cost‑effective machines, affordable materials, and energy‑efficient systems, …). However, there are also some differences between “Early-Stage Adopters” and “Advanced-Stage Adopters”. Indeed, “Early-Stage Adopters” advocate for the necessity of HEIs and research entities to deploy their training facilities & equipment, while “Advanced-Stage Adopters” do not. This is because this is linked to the need to train low-skilled staff members (especially of defense and military organizations): as AM adoption progresses and becomes advanced, training of armed forces is not required anymore. Some training of new recruits might be necessary, but, as it will be discussed better when elaborating on the activities, internal training will suffice and HEIs and research entities are not required to be involved anymore. Additionally, a resource not recognized by “Early-Stage Adopters” is required from HEIs and research entities according to “Advanced-Stage Adopters”. This is the theoretical modeling capabilities, which is necessary to design and develop ecosystem models.

Finally, many differences are visible also for defense and military organizations. As AM adoption level progresses, defense and military organizations have now resources that they did not have at the early adoption stages, which are critical to mitigate some challenges. Particularly, at advanced soption stages, they have a consolidated network (of, e.g., suppliers) and infrastructure as they have already identified suitable suppliers, setting in place agreements for example. Additionally, after a long use of AM, they have now skilled workforce/soldiers and knowledge on AM, things they do not have during the first uses of AM. Finally, another resource they can leverage is the collaboration network with foreign partners: this is something possible also at the early adoption stages, but only “Advanced-Stage Adopters” have identified this as a suitable resource to overcome some challenges (e.g., “High Investment Costs” (C2)).

Activities

These are the actions that diffent actors need to take to use the just-described resources to boost and further extend the use of AM in the defense sector. Hence, governmental bodies are required to provide funding opportunities and provide research and R&D grants to overcome some of the identified challenges (e.g. “Lack of Supplier” (C1), “High Investment Costs” (C2), “High Operational Costs” (C3), etc.). Interestingly, both groups of practitioners have identified these as activities required by governmental bodies, but these are seen as less crucial activities by “Advanced-Stage Adopters”. Indeed, while “Early-Stage Adopters” see this as the only way to overcome certain challenges, “Advanced-Stage Adopters” have found other ways to overcome such challenges. Additionally, given the discrepant view between “Early-Stage Adopters” and “Advanced-Stage Adopters”, governmental bodies should develop and provide “AM benefits campaigns” only at the initial AM adoption stages as, when AM adoption level is high, AM benefits are considered already known, with consequent no further need to describe AM benefits to win the reluctancy of managers and/or staff members.

Then, as previously discussed, legal and regulatory bodies are required to develop new standards and regulations for AM, as well as IP licensing agreements. By doing so, both groups of practitioners agree that legal and regulatory bodies would support AM adoption since this could mitigate the challenges “IP Issues & Data Breaches” (C4) and “Standardization and Certification” (C6). Additionally, “Advanced-Stage Adopters” suggest that legal and regulatory bodies should also develop supplier qualification programs as this would allow to mitigate the challenge “Lack of Supplier” (C1).

Dealing with HEIs and research entities, both groups of practitioners agree that their activities should deal with (i) developing AM-related study programs/courses, (ii) supporting in R&D activities, and (iii) participating/leading research projects/initiatives. Particularly, (i) is linked to the countermeasure “AM curricula” that has been proposed to overcome the challenge “Lack of skilled personnel”. (ii) and (iii), instead, are linked to countermeasures suggested to overcome/mitigate challenges linked to “technological constraints” (e.g., “Material limitation” (C7), “Production Limitation” (C10), “Need for post-process operations” (C11), etc.). As for the other actors, there are differences in the activities that HEIs and research entities should carry out according to “Early-Stage Adopters” and “Advanced-Stage Adopters”. According to “Early-Stage Adopters”, HEIs and research entities should provide training and workforce development programs. This was not recognized as a required activity by “Advanced-Stage Adopters”. As discussed above, this can be linked to the fact that, as AM adoption progresses, training is not required anymore since experience and knowledge have already been gained; some training of new recruits might still be necessary, but internal training will suffice and HEIs and research entities are not required to be involved anymore. Interestingly, “Advanced-Stage Adopters” suggested two actitivities that were not recognized by “Early-Stage Adopters”, i.e., to develop ecosystem models to ensure a successful, long-lasting AM adoption and to determine (or support to determine) optimal production process parameters, design strategies, etc. These new activties are linked to new countermeasures that have been identified only by “Advanced-Stage Adopters”, such as “Design and process optimization – optimize design and process (e.g. use topology optimization and scheduling models)”, “Smart design and process selection – act on the selection of AM machines and/or design strategies that minimize the need for post-processing”, “Ecosystem models – develop ecosystem models to provide guidance and ensure all partners benefit from being part of it”, etc.

Next, OEMs are also characterized by some activities that are common between the two groups of practitioners and some that differ. Common between the two groups of practitioners is the perspective that OEMs should ensure sustained collaboration with the ecosystem (especially willingness to share IP rights) and participate in research projects/initiatives. Dealing with the former, this is due to the fact that the challenge associated with this activity (“IP Issues & Data Breaches” (C4)) cannot be overcome by any other actor than OEMs. Dealing with the latter, this is linked to countermeasures that both groups of practitioners suggested for challenges linked to “technological constraints” (e.g., “Material limitation” (C7), “Production Limitation” (C10), “Need for post-process operations” (C11), etc.), which are relevant for both groups. However, “Advanced-Stage Adopters” have also identified some alternatives for these challenges, which explain some of the differences between the activities identified by “Early-Stage Adopters” and “Advanced-Stage Adopters”. Indeed, based on “Advanced-Stage Adopters” insights, OEMs should determine (or support to determine) optimal production process parameters, design strategies, etc., concur to develop internal production guidelines, and lease AM machines. As already discussed above, the first two activities are linked to countermeasures identified only by “Advanced-Stage Adopters” for challenges linked to to “technological constraints”. The latter activity (i.e., lease AM machines), derives from “Advanced-Stage Adopters’” suggestion of “AM machine leasing program” as countermeasure to the challenge “High Investment Costs” (C2). Finally, as it occurred for HEIs and research entities, the activity “training and workforce development programs” was suggested only by “Early-Stage Adopters” insights: as AM adoption progresses, training is not required anymore since experience and knowledge have already been gained.

Dealing with AM technology and material providers, as the challenges linked to “technological constraints” are relevant for both groups of practitioners, the activities linked to their countermeasures are suggested by both groups. So, both groups of practitioners agree that AM technology and material providers should carry out R&D activities, participate/lead research projects/initiatives, and develop new AM solution/processes/materials (with HEIs & research entities if necessary). Additionally, as discussed also for other actors, the insights from “Advanced-Stage Adopters” allow to identify activities not recognized by “Early-Stage Adopters” to overcome challenges linked to the so-called “technological constraints”. This is the case of activities like “Support to determine/determine optimal production process parameters, design strategies, etc.” and “Concur to develop internal production guidelines”. Additionally, other two activities were identified just from the insight of “Advanced-Stage Adopters”: “Lease AM machines” and “Concur to develop supplier qualification programs”. While we have already discussed above about the former, the latter appears only in the “Advanced-Stage Adopters”-related ecosystem as they are the only ones to suggest the countermeasure “Qualified Supplier Program” for the challenge “Lack of Supplier” (C1). Finally, as described also above, the challenge “Lack of skilled personnel” is not relevant for “Advanced-Stage Adopters”. This implies that activities like “Provide trainings on using AM machines” are not considered required when AM adoption progresses. Additionally, contrary to “Early-Stage Adopters”, “Advanced-Stage Adopters” did not suggest “IT security” as countermeasure to the challenge “IP Issues & Data Breaches”. Therefore, the activity “Improve AM machines IT safety” does not appear in the ecosystem developed based on “Advanced-Stage Adopters” insights.

For the same reason, the activity “Improve IT systems” does not appear among the activities of defense and military organizations derived from “Advanced-Stage Adopters” insights. However, new activities can be derived based on “Advanced-Stage Adopters” insights. First, the activities linked to the countermeasures identified only by “Advanced-Stage Adopters” for challenges linked to to “technological constraints”: “Support to determine/determine optimal production process parameters, design strategies, etc.” and “Concur to develop internal production guidelines”. Then, we the activity “Military asset sharing”: this is linked to the countermeasure “Military asset sharing program”, again only identified by “Advanced-Stage Adopters”. Finally, as defense and military organizations have gained knowledge and experience with advancements in AM adoption, they can also provide “Internal training for new members (if needed)”, with support from HEIs and research entities, OEMs, etc. not longer being required for this (as discussed above). Finally, there are also activities suggested by both groups of practitioners. The first is the willingness to adopt AM and to integrate it in field operations, which is the cornerstone of the ecosystem given its nature. Then, both groups of practitioners agree that defense and military organizations should support staffs’ education in order for the staff to appreciate the opportunities of AM products, how to handle such products, etc. In this way, by enhancing their knowledge on AM, it is expected that the staff would prefer AM solutions. Notably, this activity is suggested also by “Advanced-Stage Adopters” and not only by “Early-Stage Adopters” as new staff members might still need to be educated even when AM adoption level is high.

Value Addition

As described, the value addition construct represents the products/services/financial supports/support of other kinds provided by a certain actor to accomplish the ecosystem’s value proposition, and it is the direct outcome of the activities put in place. For this reason, and for the sake of brevity and comprehensiveness, the value additions resulting from the different activities are reported in Table H1. Notably, in the following we will not detail on the differences between value addition constructs identifiable from the two groups of practitioners as these have just been motivated when discussing the construct activities.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Actor** | **Value Addition** | **Related Activity** | **Proposer** | |
| **“Early-Stage Adopters”** | **“Advanced-Stage Adopters”** |
| Governmental bodies | Funding and investment for AM adoption diffusion | Provide funding opportunities | ✓ | ✓ |
| Funding and investment in AM development through research/innovation projects | Provide research/R&D grants | ✓ | ✓ |
| Widespread knowledge on AM benefits | AM benefits campaigns | ✓ |  |
| Legal and regulatory bodies | New AM standards | Development of regulation & standards | ✓ | ✓ |
| IP protection & licensing regulations | Development of IP licensing agreements | ✓ | ✓ |
| New qualified suppliers | Qualified Supplier Program |  | ✓ |
| HEIs and research entities | Establishment of AM-related courses and study programs | Develop AM-related study programs/course | ✓ | ✓ |
| Graduation of AM market-oriented students | ✓ | ✓ |
| Generation of scientific and technological knowledge with consequent technology transfer possibilities to create new AM machines/materials | Support in R&D activities | ✓ | ✓ |
| Participate/lead research projects/initiatives | ✓ | ✓ |
| Establishment of lifelong learning programs and external teaching | Provide training & workforce development programs | ✓ |  |
| Successful ecosystem models to spread AM adoption | Develop ecosystem models to ensure a successful, long-lasting AM adoption |  | ✓ |
| Guidelines and procedures for optimal production process parameters, design procedures, etc., resulting in cheaper and higher quality parts, faster production, … | Support to determine/determine optimal production process parameters, design strategies, etc. |  | ✓ |
| OEMs | IP licensing and sharing through controlled IP-sharing agreements | Sustained collaboration with the ecosystem (especially willingness to share IP rights) | ✓ | ✓ |
| Establishment of training programs | Training and workforce development programs | ✓ |  |
| Guidelines and procedures for optimal production process parameters, design procedures, etc., resulting in cheaper and higher quality parts, faster production, … | Support to determine/determine optimal production process parameters, design strategies, etc. |  | ✓ |
| Concur to develop internal production guidelines |  | ✓ |
| Increased accessibility to AM machines due to leasing possibilities | Lease AM machines |  | ✓ |
| AM technology and material providers | Development of new AM machines/solutions/raw materials | Carry out R&D activities | ✓ | ✓ |
| Participate/lead research projects/initiatives | ✓ | ✓ |
| Develop new AM solution/processes/materials (with HEIs & research entities if necessary) | ✓ | ✓ |
| Possibility to produce AM products faster, with lower costs and better quality | Carry out R&D activities | ✓ | ✓ |
| Participate/lead research projects/initiatives | ✓ | ✓ |
| Develop new AM solution/processes/materials (with HEIs & research entities if necessary) | ✓ | ✓ |
| Establishment of training programs | Provide trainings on using AM machines | ✓ |  |
| Guidelines and procedures for optimal production process parameters, design procedures, etc., resulting in cheaper and higher quality parts, faster production, … | Support to determine/determine optimal production process parameters, design strategies, etc. |  | ✓ |
| Concur to develop internal production guidelines |  | ✓ |
| Increased accessibility to AM machines due to leasing possibilities | Lease AM machines |  | ✓ |
| New qualified suppliers | Concur to develop supplier qualification programs |  | ✓ |
| Defense and Military Organizations | Use AM for field operations | Willingness to adopt AM and to integrate it in field operations | ✓ | ✓ |
| Improved IT systems, with reduced threats | Improve IT systems | ✓ |  |
| Guidelines and procedures for optimal production process parameters, design procedures, etc., resulting in cheaper and higher quality parts, faster production | Support to determine/determine optimal production process parameters, design strategies, etc. |  | ✓ |
| Concur to develop internal production guidelines |  | ✓ |
| Increased accessibility to AM machines due to resource sharing | Military asset sharing |  | ✓ |
| High skilled new staff members | Internal training for new members (if needed) |  | ✓ |

Table H1. Value addition constructs for each actor. These are linked to the activities that originate them and to the group(s) of practitioners from whose insights these were identified.

Value capture

This construct corresponds to the benefits achievable by each actor for committing to the ecosystem. The value capture (or benefits) of each actor is clearly linked to the opportunities arising from the use of AM, and it can thus be derived from the results previously presented (cf. Section 4.2.). For the sake of clarity and better understanding, we start with the Defense and Military Organizations to describe the value capture. The main benefits for defense and military organizations are the “Increased operational readiness and stability” (deriving from the opportunities “Resilient Supply Chain” (O1), “Responsiveness” (O5), “Simpler Supply Chain” (O8), and “Accessibility” (O13)), “Increased operational flexibility and adaptability” (deriving from the opportunities “Responsiveness” (O5), “Accelerated Prototyping and Deployment” (O11), and “Accessibility” (O13)). As highlighted in proposition 4, opportunities are generally static, with a perceived relevance that does not change over time. Therefore, these value capture constructs are common between the two groups of participants. However, proposition 4 also highlighted how opportunities that are linked to AM design freedom and flexibility experience an increase in the perceived relevance as AM adoption progresses due to higher knowledge and skills in AM. This leads to “Improved equipment functionalities (deriving from the opportunities “Customization and Complexity” (O4), “Part Consolidation” (O9), and “Enhanced Functionality” (O10)) as value capture identifiable from “Advanced-Stage Adopters” insights.

AM technology and material providers, then, would benefit in terms of getting support (both economic and of know-how) for AM-related research activities, which would result in the development of new AM machines and materials. Both groups of practitioners agree on this, and they suggest how this would increase their market opportunities and revenues. Additionally, according to the insights derived from “Advanced-Stage Adopters”, benefits would further derive from the monetization coming from AM machines leasing activities and from the establishment of new qualified suppliers. Similarly, OEMs are also expected to benefit from the monetization coming from AM machines leasing activities, which was again suggested only by “Advanced-Stage Adopters”. Both groups of practitioners, then, agree that OEMs adhering to such ecosystem would benefit (i) from IP monetization and licensing agreements deriving from the IP licensing sharing agreements, (ii) from new AM-skilled staffs for next-gen AM materials/machines as they would contribute to the R&D necessary to develop new machines/materials and to development of guidelines and procedures for optimal production process parameters, design procedures, etc. This would hence result in (iii) an enhanced competitive advantage over competitors.

Similar benefits are also suggested for HEIs and research entities. Indeed, both groups of practitioners suggest that HEIs and research entities would benefit from being part of such ecosystem. First, they would lead and/or be involved in AM-related research activities, receiving economic support as well as having the possibility to share and exchange know-how. Additionally, this would allow them to have a closer connection with the military industry (gaining partnerships with military and industry for practical AM solutions) and to be at the forefront of AM research and advancements, hence ensuring that their staff is skilled for next-gen AM materials/machines. Furthermore, the new and attractive study programs/course that they can develop would lead to an increased student satisfaction. All these aspects, would finally result in a recognized academic leadership in AM. Interestingly, these aspects were identified by both groups of practitioners, with no differences between the groups.

Legal and regulatory bodies, then, would experience higher satisfaction on AM standards as a consequence of new and updated standards. Similarly, they would also experience revenues related to IP-control, licensing, and standards, which derive from the developed regulation, standards, and IP licensing agreements. Notably, these benefits are derived from both groups of practitioners, as they both agree on the necessity for legal and regulatory bodies to develop new regulation, standards, and IP licensing agreements. Furthermore, based on the insights from “Advanced-Stage Adopters”, legal and regulatory bodies could experience an increase in revenues deriving also from their qualified supplier program, where new suppliers will be established and will pay a fee for the certifications. Finally, governmental bodies are also expected to benefit from joining the ecosystem. Specifically, both groups of practitioners believe that governmental bodies will benefit from “Improved national security and autonomy through increased supply chain resilience and responsiveness” (deriving from opportunities “Resilient Supply Chain” (O1), “Responsiveness” (O5), and “Simpler Supply Chain” (O8)) and “Cost savings in defense procurement (deriving from the opportunity “Cost effectiveness” (O12))”. Additionally, the wider adoption of AM is expected to give rise to the establishment of new companies and organizations working on AM, hence leading to “Economic growth, job creation, higher tax income”.

Risk

As described earlier, risks represent the challenges that could obstruct or limit the realization of the ecosystem’s value proposition, and these issues are closely linked to the previously identified challenges. To enhance clarity and facilitate understanding, the discussion on risks will start from the defense and military organizations. The risks that these can encounter are various and, based on the insights from the two groups of practitioners, some might vary as AM adoption level progresses. This is the case of risks such as “Lack of skilled personnel (deriving from “Lack of skilled personnel” (C8))”, “Reluctancy in using AM (deriving from “Workforce resistance” (C5), “Lack of managerial support” (C9), and “Difficult ecosystem establishment” (C14))”, and “High investment costs” (deriving from “High Investment Costs” (C2), and “High Operational Costs” (C3)), which are neglected by “Advanced-Stage Adopters”. This is linked to the reduced perceived relevance attributed by “Advanced-Stage Adopters” to such challenges as, when AM adoption level is high, employees are skilled, committed to use AM given its benefits, and with the infrastructure already developed. However, a new risk can be identified based on “Advanced-Stage Adopters” insights, which is “Risk of reduced responsiveness due to the non-optimalilty of current processes/machines” (deriving from “Production Limitation” (C10), “Need for post-process operations” (C11), and “Lack of process repeatability” (C15)): as discussed in Section 4.1.2., the relevance of these challenges becomes noted only when the use of AM is extensive as it is for “Advanced-Stage Adopters”. Nevertheless, despite the differences, there are also similarities between the two groups of practitioners. Indeed, as discussed in Section 4.1.2., both groups of practitioners attribute similar relevance to certain challenges, which leads to certain risks being perceived by both groups of practitioners. This is the case of “Lack of support in utilizing the process and regulation adherence” (deriving from “Standardization and Certification” (C6), and “Difficult ecosystem establishment” (C14)), “Dependency on few AM suppliers due to difficulty in finding suitable suppliers and materials” (deriving from “Lack of Supplier” (C1), and “Material Limitation” (C7)), “Parts with low quality” (deriving from “Lack of governmental support” (C12), and “Lack of process repeatability” (C15)), and “Threat of IP legal battles” (deriving from “IP Issues & Data Breaches” (C4)).

Dealing, then, with AM technology & material providers, the risks they are subject to are strictly linked to the activities they are required to carry out. As discussed above, “Carry out R&D activities”, “Participate/lead research projects/initiatives”, and “Develop new AM solution/processes/materials (with HEIs & research entities if necessary)” are the activities suggested by both groups of practitioners. As it can be seen, they all require funding and R&D activities. Hence, “Funding limitations for AM research” (linked to the challenge “Lack of governmental support” (C13)), “Failure in carrying out successful R&D activities”, and “Difficulty in benefiting from participating in the ecosystem” (linked to the challenge “Difficult ecosystem establishment” (C14)) are the major common risks. Additionally, based on the insights from “Advanced-Stage Adopters”, another risk can be identified. This is “Difficulties in determining generally optimal production process parameters, design procedures, etc.”, which is linked to the activity “Support to determine/determine optimal production process parameters, design strategies, etc.”. Interestingly, this risk is common also to OEMs and HEIs and research entities. Additionally, these two actors are also subject to other risks. OEMs, indeed, experience the major risk of “IP protection issues” (i.e., difficulty in safeguarding proprietary AM designs from unauthorized use) (linked to the challenge “IP Issues & Data Breaches” (C4)). This may lead to reluctancy in participating in the ecosystem (C14). This is pointed out by both groups of practitioners as they both attributed high relevance to the challenge C4 (which is linked to IP). Additionally, according to both groups of practitioners, OEMs might not see the benefits in participating in the ecosystem for both IP reasons but also for the risk of reduced incomes (and this is why it is necessary that an ecosystem model will be developed). HEIs and research entities, on the other hand are expected to “Develop AM-related study programs/course”, “Support in R&D activities”, and “Participate/lead research projects/initiatives”. The major risks affecting them are funding limitations: “Funding limitations for AM research” (deriving from “Lack of governmental support” (C13)), and “Funding limitation for AM curricula” (deriving from “Lack of governmental support” (C13)). Additionally, it can occur that there is a “Misalignment between research focus and real-world military needs”.

Finally, dealing with the two remaining actors, i.e. Governmental bodies and Legal and Regulatory Bodies, the former is characterized by one single major risk, identified by both groups of practitioners: as they both consider the establishment of funding schemes and other economic incentives as the major activity Governmental bodies are required to do, there major risk is “High investment costs that might conflict with budget constraints (deriving from the challenge “High Investment Costs” (C2), and “High Operational Costs” (C3)). Legal and Regulatory Bodies, then, are also characterized by a single major risk, identified by both groups of practitioners. This is “Difficulty in enforcing AM-related standards, IP rights licenses” (deriving from the challenge “IP Issues & Data Breaches” (C4), and “Standardization and Certification” (C6)). These are linked to the major activities required by this actor, i.e. the“Development of regulation & standards” and “Development of IP licensing agreements”.