ROUTES TO SUSTAINABLE SOFTWARE IN SCIENCE: TRANSITIONING TO PEER PRODUCTION

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Motivation

Benkler, 2002; Bietz, Ferro, & Lee, 2012; Feldman, 2000; Howison & Crowston, 2014; Katz et al., 2014; Mintzberg, 1980; von Hippel & von Krogh, 2003

Need for Sustainable Software

- Software is used to discover, share, and reproduce knowledge
- Software decays over time while publications remain static

Costs of Maintenance Work

- Maintenance is majority of software work
- Maintenance work is at odds with academic incentives
- Peer production participants share maintenance costs

Successful Transition Examples

- Enzo was supported by grants but created a peer production community
- Funding agencies want to develop more such communities

Findings

4 organizational configurations that produce scientific software:

1. Author Group

4 in our sample
3 transitioned
1 transitioned to peer production

2. Lab

9 in our sample
0 transitioned
0 transitioned to peer production

3. Tool Group

6 in our sample
0 transitioned
0 transitioned to peer production

How can grant funded organizations transition their software to peer production?

Option 1: Change your organization so that it becomes a peer production community

Option 2: Hand over the software to an existing peer production community

3 organizations successfully handed off software to an organization with a different configuration

NO organization successfully changed its configuration

4. Peer Production

3 in our sample
0 transitioned to another configuration

Three modes of transition:

1. Transmutation: an organization changes its configuration (*e.g.* Enzo changing from lab to peer production)

2. Migration: an organization hands off their software to another organization that has the same configuration (*e.g.* prior to the period of investigation, GASP was created in one lab but then handed over to another)

3. Transposition: an organization hands off their software to another organization that has a different configuration (*e.g.* an author group merged their feature into ASPECT)

	configuration same	configuration different
organization same	no transition 20	transmutation 0
organization different	migration 0	transposition 3

Grants, Their Configurations During Initial Software Work, and Their Key Characteristics

Grant	Starting Configuration	Group Website	Group Name	Invite to Contribute	Interests	Self-identify	Transition Method
1148011	lab	yes	yes	yes	diverse	no	none
1440420	lab	no	yes	no	diverse	no	none
1440547	lab	yes	yes	no	diverse	no	none
1440800	lab	yes	yes	no	diverse	no	none
1535150	lab	yes	yes	no	diverse	no	none
1047586	lab	yes	yes	no	diverse	no	none
1047828	lab	yes	yes	no	diverse	no	none
1265278	lab	yes	yes	no	diverse	no	none
1339785	lab	yes	yes	no	diverse	no	none
1148453	tool group	yes	yes	yes	singular	no	none
1148461	tool group	yes	yes	no	singular	no	none
1450280	tool group	yes	yes	yes	singular	no	none
1339844	tool group	yes	yes	yes	singular	no	none
1339707	tool group	yes	yes	no	singular	no	none
1047916	tool group	yes	yes	yes	singular	no	none
1047963	author group	no	no	no	singular	no	none
1339768	author group	no	no	no	diverse	no	transposition to lab & author group
1440811	author group	no	no	no	singular	no	transposition to peer production
1148124	author group	no	no	no	singular	no	none
1148144	author group	no	no	no	singular	no	transposition to tool group
1148116	peer production	yes	yes	yes	dual	yes	none
1535651	peer production	yes	yes	yes	singular	yes	none
1265872	peer production	yes	yes	yes	singular	yes	none

Implications

Organizational change is rare; funders should support applicants who plan to contribute to an existing peer production community

However, this work shows that there are alternatives to commercialization that may be more appropriate for some scientific software

Future research should investigate the specific challenges that different configurations face when attempting transitions