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Deliverable D4.6 - Report on Sustainability Model of Development Support Services

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Abstract:

CESSDA Service Providers are obligated to provide support to member countries where the national infrastructures are immature and/or fragile. This report proposes a model for sustainably providing support services to aid the development throughout the CESSDA Service Provider community and to aspiring members.

Development support is categorised into long-term services and discrete activities, and the scope and scale of the demand for support were analysed.

Towards the sustainability of development support services, we examined the financial models that may be deployed, possible external sources of funding, how to support knowledge about the services and activities that are available, and how needs should be assessed.

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Executive Summary

The CESSDA ERIC statutes, in the Service Providers' Obligations (Annex 2) states that a Service Provider (SP) shall have the obligation to "provide member support for countries with immature and fragile national infrastructures to help them build up needed competence later to be able to fulfil tasks as Members"[1] and to "provide mentor support for CESSDA ERIC Observers and their representative Service Providers to achieve full Membership."[2] This report considers what is required to meet those obligations.

We review the categorisation of development support services (DSS), which were first proposed in Deliverable D4.5 'Provision of development support services on the basis of identified demand' (Priddy et al., 2017), to aid the evaluation of sustaining the services and the infrastructure required.

Analysis of the results of the SPs (and candidate DAS) self-assessments undertaken in CESSDA SaW Task 3.2, using the CESSDA Capability Development Model (CESSDA-CDM) described in Deliverable D3.1 'Heuristic Maturity Development Model (Priddy et al., 2016), was used to determine the scope and scale of demands for development support services. Although it was clear that there is a need, it could not be quantified as the level of maturity in capabilities and activities required by CESSDA had not been defined. As was noted in Deliverable D3.6 'Final integrated audit report' (Štebe et al., 2017b), it is clear that size, and capacity, of the organisation does have an influence upon their maturity in many capabilities and activities.

Towards the sustainability of development support services, we examined the financial models that may be deployed, possible external sources of funding, how to support knowledge about the services and activities that are available, and how needs should be assessed.

In conclusion, there is an evident need to improve the capabilities and maturity of the SPs' provision to their designated communities. This need is not uniform across all SPs or for every capability but is more apparent amongst the smaller service providers with less the capacity to meet the Service Provider Obligations.

It is for CESSDA and the service provider community to develop support services, and ensure that the Service Providers' Obligation to "provide member support" is fulfilled and sustained over time, by enabling deeper insight into the provision of DSS and needs, plus providing the opportunity to meet the development requirements through an infrastructure that facilitates more inclusive and encompassing work plans and projects.

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[1]https://www.cessda.eu/content/download/1466/20924/file/STATUTES%20of%20CESSDA%20ERIC_2017.pdf [Accessed 12/10/2017]
[2] ibid.

Abbreviations and Acronyms

CEF	Connecting Europe Facility
CESSDA	Consortium of European Social Science Data Archives
CESSDA-CDM	CESSDA Capability Development Model
CF	Cohesion Fund
CPA	Capability Process Area
CRA	Capability Requirements Area
DARIAH - EU	Digital Research Infrastructure for the Arts and Humanities (ERIC)
DAS	Data Archive Service
DoA	Description of Actions
DSA	Data Seal of Approval
DSS	Development Support Service
DSSP	Development Support Service Provider
ERA	European Research Area
ERDF	European Regional Development Fund
ERIC	European Research Infrastructure Consortium
ESF	European Social Fund
ESIF	European Structural and Investment Funds
HaS	Humanities at Scale
OAIS	Open Archival Information System
RA	Required Activity
SEEDS	South-Eastern European Data Services
SERSCIDA	Support for Establishment of National/Regional Social Sciences Data Archives
SLA	Service Level Agreement
SP	Service Provider

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1. Introduction

1.1 Audience for this Report

The primary audiences for this report are the management bodies and committees of the CESSDA ERIC, and specifically the CESSDA SP Forum, individual new and aspiring service providers, CESSDA Main Office and Board of Directors, and possibly also the CESSDA General Assembly.

Others may be interested in how we categorise development support, models of funding, and the suggestions on how development support can be sustained over time.

The outcomes and conclusions of this deliverable may be of value for those Service Providers (SPs) and candidate Data Archive Services (DAS) looking for examples of how to fund the further development of their capabilities and services they provide to their designated communities.

1.2 Background

This work follows on from Deliverable D4.5 'Provision of development support services on the basis of identified demand' as part of the work on 'establishing the necessary conditions for creating new or reinforcing existing social science data services.'

From the Description of Actions (DoA): 'The [overall] objective of this task is to establish the conditions for creating new or reinforcing existing social science data services. In the start-up and consolidation phases of new archives, selected well established CESSDA archives will perform supportive tasks for starting ones, especially offering technical facilities and expertise on software tools, backup services and archival policies, for as long as trustworthy and sustainable services in the countries aspiring CESSDA membership are lacking.' This relates to two specific Service Providers' Obligations in the Annex 2 of the CESSDA ERIC statutes, namely:

- 10. provide mentor support for CESSDA ERIC Observers and their representative Service Providers to achieve full Membership;
- 11. provide member support for countries with immature and fragile national infrastructures to help them build up needed competence later to be able to fulfil tasks as Members.[3]

Therefore, the DoA and the CESSDA ERIC statutes assumed that the established, mature Service Providers (SP) are expected to help the smaller and newer SPs/DAS. However, we contend that expertise, knowledge, and services may exist in any and all SPs, and therefore this situation may be reversed, or clusters of SPs may work together towards a common need or goal. Thus, this report takes into account the different situations that may be found in a community of Service Providers and how development support may be organised and funded.

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[3] https://www.cessda.eu/content/download/1466/20924/file/STATUTES%20of%20CESSDA%20ERIC_2017.pdf [Accessed 12/10/2017]

Deliverable D4.5 demonstrated the feasibility and advantages of SPs providing development support services (DSS) to other SPs and aspiring SPs, however, funding for these activities are only guaranteed for the duration of CESSDA SaW. Therefore, to ensure that SPs can fully meet their obligations from Annex 2 into the future, there needs to be proposals for models of service sustainability and funding.

It was clear in the work towards Deliverable D4.5, that many SPs that were interested in development support, but were at differing levels of capabilities, capacity and maturity. Moreover, there were very few existing services that could be delivered to a new or aspiring SP. Therefore, each pilot study undertaken required a specific bespoke approach to providing a service and furthermore, the results were not a 'production ready' service that could be used immediately by the SP and their user community.

Projects such as CESSDA SaW deliver a considerable amount of support to the community of SPs. There is substantial experience within the Service Provider community, considering its relatively small size, and therefore the community is best placed to provide many support services to others of the community. The challenges are to understand what support is needed over time, how this SP-to-SP support can be provided, and what is required to maintain the community of SPs and DAS.

2. Categorisation of Development Support Services

We define a Development Support Service as one or more activities, or actions, that are undertaken by one SP on behalf of another SP to aid the capability and maturity of the SP.

Support provided, formally or *ad hoc*, can be categorised as either a continuous service or a discrete activity. Activities are discontinuous tasks, actions or events undertaken by an agent (human or machine). As such an activity has an initiation, action, and a completion. A sequence of activities can form a process, with decision points that will affect the flow of activities. A number of processes, repeatable in series or in parallel, form a service which can be delivered to a service consumer (or client) with a service agreement governing the delivery. A number of services can also be packaged together, but this can be seen as a marketing strategy rather than a need to serialise services (Figure 1).

Figure 1: Hierarchy of packages, services, processes, and activities
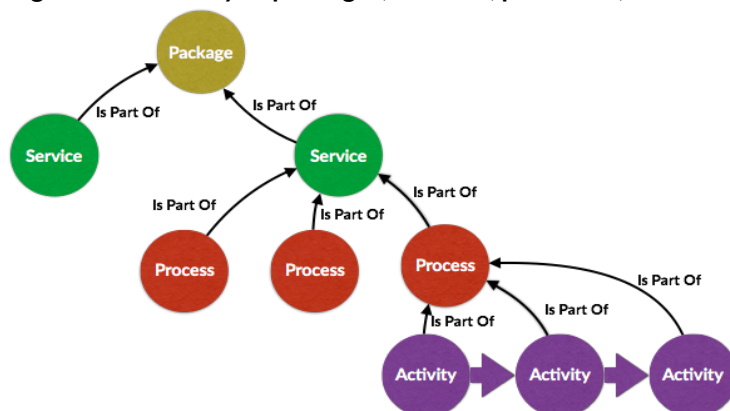
By identifying the aspects involved in delivering support services and activities it is possible to assess if a specific service or activity offered will meet the needs of the consumer of the service or activity. If the provision of a service or activity is *ad hoc* and *pro bono* then this level of detail may not be necessary. However, as a consumer of a service that is core to the delivery of services to a designated community, then an understanding of the quality of the support service actively used, is essential.

Deliverable D4.5 (Priddy et al., 2017) contains details of the categorisation of types services and activities and examples of these.

2.1 Continuous/Long-term services

As the term suggests, these are open-ended services that one SP makes available to another SP without a significant break in the provision. There are only a few examples of such services currently available within the CESSDA SP community.[4]

Reliance upon another SP to provide core or important services does require a formal agreement. Normally this would be in the form of a Service Level Agreement that lays out the details of the service provision as well as any legal aspects required in such an agreement, but such agreement must also contain information about how the service will be sustained over a period of time, how risks of service interruptions are mitigated, and if there is a continuation of the service.

On-demand services are used or invoked when there is a need, and could be considered like activities in that each invocation is discrete and completed (within a time frame). However, there may still be a need for a SLA to be in place to govern the provision and repeated consumption of the service over a longer period.

2.2 Activities

Activities are discrete tasks, actions or events that have a defined start, action, and a completion. An activity may be repeated but each instance is discrete.

Activities are not only the easiest development support to deliver, but they also enable more SPs to deliver activities such as consultancy, site visits and training. Sharing of expertise can be bilateral (or multilateral) where needs and knowledge fit together. We could consider that there would be more regional support in the form of activities. Regional development support may fit well with alternative sources of external funding. The SERSCIDA[5] and SEEDS[6] projects are good examples of regional development support.

For the development support service pilots, we did not undertake pilots on training or educational resources as these were part of other work packages within CESSDA SaW.

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[4] Examples are da|ra from (GESIS) https://www.da-ra.de/en/home/ and NESSTAR from (NSD) http://www.nesstar.com/about/about.html.
[5] http://www.serscida.eu/en/ [Accessed 24/10/2017]
[6] http://seedsproject.ch/ [Accessed 24/10/2017]

However, these resources could be considered as a support activity and are also likely to be more common, despite the effort needed in creating good resources.

By categorising development support services, we can, not only determine gaps in offered support, but also discover where SPs require development services and determine what specific response is required to address the needs. Clarity in understanding the needs of a SP could come with regular use of the CESSDA Capability Development Model (CESSDA-CDM) to assess the current situation and which steps to take. It should be noted that the CESSDA-CDM requires development to include a full questionnaire and recommendations that would form part of a stepwise development plan.

3. The Need for Development Support Services

3.1 The CESSDA Capability Development Model (CESSDA-CDM)

Deliverable 3.1. describes the CESSDA Capability Development Model (CESSDA-CDM): The CESSDA-CDM is a collection of elements that describe the characteristics of effective data preservation processes and associated activities. The model aims at providing a structured view of processes across an organisation. The CESSDA-CDM is oriented towards the Reference Model for an Open Archival Information System (OAIS)[7] and the European Framework for Audit and Certification.[8]

On the basis of the CESSDA-CDM task 3.2 has undertaken to map the current state of Data Archive Service (DAS) in each European Research Area (ERA) country based upon, among other resources, a comprehensive audit of data services (Štebe et al. 2017a). The results of the audit can be used to assess the maturity level of the different Capability Requirement Areas (CRA) and in Capability Process Area (CPA) across SPs and DAS, with a view to assessing the general areas of demand/support, i.e. which areas will, in all probability, require development support services.

Whereas the Deliverable 3.2. reports on CESSDA members with established SPs, countries with existing Data Archive Services (DAS) that are non-members or aspiring members, as well as countries with no existing DAS, we have in this Deliverable focused on the former two categories: CESSDA members with established SPs and those countries with existing Data Archive Services that are aspiring CESSDA members.

The CESSDA-CDM focuses on three sets of processes in order to capture information on the maturity of the DAS and the SPs, these are, in an abbreviated form, the three CRA:
1. Organisational Infrastructure
2. Digital Object Management
3. Technical Infrastructure and Risk

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[7] https://public.ccsds.org/pubs/650x0m2.pdf
[8] http://www.trusteddigitalrepository.eu/Welcome.html

The three CRA are subdivided in Capability Process Area (CPA), and each CPA has a number of Required Activities (RA) and possibly Generic Activities (GA).

CRA Organisational Infrastructure[9]

A. CPA Mission and Scope, including: approved mission, mission statement, definition of scope of collection, continuity of access,
B. CPA Contracts, Licences and Liabilities, including: knowledge of legislation, legal/contractual regulation,
C. CPA Funding, Staff, Resources, including: monitoring demand, appropriate staff to meet all functions,
D. CPA Confidentiality, Ethics and Disclosure Risk, including: data handling requirements, confidentiality and disclosure.

CRA Digital Object Management

A. CPA Data Acquisition and Ingest, including: documentation/metadata requirements, provenance, data citation processes, conditions placed on content, deposit licences, legal transfer of custody /agreements on rights /responsibilities, data completeness and correctness,
B. CPA Data preservation, including: storage, curation and planning, including: persistent identifiers (PIDs)/locators, preservation strategies,
C. CPA Access / Provision, including: metadata standards, authentication and authorisation infrastructure.

CRA Technical infrastructure and Risk[10]

A. CPA Risk Assessment, including: procedure and risk analysis
B. CPA Technical Planning and Management
C. CPA Technical Resilience - Disaster Planning, including: appropriate succession and/or contingency plans.

Maturity of the Required Activities in the CESSDA-CDM are evaluated on a scale from 0 to 5. The general characteristics that define each level are:

(0) Not defined: There is no awareness, no activity, no evidence.
(1) Initial: There is some awareness of the processes; activities are uncontrolled, disorganised and *ad hoc*. There is a reactive approach. Roles and responsibilities are not defined.
(2) Repeatable/partial: There is a more active. Processes and functions follow a regular pattern. However, responsibilities are left to individuals and processes are uncoordinated and error prone.
(3) Defined: The organisation has a calculative. Tasks are defined and are connected to processes and process descriptions. Roles and responsibilities are defined and connected to tasks. Institutional commitment is significant.

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[9] This CRA also has CPAs on: Outreach and Communications, Documentation, and Management Oversight which were not used for the assessment.
[10] This CRA also has CPAs on: Technical Resilience - Infrastructure, Technical Resilience - Security.

(4) Managed: The organisation has a proactive approach. Processes and activities are monitored and quantitatively assessed. Inconsistencies and incidents are recorded for quality and assessment purposes. Tasks and processes are integrated into high level policies and objectives.

(5) Optimized: The organisation has a proactive and predictive approach of systemised optimisation, based upon regular reviews of policies, procedures, and monitored activities.

3.2 Analysis of Deliverable D3.2 with a View on Identifying Development Demand and Supply

In order to develop a sustainable model of development support services and to distribute support services within CESSDA and aspiring CESSDA members, specifically for the CESSDA annual work plan, the skills, expertise and tools of SPs and DAS should be described and listed.

It should be noted, that since CESSDA did not define what the expected, or minimum, maturity was required for activities and processes, it is not possible to determine if a SP requires further development in the capability or activity, or not. However, we can consider that if a number of SPs score a low maturity in required activities, then there may be a need to evaluate further to establish if there is a clear development demand. Hence, we can only make an overall assessment of the needs of all SPs in a CRA. Furthermore, one SP did not complete the survey so we only have data on 15 SPs and only 8 DAS respondents of a further 18 DAS from non-member countries.

3.2.1 CRA Organisational Infrastructure

In the following, the Required Activities pertaining to CRA Organisational Infrastructure, are analysed to determine the relative number of SPs which have a defined, managed or optimised score for an assessed Required Activity (RA), and those for which a RA is, not defined, initial, or partial (repeatable).

Figure 2: Maturity of CRA Organisational Infrastructure for Service Providers
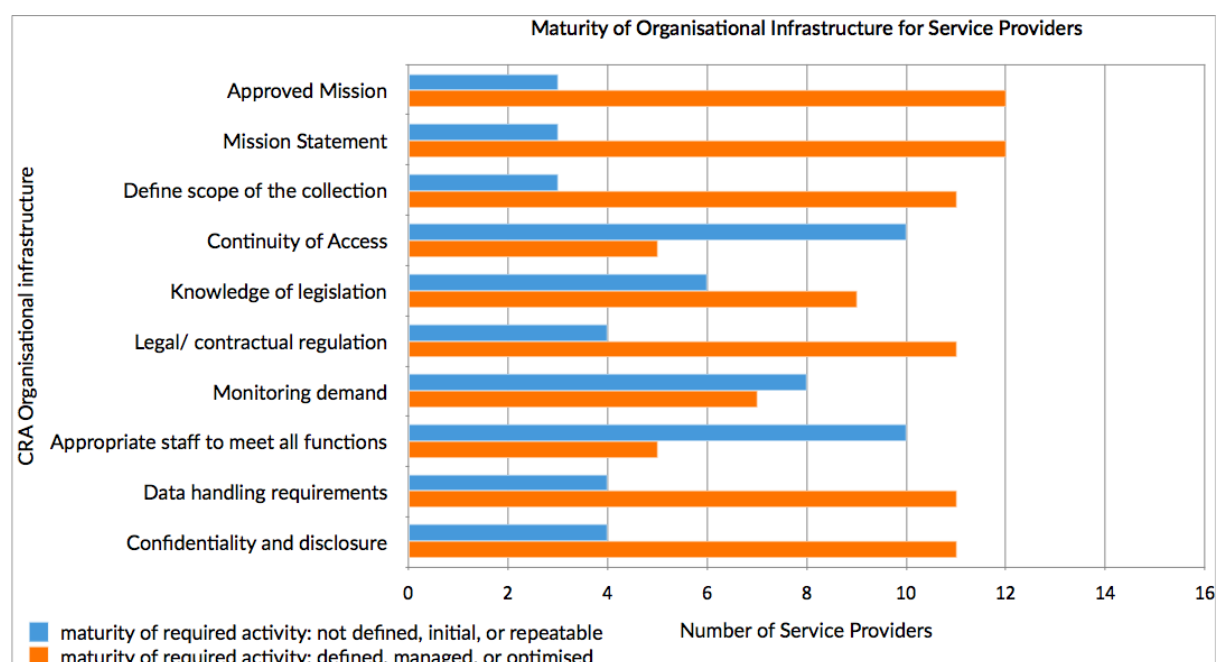

In this CRA, for those RAs measured for current SPs the overall maturity is good with more SPs scoring 3 (defined) or higher, than those scoring 2 (repeatable) or less. There are 3 RAs which may require development support for a majority of SPs: Continuity of Access, Monitoring Demand, and Appropriate Staff to Meet all Functions. The latter is to do with staff numbers and therefore cannot be directly improved with development support services, but indirectly support services may help reduce the burden on existing staff. Continuity of Access cannot really be supported by a service or support activity, however, for Approved Mission, Mission Statement, and Defined Scope of the Collection there should be no SP scoring below 3 (defined) therefore a support activity, such as obtaining a Core Trust Seal, should be made available to those SPs. Knowledge of legislation may require training materials or a training workshop to ensure there is no gap here. Monitoring Demand is again a matter of support and training materials that can facilitate the monitoring. It should be noted that this is an open RA, and that some SPs and DAS may not fully understand the requirement. For the RAs, Data Handling Requirements and Confidentiality and Disclosure, it may be such that initial, or repeatable is a sufficient level of maturity for some SPs which do not routinely handle data with privacy or confidential issues, however, if they do then a training activity or resource, or expertise may be required.

Generally, the maturity of SPs and the DAS in the RAs of the CRA determine the supply potential: Roughly 75%, that is 11 to 12 SPs score defined, managed and optimized in the following RAs: Approved Mission, Mission Statement, Scope of Collection, Legal/Contractual Regulation, Data Handling Requirements, Confidentiality and Disclosure.
In the field of Approved Mission, Mission Statement and Defined Scope of Collection there is much supply potential for a comparatively low yet existing demand which could be met with a support activity such as obtaining the Core Trust Seal (see above). The RAs for Legal/Contractual Regulation, Data Handling Requirements, Confidentiality and Disclosure

again has a good supply potential with a relatively low but existing demand which could be met with training activities and consultancy. Providing development support services for the RA Legal/Contractual Regulations might become easier once the General Data Protection Regulation (GDPR), which also aims at a unification of European data protection legislations and practices, comes into force.

Figure 3: Maturity of CRA Organisational Infrastructure for Data Archive Services
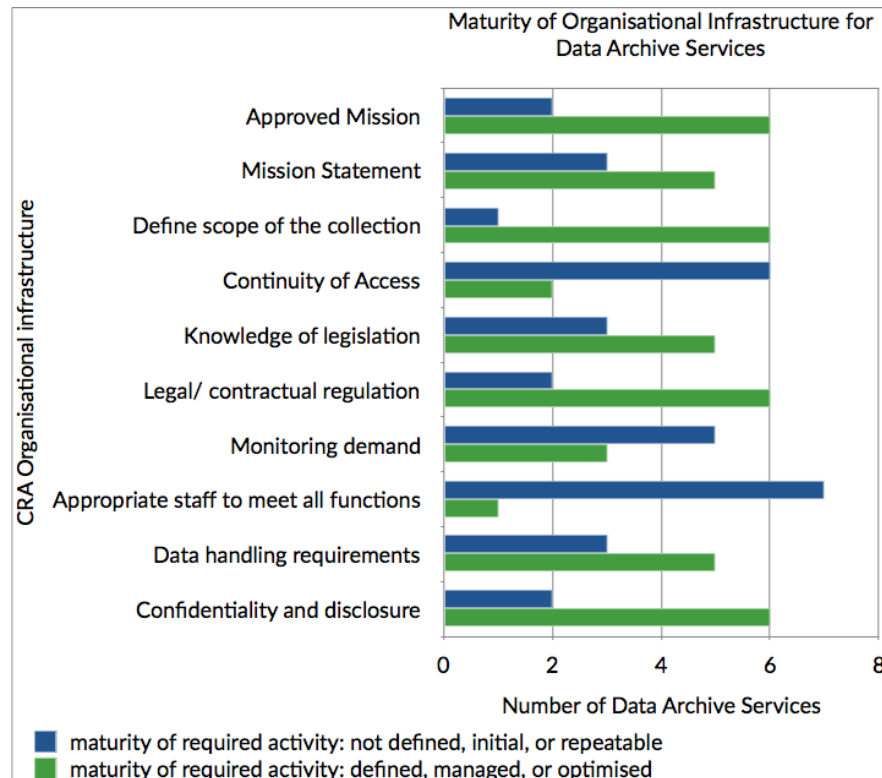
When we consider the DAS that are not as yet a CESSDA SP, the pattern across the RAs is broadly similar to the CESSDA SPs: 6 of the 8 DAS score defined, managed and optimized in the following RAs: Approved Mission, Define Scope of Collection, Legal/Contractual Regulation, Confidentiality and Disclosure. The RAs

Mission Statement and Data Handling Requirements show less maturity than among the SPs. The least mature functions are, as with the SPs, the ensuring of the continued access to data as well as Appropriate Staff to Meet all Functions. The high number of DAS, 7 out of 8, who do not consider they have sufficient staff numbers to meet all their functions, does stand out. The immaturity in this field is more pronounced than among the SPs. A low level of maturity is reported by 5 out of 8 DAS in Monitoring Demand. Interestingly though 6 DAS report maturity in the RA Approved Mission, only 5 do so for the Mission Statement, whereas three DAS and also 3 SPs do not seem to have drawn up a Mission Statement. CESSDA SaW has addressed the issue of drawing up policies in task 4.2 and provides support with the Policy Element Description Template in the Deliverable 4.3 (Kvamme et al., 2017).

Supply potential in the CRA Organisational Infrastructure for the DAS is very similar to the supply potential of the SPs: it is found primarily in the RAs Approved Mission, Define Scope of Collection, Legal/Contractual Regulation and Confidentiality and Disclosure (see above).

Overall, we can observe maturity gaps that may need closing in a significant number of DAS and SPs across the range of this CRA on organisational infrastructure.

3.2.2 CRA Digital Object Management

The following the Required Activities pertaining to CRA Digital Object Management are analysed to determine the relative number of SPs which have a defined, managed or optimised maturity for an assessed Required Activity (RA), and those for which a RA is, not defined, initial, or partial (repeatable).

Figure 4: Maturity of CRA Digital Object Management for Service Providers
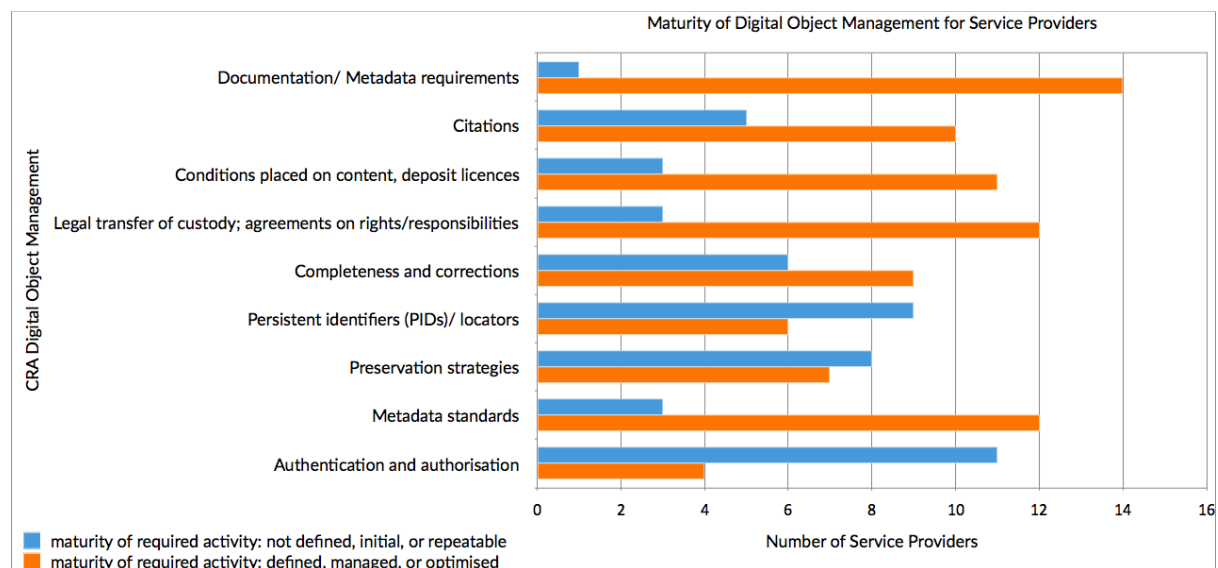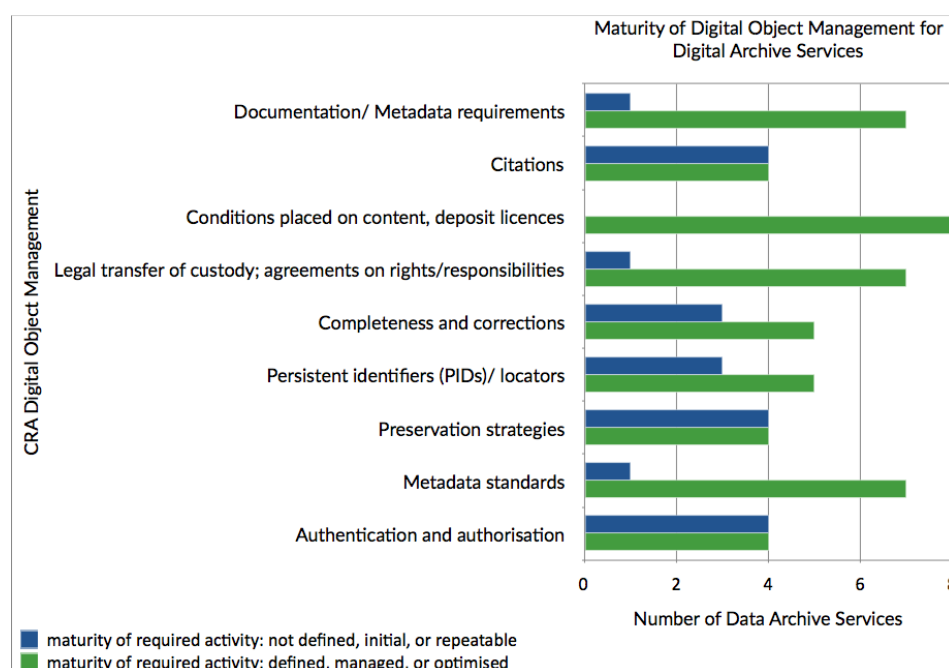

For the CRA Digital Object Management the RAs for Documentation/Metadata Requirements, Metadata Standards, Citations, Conditions Placed on Content/Deposit Licenses and Legal Transfer of Custody all have a significant proportion of SPs, ten or more, with a defined, or better, maturity. Mainly Documentation/Metadata Requirements is very mature with 14 SPs reporting a maturity of at least defined with only one SP reporting lack of maturity. Those SPs which have a low maturity level in the areas of Documentation/Metadata requirements, Metadata Standards, Citations, Conditions Placed on Content/Deposit Licenses and Legal Transfer of Custody will probably need support to at least have defined policies in these required activities.

The least developed RAs are Persistent Identifiers (PIDs)/Locators with 9 SPs reporting a score of repeatable or lower, Preservation Strategies with 8 SPs lacking maturity and finally Authentication and Authorisation with 11 SPs with low maturity. There is thus a need for an Authentication and Authorisation service for a significant proportion of SPs. A persistent

identifier (PID) service exists within the service provider community, namely da|ra[11], which is offered by GESIS. Therefore, it is possible for the 9 SPs with a low maturity in this RA to investigate this option and hopefully improve their maturity. The RA Preservation Strategies would probably require further investigation to understand why 8 SPs have a low maturity but it may be that existing contingency action points have yet to be synthesised into a strategic plan. The Deliverable 4.3 again provides not only support for drawing up the Preservation Policy, but also details elements to evolve a preservation. There is also expertise within the SP community to offer consultancy to these SPs. The RA Completeness and Correctness for a SP could have a maturity level that is acceptable at almost any level in accordance with the policies and strategy of the SP, therefore, requires further details to make an assessment of the need for development support.

Figure 5: Maturity of CRA Digital Object Management for Data Archive Services

For the 8 DAS respondents to the survey, we see an overall more evolved picture:

The mature RAs correspond largely with the results of the SPS being Documentation /Metadata Requirements, Conditions Placed on Content, Deposit Licences, Legal Transfer of Custody, Agreements on Rights/Responsibilities and Metadata Standards. Persistent Identifiers (PIDS)/Locators are considered not well developed by only 3 DAS. Authentication and Authorisation maturity is more developed than among the SPs.

However, across the two groups (SPs and DAS) there is a clear need for these last two required activities to be supported by a community or centralised CESSDA service. Once again, for those DAS with low maturity in other RAs of this CRA, expertise within the community could advise and help with increasing their maturity levels.

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[11] https://www.da-ra.de/en/home/

Supply potential for development support services such as consultancy is given in a range of RAs such as Documentation /Metadata Requirements, Metadata standards, Legal Transfer of Custody, Agreements on Rights/Responsibilities.

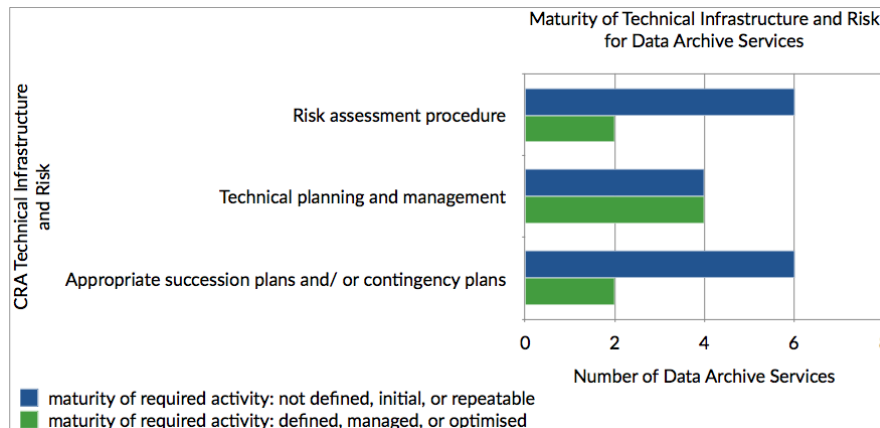### 3.2.3 CRA Technical Infrastructure and Risk

The CRA Technical Infrastructure contains only three RAs which are Risk Assessment Procedure, Technical Planning and Management and Appropriate Succession Plans and/or Contingency Plans with a rather low overall maturity level.

Figure 6: Maturity of CRA Technical Infrastructure and Risk for Service Providers
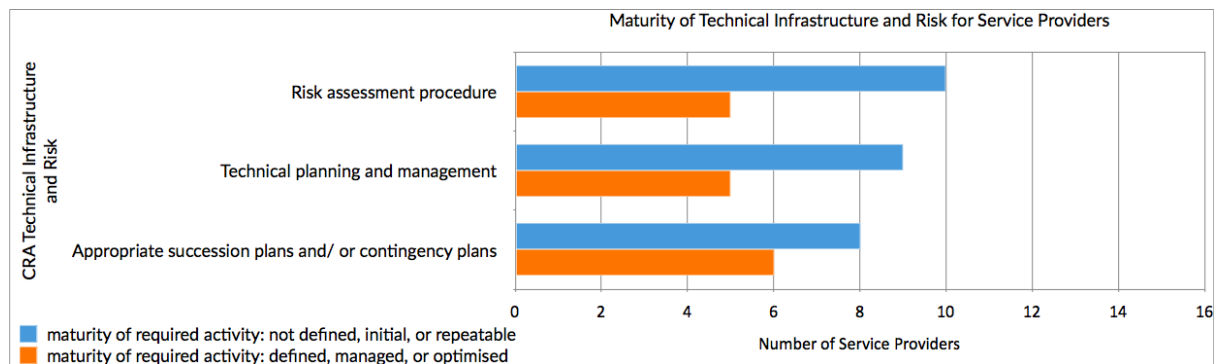
The chart shows that for the SPs the degree of immaturity exceeds the degree of maturity in each of the three RAs.

Figure 7: Maturity of CRA Technical Infrastructure and Risk for Data Archive Services

The picture presented by the DAS is a bit more varied: In the RA Risk Assessment Procedure 6 out of 8 report maturity; in the RA Technical Planning and Management, the number of immature and mature DAS is even which is the main difference to the results of the SPs; again only 25% of DAS report having found a solution for the problem of Appropriate Succession Plans and/or Contingency Plans while among the SPs the percentage of those having managed that problem is 37.5%.

With Technical Infrastructure and Risk being the most immature CRA the supply potential is relatively low. The required activities assessed in this CRA tend to suggest this is an area of weakness requiring further development support for both SPs and candidate DAS. In such a

case, there may need to be a coordinated plan for the provision of support which may be delivered by more than one mature SP. This may be a broad topic for a project funded externally to CESSDA. Since not all the RAs for the CPAs in this CRA were part of the assessment we cannot ascertain if the lack of maturity is in the area of risk and technical infrastructure as a whole or in these specific RAs.

3.2.4 Maturity assessment with respect to size of Service Provider

In the SaW Deliverable D3.6 'Final integrated audit report', an evaluation of the self-assessed RAs against the size, in terms of estimated full-time equivalent (FTE) staffing levels of the SPs and DAS was undertaken (Štebe, et al. 2017b). On this topic, the report concludes that:

> "Appropriate Funding, Staff and Resources are a condition that severely hampers more than half of the European national data service providers. In many places, the expertise established cannot be utilised yet to full potential due to the lack of basic organisational conditions." (Ibid., p.24.)

Also, the larger SPs have a higher level of maturity in most areas as one might expect, especially as they may well have the capacity to undertake the process of gaining a trust (TDR) certification. Furthermore, it is considered in Deliverable D3.6 that:

> "It is clear that larger organisations, which all reside in the countries that are members of CESSDA, are also in a most favourable position in acquiring professional knowledge and other resources. Both further development of various solutions and spreading established ones them among other members are the tasks that can be achieved in collaboration." (Ibid., p24.)

The delivery of support services to the smaller SPs and candidate DAS must be carefully managed as to not overwhelm them. Expertise does reside in the smaller organisations, but the capacity to utilise this knowledge does not. Simply providing more training and workshops will not bridge the gap in maturity, but is there sufficient services and capacity within the CESSDA SP community to aid the targeted development of the smaller organisations?

Figure 8: Maturity of required activities by size of SP and DAS. Based upon Deliverable D3.6 Final integrated audit report.
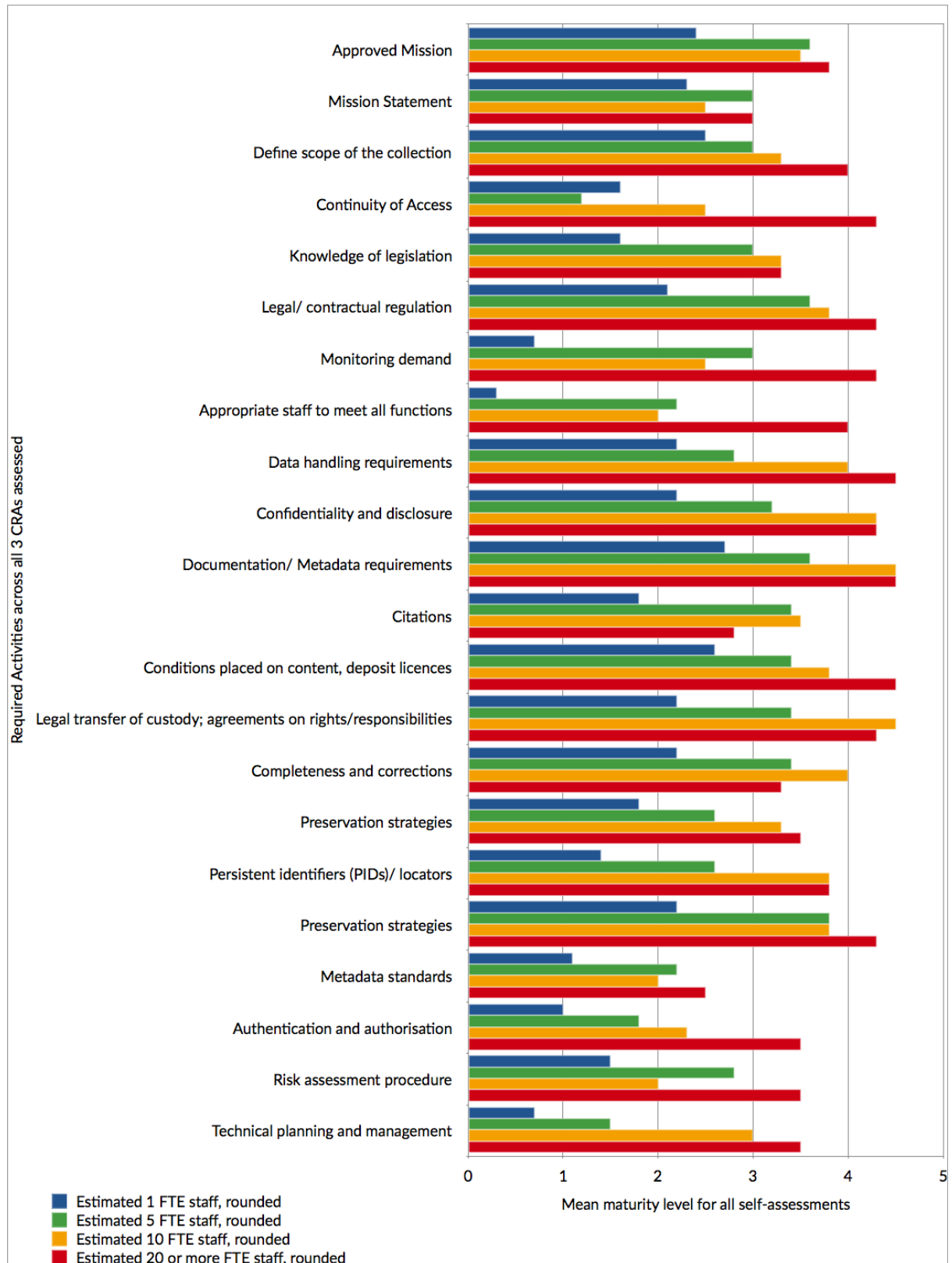
3.3 Conclusions on Demand and Supply

3.3.1 Demand

If we compare the mean score of all scores (scale from 0 to 5) of the RAs of the CRAs it would seem that on the whole the CRA Digital Object Management is the most mature area, followed closely by CRA Organisational Infrastructure which is due to the very low scoring of the RA Appropriate Staff. The least developed and mature area is the CRA Technical Infrastructure and Risk:

- CRA Organisational Infrastructure (mean score 2.67)
- CRA Digital Object Management (mean score 2.9)
- CRA Technical Infrastructure and Risk (mean score 2.03)

In terms of the RAs across all CRAs the following are the least mature according to the sum of their scores and their mean score:

- Appropriate Staff (mean score 1,7)
- Risk Assessment Procedure (mean score 1.9)
- Authentication and Authorization (mean score 1.9)
- Appropriate Succession Plan (mean score 2)
- Continuity of Access (mean score 2.1)
- Technical Planning and Management (mean score 2.2)
- Monitoring Demand (mean score 2.2)

These seven least mature RAs pertain to the CRAs Technical Infrastructure (3), Digital Object Management (1) and Organisational Infrastructure (3). All three RAs of the CRA Technical Infrastructure and Risk are included in the list of the least mature RAs.

Based on an analysis of the evaluation of the SPs and DAS in Deliverable 3.2 by scores and mean scores we could conclude that the demand for development support services would be highest in the CRA Technical Infrastructure and Risk. Since the mean maturity was low for all RAs assessed, a collaborative development project in this area might be most appropriate to raise the maturity level for CESSDA.

From the areas and activities with low maturity, as listed above, some are suitable for internal development with the CESSDA members and aspiring members supporting at a national level, perhaps with some expert consultancy from CESSDA SPs.

The requirement of Appropriate Staff may not be something that can be directly supported by more mature SPs through a development support service, however training activities might help along with consultancy on impact and roadmaps for development of the national infrastructure.

3.3.2 Supply

The RAs with a mean score of three or higher are considered the RAs with the potentially more opportunities for SPs to supply the support service or activity. Five of them belong to the most mature CRA Organisational Infrastructure while four belong to the CRA Digital Object Management. No RA from the CRA Technical Infrastructure and Risk is represented in the list of the most mature RAs with a mean score of 3 or more:

- Documentation/Metadata Requirements (mean score 3.7)
- Conditions Placed on Content, Deposit Licences (mean score 3.3)
- Metadata Standards (mean score 3.2)
- Legal/Contractual Regulation (mean score 3.2)
- Confidentiality and Disclosure (mean score 3.2)
- Legal Transfer of Custody; Agreements on Rights/Responsibilities (mean score 3.2)
- Data Handling Requirements (mean score 3.1)
- Define Scope of Collection (mean score 3)
- Approved Mission (mean score 3)

4. Sustainability of Development Support Services

When considering the sustainability of development support services, we must examine the requirements for maintaining the long-term services, the activities, and the ecosystem/infrastructure as a whole. Here we investigate the financial models that may be deployed, possible external sources of funding, how to support knowledge about the services and activities that are available, and how needs are assessed.

4.1 Financing Development Support Services

We cannot consider the sustainability of development support services without considering the costs of providing support services SP to SP (or aspiring SP). There are a number of traditional and alternative models we could consider for this, however, there are factors limiting the choice of funding models for this cooperative environment. The following models could apply to providing development support services and activities.

4.1.1 Provider and Consumer Model (Market Economy)

The most obvious model for providing development support services and activities is for the consumer (client) to pay the supplier, and there is a clear contract detailing what will be supplied and at what cost. Considering that some development services incur considerable cost, this may be appropriate. However, this model does not seem reasonable for fostering a cooperative, collaborative, supportive community, especially when there appears, from the analysis of D3.2, to be a need for more expertise and consultancy than continuous services. Moreover, it may be seen to be a poor model if one SP is profiting considerably from the rest of the community.

A service may only be sustained if there are sufficient SPs paying for it in this model. Therefore, since the community of SPs is quite small, it may not be economically possible to deliver core

services with high maintenance overhead costs. With such a small community, the value of market pressure on service prices may not be present, where only a single SP is offering the service and there is little benefit for other SPs to offer a competing service.

Bespoke software development, as an activity, could fit this model as there are clear costs of personnel time, as might also event management for training, workshops, and conferences.

Figure 9: Provider Consumer Model (Market Economy)

Provider Consumer Model
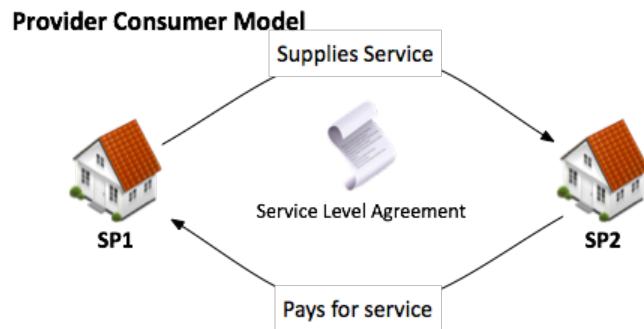
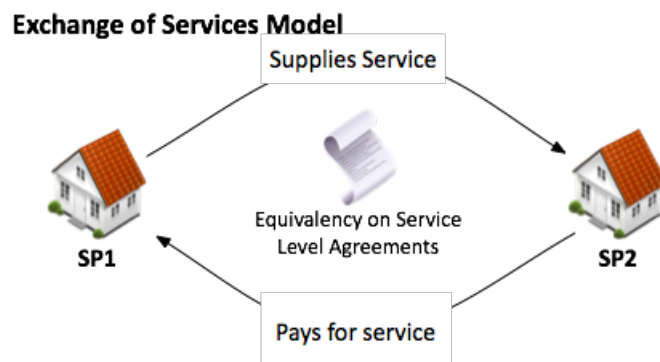### 4.1.2 Mutually Beneficial Exchange of Services Model (Barter Economy)

If two SPs need each other's service or activity, a mutual exchange is possible. There should be a reasonable equivalency in the value of the services provided and service level agreements should be considered if the mutual services last over a period of time.
This model may work well for exchange of expertise, or site visits, especially regionally and where costs are low or equivalent.
The challenge of this model exists in the fact that there may not be enough pairs of SPs with matching needs and provisions, Furthermore, there may be high demands upon one SP for a specific service where that SP no longer needs or wants services from the requestors.
Therefore, this model could be part of an overall package of methods to deliver development support services but not exclusively by itself.

*Figure 10: Mutually Beneficial Exchange of Services Model (Barter Economy)*

Exchange of Services Model

4.1.3 Pay it Forward Model[12] (Gift Economy)

An evolution of the mutual beneficial exchange model in which one SP altruistically provides a service or activity to a second SP on the basis that the second SP make a commitment to provide the service or activity to a third SP, and so on.

In this manner, the whole community of SPs can consume the service or activity quickly. The rate of knowledge transfer could be increased if the second SP is required to pass on the activity or service to two other SPs. This model would work well with running training and workshops, especially when there is some new EU-wide legislation, or where many SPs have low maturity on a required activity for a SP obligation, and possibly expertise/consultancy. As with the exchange of services model, this model should be considered as part of a portfolio of models for the delivery of development support services.

*Figure 11: Pay it Forward Model (Gift Economy)*
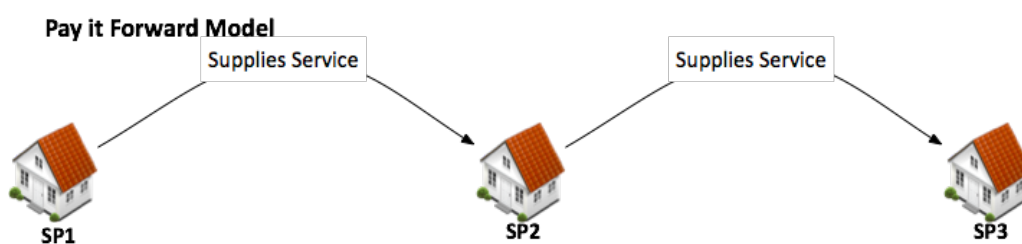
4.1.4 Contribution (to the CESSDA Community) Model (Sharing Economy)

Currently, through the Humanities at Scale (HaS) project, DARIAH-EU is developing a solution for non-cash contributions to its infrastructure (de Leeuw et al., 2017). As part of the DARIAH ERIC statutes, country members contribute to the infrastructure both in cash and in in-kind contributions. In DARIAH the national in-kind contributions tend to be for the researcher community rather than the infrastructure provider (partner) community. The types of contributions are broader than those we have presented in SaW Deliverable D4.5, but are divided into both long-term services and discrete activities (Ibid.) In DARIAH data processing services and access to resources are considered as service contributions, and activities such as resource creation and coordination efforts are possible to submit as a contribution. In each member country, a national coordinator selects contribution submissions made by institutional partners to be included in the in-kind contribution the country is expected to make (Ibid.) The contributions registered are not necessarily included in the in-kind value but are still part of the DARIAH infrastructure and are made available to users. Submitted contributions undergo a quality assessment by experts in the infrastructure (Ibid.)

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[12] http://sustainabilitypatterns.info/Passing_On_The_Gift.html [Accessed 25/10/2017]

Figure 12: Contribution (to the CESSDA Community) Model (Sharing Economy)
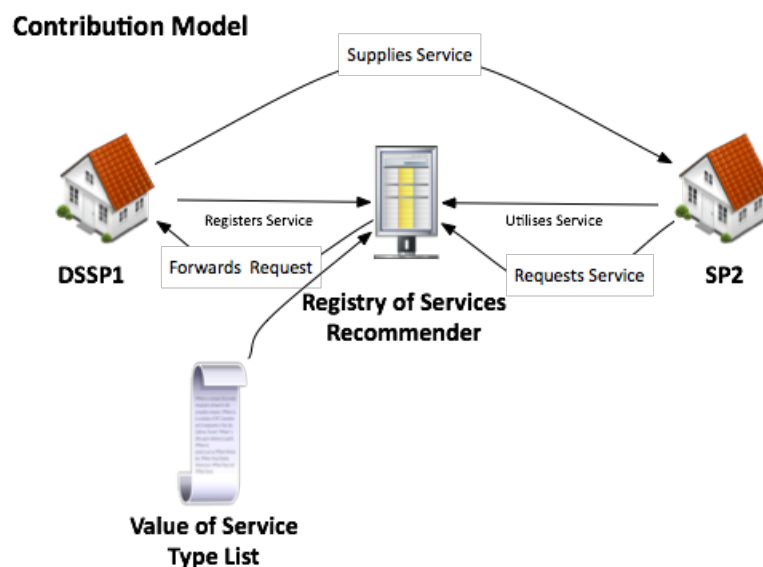
In a contribution model for development support service there must be a central registry of services and potential activities that a development support service provider (DSSP) can offer. From this registry, a service provider can select what they need and request as service from a DSSP. Each type of service has a fixed token value, which removes price competition from the model. Each SP has a set number of tokens that they can use to acquire services in any year. A DSSP can bank additional tokens to use with another DSSP (and not a direct exchange).

The advantages of this model are that there is a registry of what is available within the service provider community and it would encourage SPs to become DSSPs and DSSPs to offer more services. Furthermore, it removes the need to find equivalent value services in the exchange of services model. However, if there is a popular service provided by one DSSP, and if there are no services that the providing DSSP requires, then there is a skewing in the distribution of tokens and no way out without losing value for the DSSP; since the number of service provider in CESSDA is small.

Making this an in-kind contribution model would require a reduction of financial contributions to CESSDA from the member states in exchange for the development support services provided by the country's SP. Alternatively there is a separate in-kind value that a member state is required to contribute. This may be unfair for the DSSP in that they may not get due recompense for their support to other CESSDA SPs. The challenge for CESSDA is the inability to plan central activities if the financial contributions are not regular and the additional overhead costs of managing and maintaining such a solution. Furthermore, to include an in-kind aspect to this model would probably require a change to the CESSDA ERIC statutes, or at very least additions to Service Provider Obligation 11 of Annex 2, obliging SPs to offer and provide development support services with a value that is a multiplier of their country's financial contribution.[13]

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[13] The multiplier can be less than 1, i.e. the in-kind value is less than the financial contribution.

Although there are benefits to this model with such a small community of service providers, all with different levels of maturity for their capabilities, this model does not appear currently feasible for CESSDA.
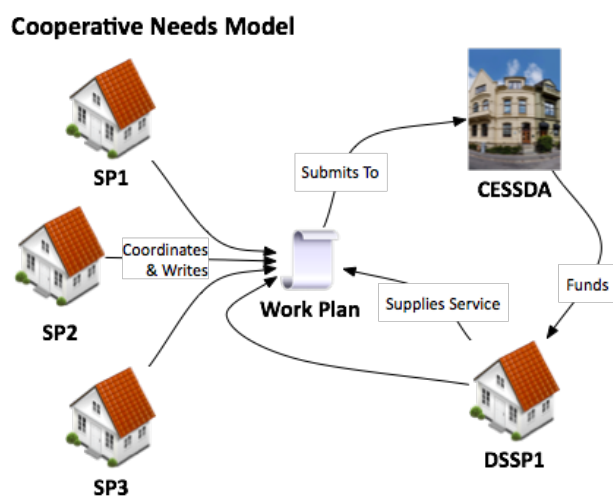
4.1.5 Cooperative Needs Model

If a number of SPs require the same development support service or support activity then it may be beneficial to create a group, develop a work plan, and submit it for funding. Naturally this takes time, but does mean that a number of SPs progress their maturity together.

For the DSSP there may be more work to undertake, but it will be funded. Funding may come from CESSDA, a proposal submitted to a call from the European Commission (EC), or other sources of external funding. In larger proposals, such as CESSDA SaW, there will be more DSSPs providing specialised services and activities. This model works well for activities rather than long-term services as the there is an end to the project and associated funding.

Activities such as training, and in particular training resources, software development and installation all fit well in this model due to the high initial costs and then the resources can still be available beyond the end of funding.

Figure 13: Cooperative Needs Model

Cooperative Needs Model

4.1.6 Service Package Model

Similar to the Cooperative Needs model, in this model we consider that there are a number of DSSPs who can provide a set of services and activities that can be offered to a new SP to ensure their progression to meeting the Annex 2 Obligations, and other requirements to be a participant in the CESSDA infrastructure. Depending upon the maturity level of the capabilities and the capacity of the new SP to undertake a development programme, it may take an extended period of time to deliver the package. For example, in CESSDA SaW, Task 4.3 - Development Support: achieving the Data Seal of Approval (DSA),[14,15] only of those which

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[14] Mandatory obligation for CESSDA Service Providers.
[15] DSA in collaboration with the ICSU World Data System have launched the CoreTrustSeal which will replace the DSA: https://datasealofapproval.org/en/news-and-events/news/2017/9/11/coretrustseal-certification-launched/.

started the process achieved the DSA within the two years of the project with another 8 submitted out of a total of 24 (Tjalsma et al., 2017).

Elements of the package could be delivered via externally funded projects (similar the Cooperative Needs Model), but ensuring the timeliness of the deliverable is important. Furthermore, the new SP must have a clear development plan based upon the results from regular self-assessments based upon the complete CESSDA-CDM.

Figure 14: Service Package Model
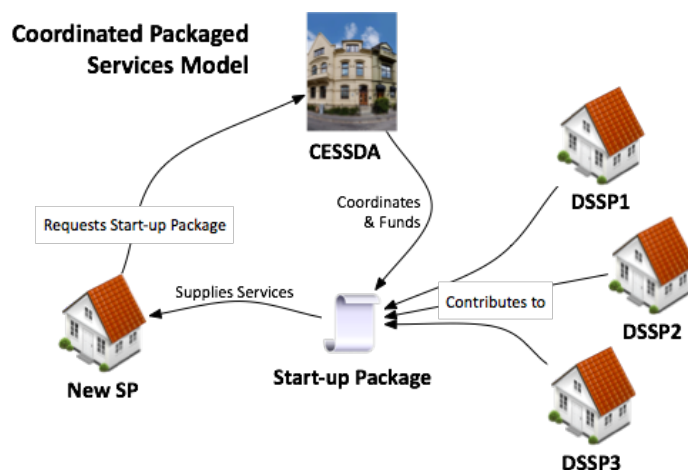
4.2 European Funding Opportunities

Since some of these sustaining economic models could utilise financial input, we should consider the possible sources of funding further afield than Horizon 2020. Fortunately, Humanities at Scale have recently published a comprehensive analysis of opportunities on European Union funding schemes in its report D3.4 (Raciti, 2017), which includes:

- European Structural and Investment Funds (ESIF)
  - European Regional Development Fund (ERDF)
  - Cohesion Fund (CF)
  - European Social Fund (ESF)
- COST Actions
- Creative Europe
- Erasmus+
- Connecting Europe Facility (CEF)

Although the analysis was undertaken in the context of DARIAH and the Humanities, it is valid, in most cases, for Social Sciences as well.

National and intra-regional funding sources is too broad and complex to consider in this report. Organisations are often very aware of their local sources of funding.

4.3 Sustainability of the Support Services

Ensuring continuity and reliability of a service upon which an organisation relies to provide a reliable service to their designated community is a challenge, not only for CESSDA SPs but many service companies. We rely on the delivery of electricity upon demand, when we plug a device into the supply, and increasingly we expect digital services provided by internet service providers and telecommunication companies to always be there and complain vehemently when they are not.

Long-term services supplied by on SP to another SP have specific challenges because it is not always possible to rapidly switch supplier because of specialised requirements, knowledge and expectations.

Normally terms, expectations, and conditions are laid out in a Service Level Agreement (SLA) for characteristics of the service such as quality, availability, and responsibilities of both the provider and consumer. This will cover the provision of the service for most circumstances. If there is a dispute between SPs on the supply of a development support service, where there is no direct payment for the provision, then CESSDA may need to arbitrate between the parties. This should form part of risk management policy of CESSDA and the SPs.

What happens if a SP decides to terminate a service it has been providing to other CESSDA SPs? There must be contingency plans in place if the service remains necessary for SPs, and this should form part of policy extension to the obligations of SPs.

The following circumstances need to be addressed by CESSDA and the SPs in the risk management policy. Firstly, it must be determined if the service can be transferred to another DSSP or integrated into all the client SPs individual infrastructures. If another DSSP cannot be found then can CESSDA take over the responsibility of running the service? If this looks unlikely, then what support can be provided to those SPs losing the service to mitigate or minimise disruption to their commitments to their designated community and CESSDA?

It may be appropriate and pragmatic for CESSDA to develop a template SLA for the provision of services within the CESSDA infrastructure.

Not only is governance of the provision of services essential, but so it is for the support infrastructure as a whole, which should also form part of a CESSDA policy on the governance of service provision.

4.4 Sustainability of the Development Support Infrastructure

The CESSDA SP community could continue to help and support each other on an *ad hoc* basis, as it currently does, however this is challenging for new and candidate service providers as they may not have the network of contacts. It may be by luck that a SP does find the expert advice, the support they need, or gets involved in a useful project. Therefore, engineering this serendipity should make it possible for a SP to improve its capabilities and maturity.

It was evident in the work towards Deliverable D4.5 and from D3.6 that there are services, potential services, and expertise that can be offered to support others in a more organised fashion. There is a clear need to catalogue what is available in the community, but more importantly, it is necessary to understand what potential there is available and to encourage its provision to others. An audit of tools, services, training and knowledge across all SPs should be undertaken. There are conspicuous support circumstances, but there are also less obvious opportunities particularly in expertise and knowledge.

Knowing what is possible to provide is one thing, but encouraging it to be offered as a development support service or activity is quite a different challenge. The most likely way to ensure this is to include it in funded development projects.

The converse and corollary to knowledge of the supply side, is the understanding of the needs. Here the CESSDA-CDM can help. Improvement to the CDM, the development of a complete self-assessment, and recommendations for next steps, would provide a SP with a roadmap for improvement and meet the Annex 2 obligations.

To match the offers and the needs a Support Services Noticeboard or registry may be required, in which both offers of support and needs are listed. Not only will it make matches between DSSP and SP, but also could be used for establishing collaborations around broadly similar needs. Moreover, it would ensure that any future project proposal includes the best suited SPs in work packages and tasks. However, there are overhead time costs, which might be too onerous, for every SP to maintain their entries. Furthermore, although it will identify gaps in supply, it will not help to fill those imbalances between offers and needs, except via a project or a work plan, which are inherently not long-term.

So far, we have not considered the capacity of a DSSP to provide a development support service or activity. This may be a limiting factor on the supply-side, thus managing demand, but also affecting the pace at which a consuming SP develops its capabilities and associated maturity levels. With SPs at different stages of their development it may not always be possible to bring all requiring the same support together in a project proposal.

5. Conclusions

It is clear, from the self-assessments conducted in CESSDA SaW's Task 3.2 and the anecdotal evidence from Task 4.4, that there is a need to improve the capabilities and maturity of the SPs' provision to their designated communities. This need is not uniform across all SPs or for every capability but is more apparent amongst the smaller SPs with less capacity to improve their capabilities. However, it is not possible to quantify the development needs at this point in time, as there were no minimum or expected maturity levels defined for the required activities assessed. CESSDA will need to set the expected maturity and capability completeness levels as part of a package of improvements and developments around the operationalisation of the Capability Development Model.

The CESSDA-CDM is essential for SPs to fully understand where they currently are and what steps they need to take to meet the requirements and obligations of CESSDA. Only with this knowledge can support services and activities be matched to the planned roadmap of development of the SP.

Where SP-to-SP support exists, it often *ad hoc* and is using personal networks. There is no overall view on what a SP can do for others, and there maybe skills and expertise buried deep within a SP. By publishing (within CESSDA only) the development support services and activities available it would be possible to match offers and needs, especially for new or candidate SPs. However, this information may be better used to engineering serendipity through the creation of inclusive work plans and project proposals. Moreover, the work required can be more reasonably distributed to those with the expertise, and targeted to those who have a clear need for the support.

The SaW project contains very good examples of support activities that are provided to the broad SP and candidate SP community, which have been achieved with external funding. For example, Task 4.3 - Development Support: achieving the Data Seal of Approval provided very pragmatic and practical support to SPs who have not met the obligation of having a DSA certification. The DataverseEU 2018 work plan developed directly from the needs of partners in SaW both in and beyond Task 4.4 where pilots around Dataverse were conducted.[16] Both of these examples practically demonstrate how the delivery of support services and activities can be delivered. Projects such as SERSCIDA and SEEDS demonstrate how regional support can be delivered.

This does not preclude other models of delivery of support, including the *ad hoc*, and often regional, support through networks of personal contacts. It would be interesting to establish a pilot of support using the Pay It Forward model. In the medium to long-term it is likely that the maturity of all current SPs and candidate DAS will reach an acceptable maturity level and meet all the Service Providers' Obligations, then the funding model will probably move to the Service Package model for new SPs.

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[16] CESSDA SaW Deliverable 4.5 details the pilots undertaken.

Other models will no doubt be tried; however, the Contribution Model would be difficult to implement due to the small size of the SP community and the overheads of managing it.

It is for CESSDA and the service provider community together to develop support services, and ensure that the Service Providers' Obligation to 'provide member support for countries with immature and fragile national infrastructures to help them build up needed competence later to be able to fulfil tasks as Members' is fulfilled and sustained over time, by enabling deeper insight into the provision of, and needs for, development support services. CESSDA should enable the opportunity to meet the development requirements through an infrastructure that facilitates both SP-to-SP support and more inclusive and encompassing work plans and projects.

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List of Figures