

Is It a Project or a Business? Perspectives on the Consideration of Sustainability

Michael Zentner

HUBzero Director

Science Gateways Community Institute Associate Director

hubzero[®]

The Pain Point

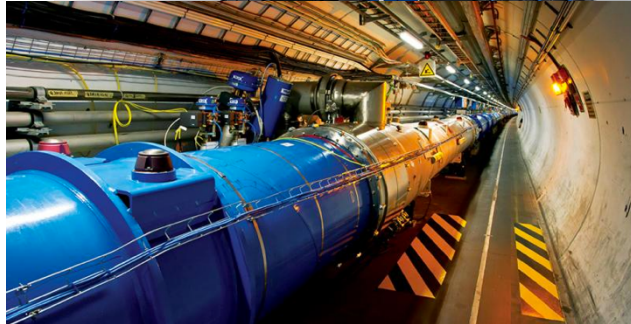
Connecting expensive resources

to scientist authors that write codes to utilize & analyze them

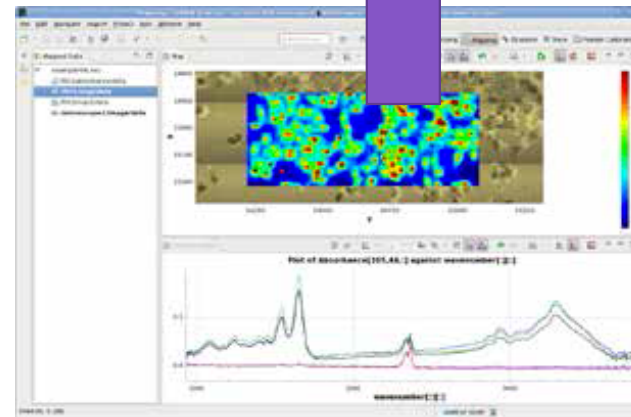
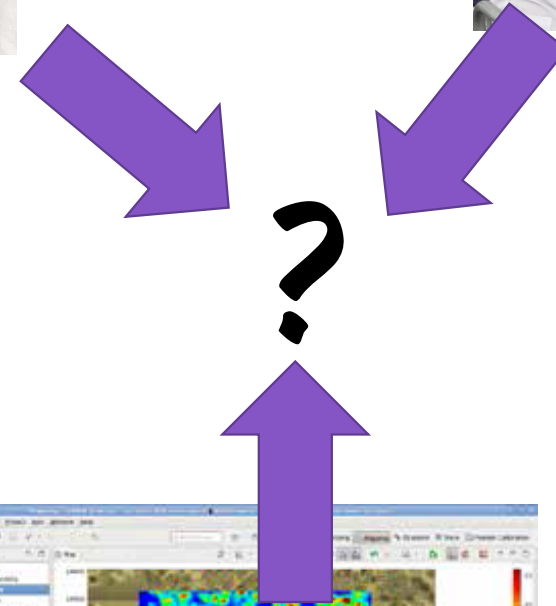
to audiences that use those codes and instruments en masse

hubzero

(expensive) Resources



Audience(s)



Software / Data Authors

The Solution: A Science Gateway

A Science Gateway:

- Connects to supercomputers and/or instruments
- Allows scientists and engineers to share access to their software codes with...
- ...large audiences who can run those codes on supercomputers and access those instruments with little to no effort.

- ...AND
 - Facilitates publishing results
 - Allows for interactions / collaborations within the scientific community
 - Assists with reproducibility of results
 - Runs citizen science projects
 - etc...

Community
Interaction / Collaboration

Knowledge
Dissemination /
Publication

Functional Capabilities of the HUBzero Science Gateway Platform

hubzero

Resource, Data, Analytics &
Application Sharing

Business vs Project in Mission

Virgin Galactic

We are a part of Sir Richard Branson's Virgin Group. With our sister companies, The Spaceship Company and Virgin Orbit, we are developing and operating a new generation of space vehicles to open space for everyone.

Our mission, to be the Spaceline for Earth, means we focus on using space for good while delivering an unparalleled customer experience.

We recognise that improving access to space is a fundamentally challenging ambition. We will achieve it only in a spirit of collaboration and with a recognition that we must continually learn and can always improve.

NASA Apollo

The national effort that enabled Astronaut Neil Armstrong to speak those words as he stepped onto the lunar surface fulfilled a dream as old as humanity. Project Apollo's goals went beyond landing Americans on the moon and returning them safely to Earth. They included:

- Establishing the technology to meet other national interests in space.
- Achieving preeminence in space for the United States.
- Carrying out a program of scientific exploration of the Moon.
- Developing human capability to work in the lunar environment.

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Project vs Business in Mission

Virgin Galactic

We are a part of Sir Richard Branson's Virgin Group. With our sister companies, The Spaceship Company and Orbit, we are developing and operating a new generation of spacecraft for everyone.

**A repeatable,
saleable product to
satisfy customers**

Our mission, to bring the space age to Earth, means we focus on using space for good while delivering an unparalleled customer experience.

We recognise that improving access to space is a fundamentally challenging ambition. We will achieve it only in a spirit of collaboration and with a recognition that we must continually learn and can always improve.

Discovery

NASA Apollo

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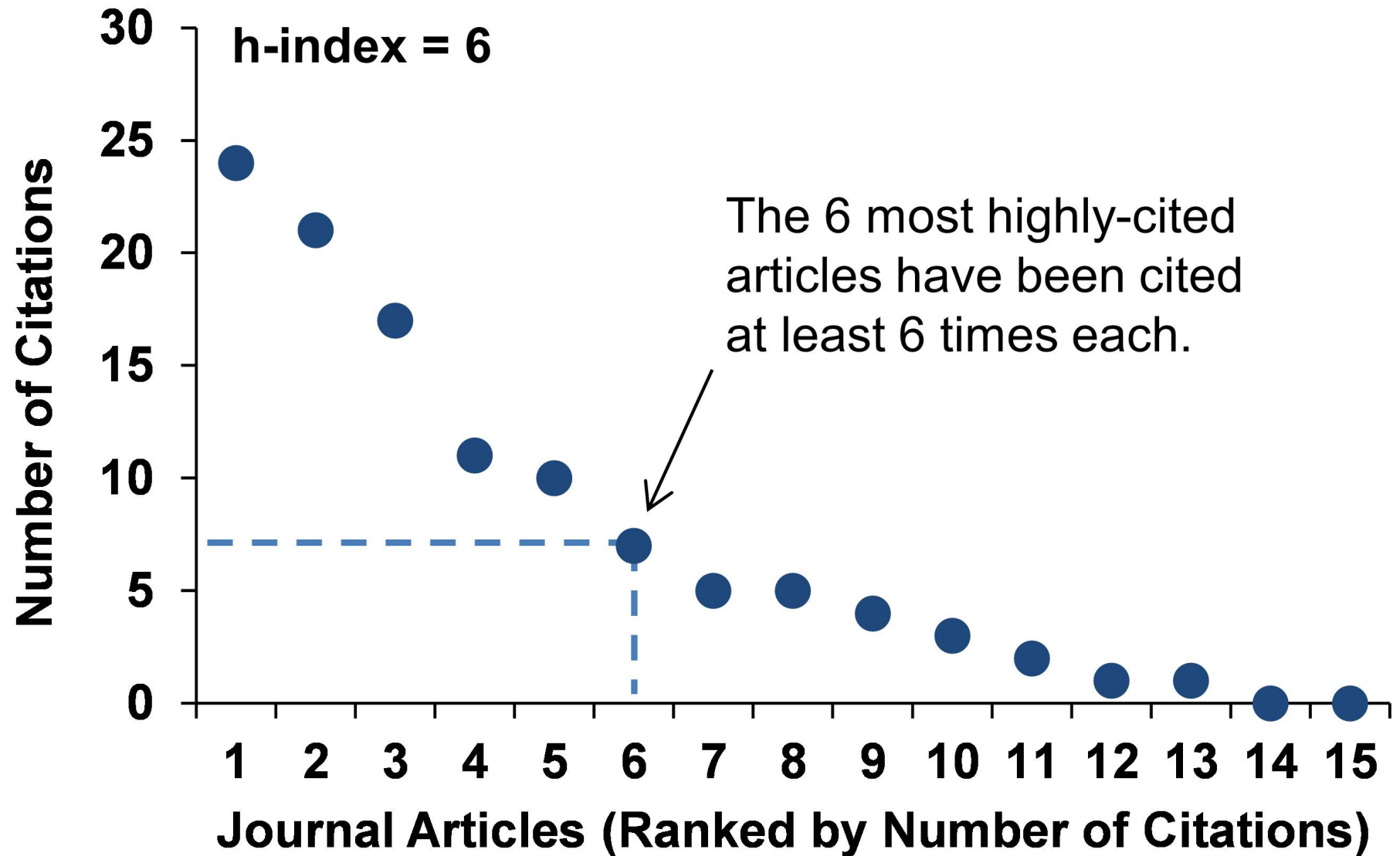
Discovery

- Establishing a capability to meet other national interests in space.
- Achieving preeminence in space for the United States.
- Carrying out a program of scientific exploration of the Moon.
- Developing human capability to work in the lunar environment.

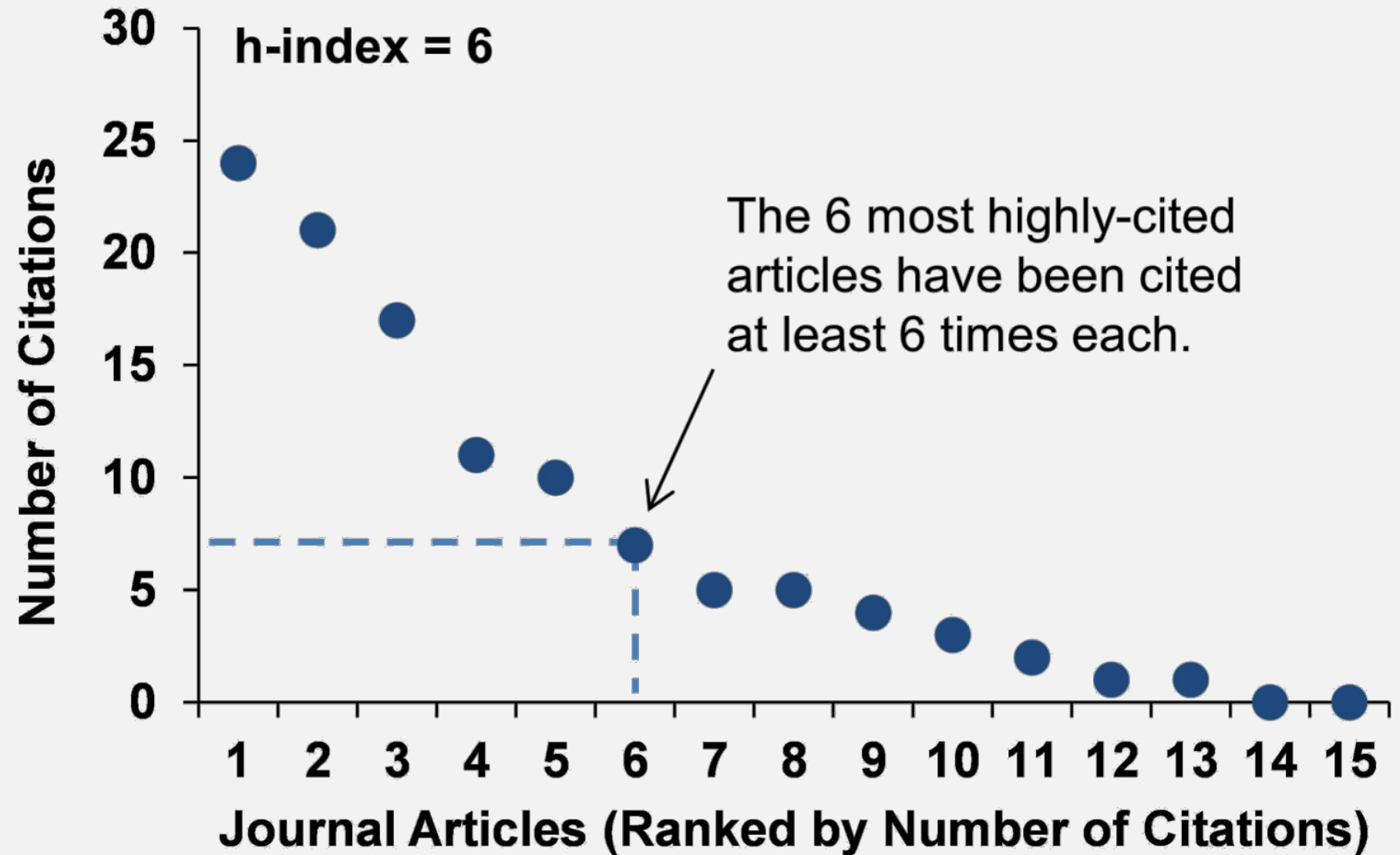
How we sell
a proposal



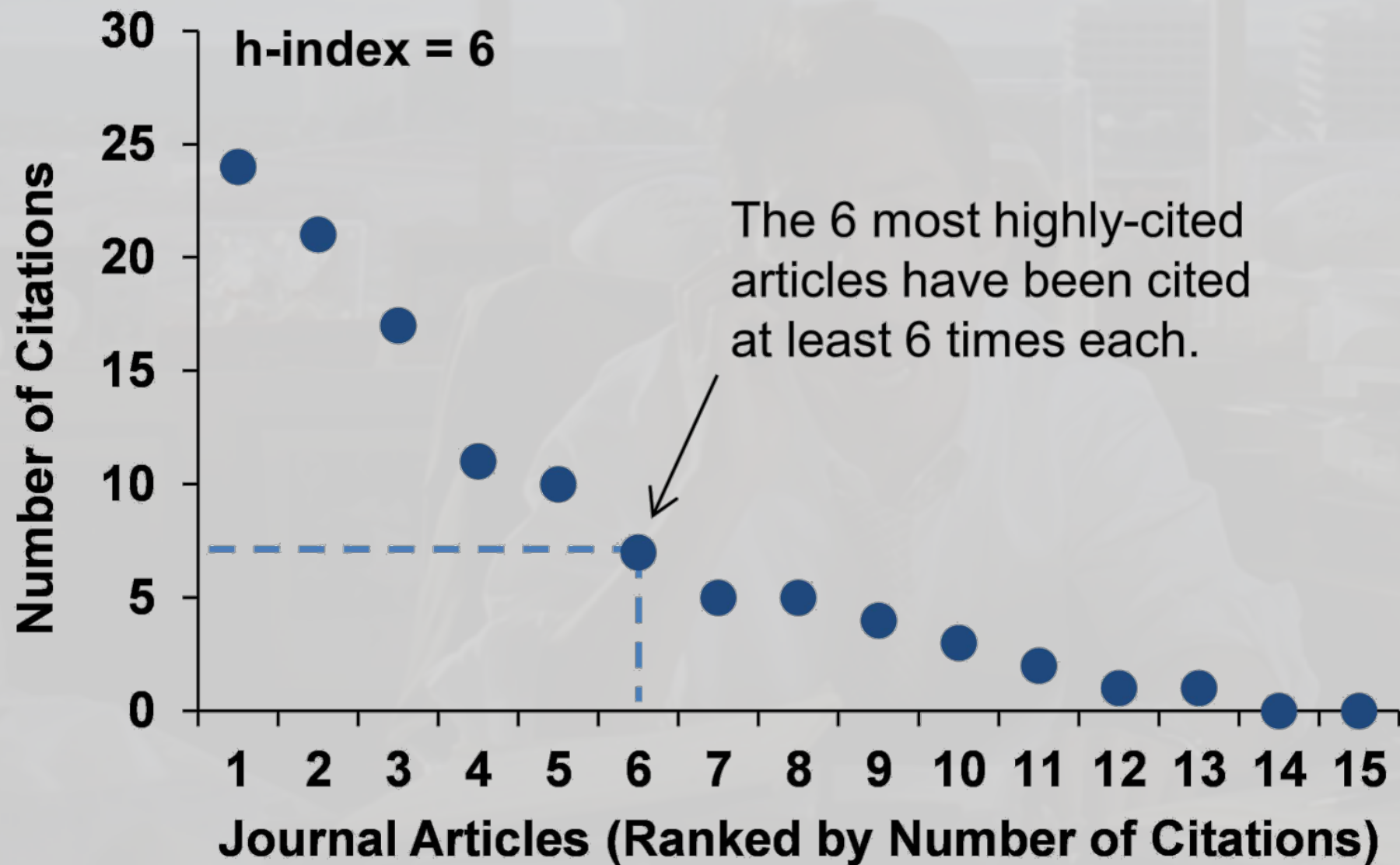
How our performance may have been evaluated...



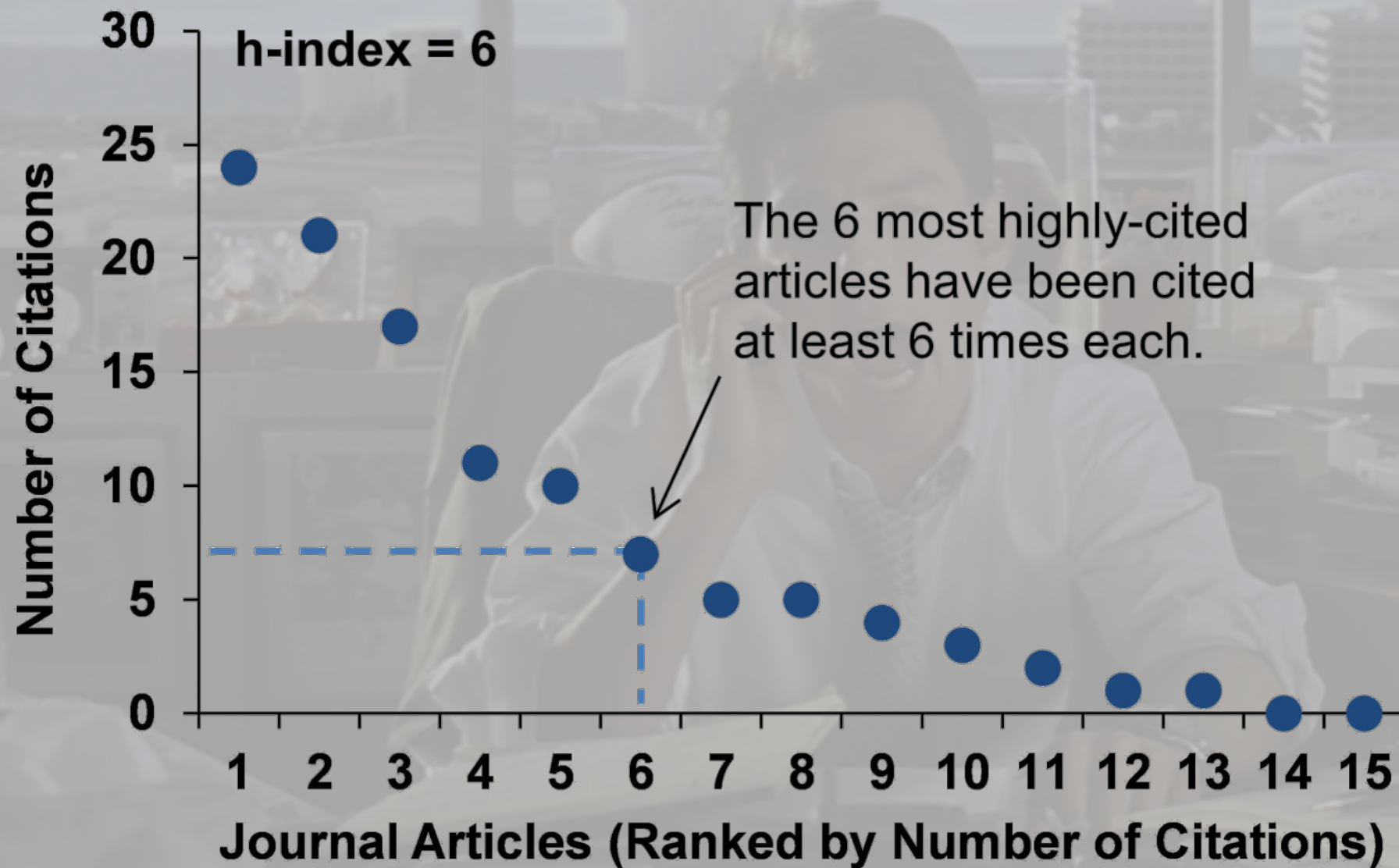
How our performance is increasingly being evaluated...



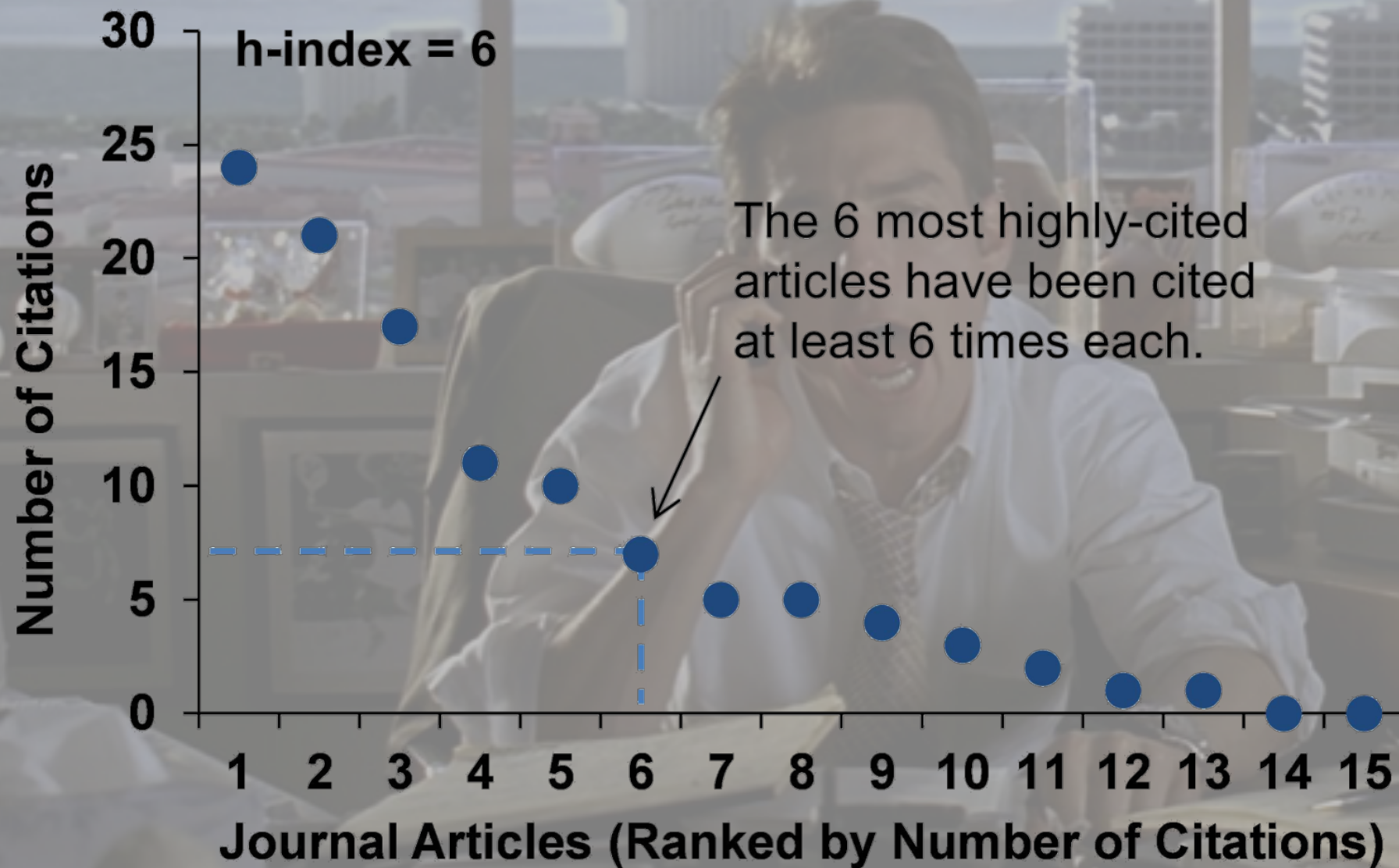
How our performance is increasingly being evaluated...



How our performance is increasingly being evaluated...

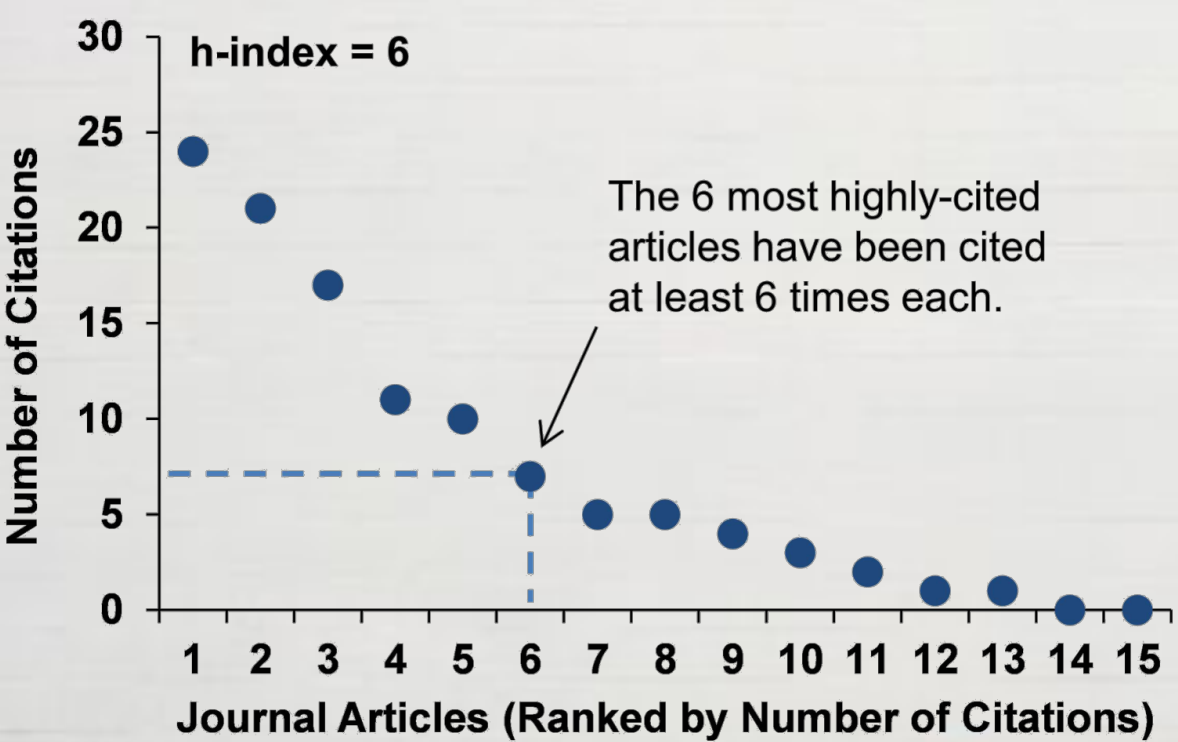


How our performance is increasingly being evaluated...



How our performance is increasingly being evaluated...





These things must be at odds right?

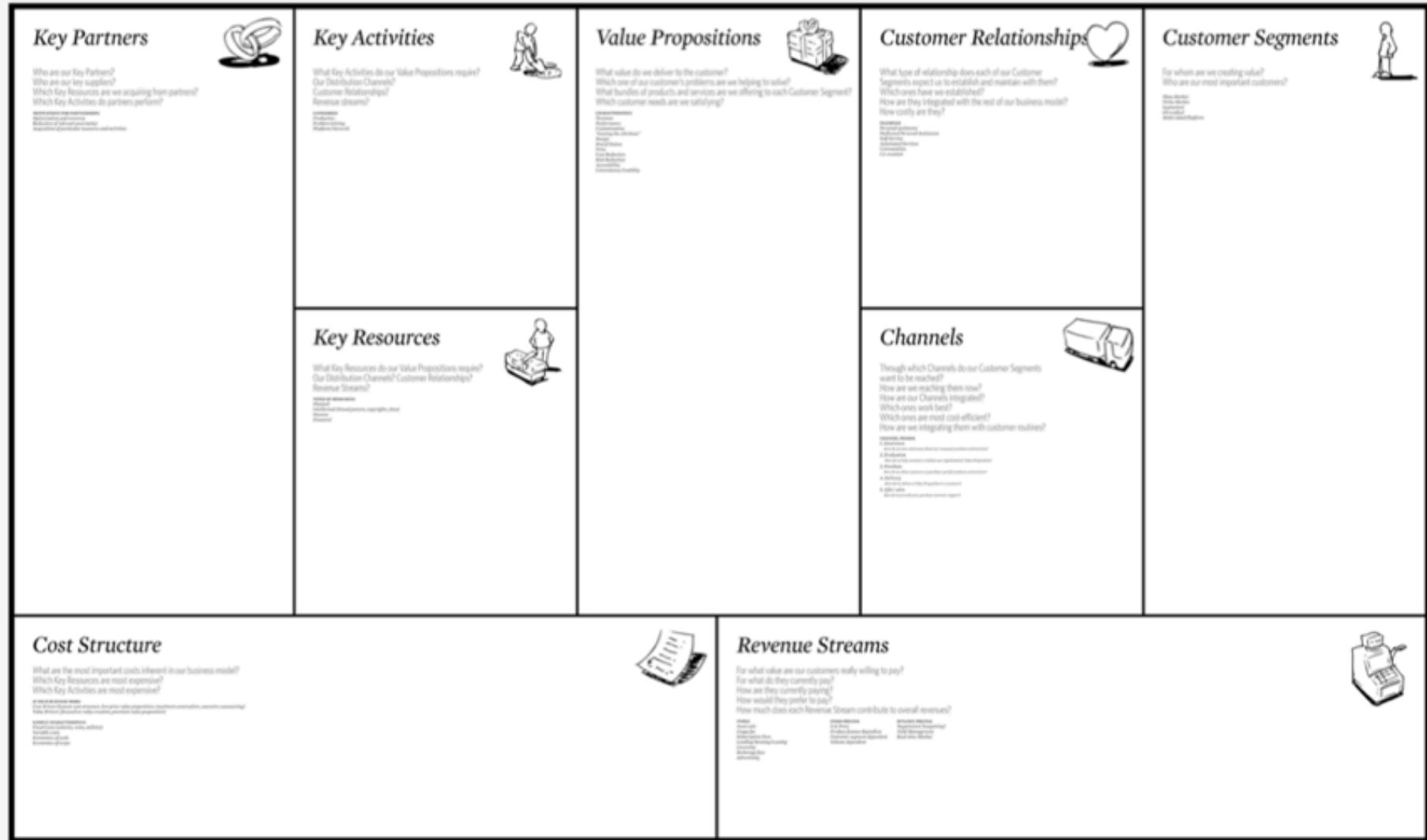
Not really...
 ...there is a unifying framework

The Business Model Canvas

Designed for:

Designed by:

On:
 Iteration:



Not
really...

...there is a
unifying
framework

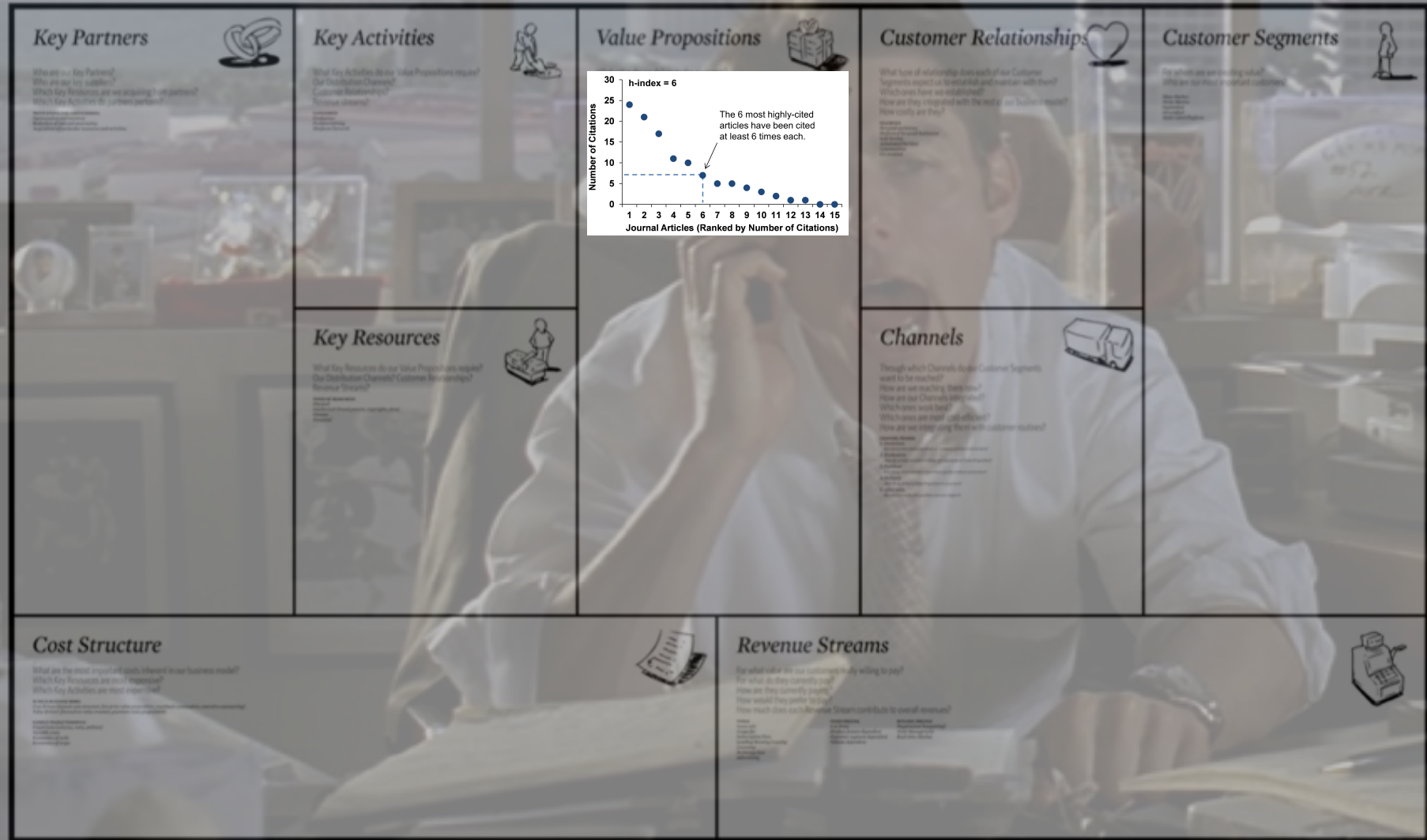
The Business Model Canvas

Designed for:

Designed by:

On:

Here/Out



Not really...

...there is a unifying framework

But how does a project fill it in?

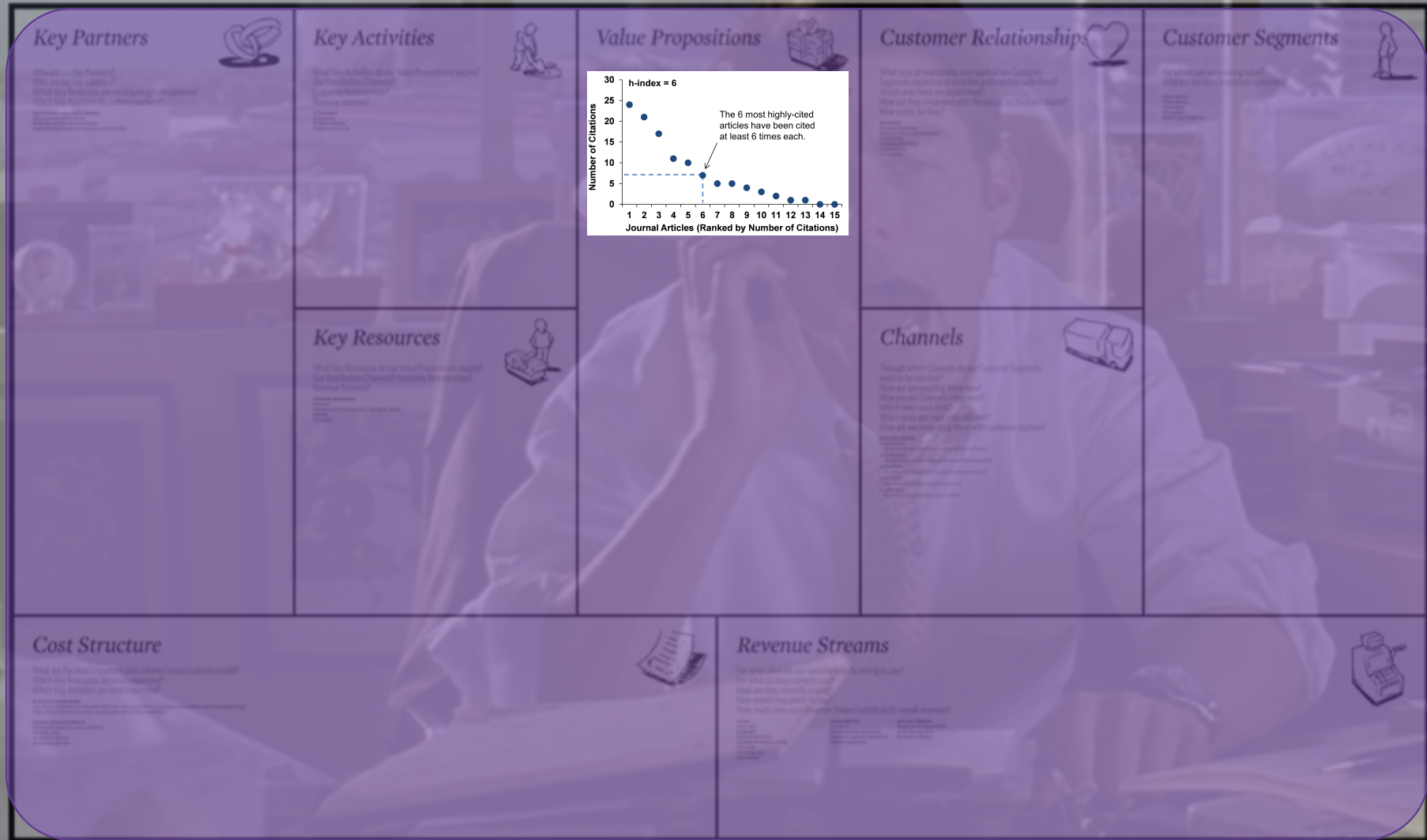
hubzero

The Business Model Canvas

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Here/Out



Not
really...

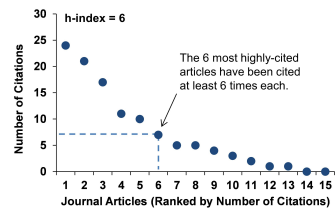
...there is a
unifying
framework

But how
does a
project fill
it in?

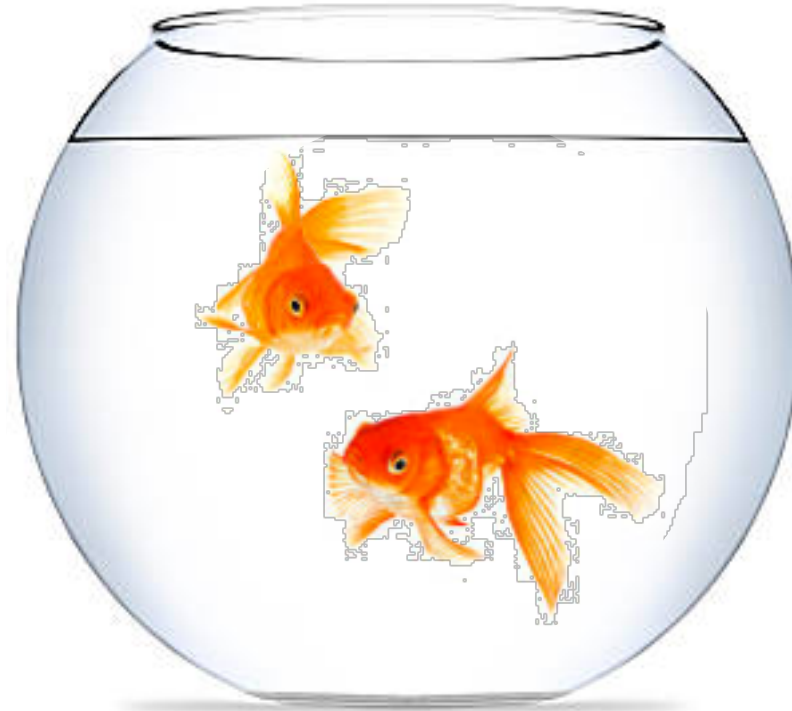
hubzero

- Solicit business investment
- Gradually build it from grant to grant
- Align with another organization already doing it

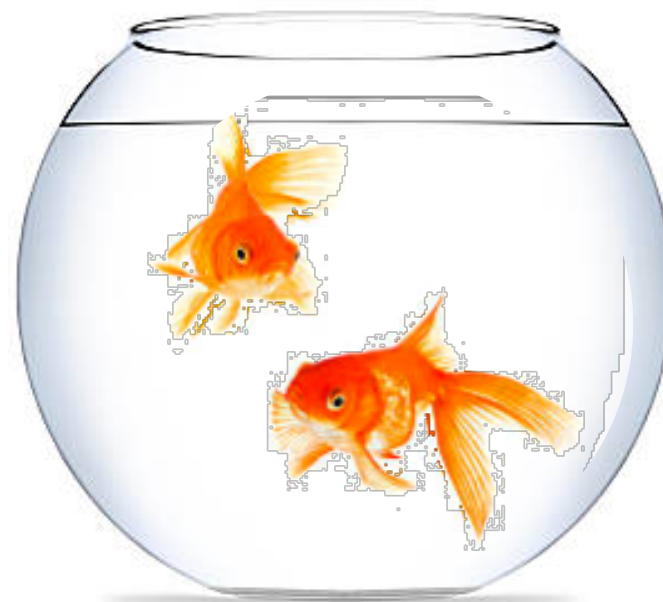
Soliciting business investment



Grant to
grant

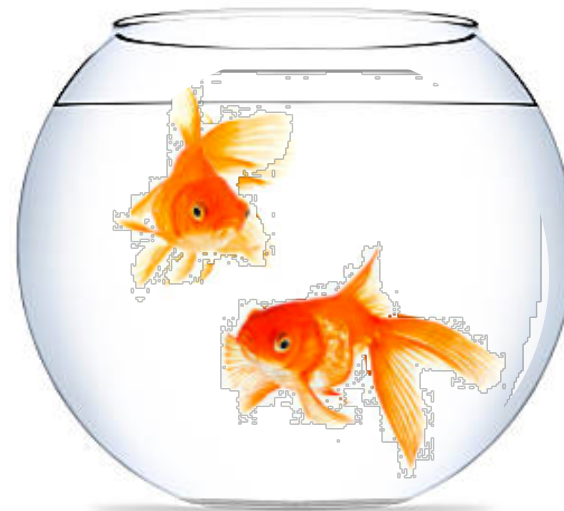


Grant to
grant



hubzero

Grant to
grant



Grant to
grant



hubzero

Grant to grant



Grant to grant



Grant to grant

Great for innovation.
Terrible for continuity.
Worse for repeatable products.
As bad as can be for sustainability.

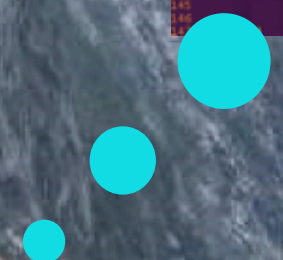


In the
beginning
(1998)...

hubzero



```
117     }
118 }
119 Vector<MasterString> wkeys = new Vector<MasterString>(masters.keySet());
120 Collections.sort(wkeys);
121 for (int i1 = wkeys.size() - 1; i1 >= 0; i1--) {
122     MasterString w = wkeys.get(i1);
123     Vector<SubducedString> subs = masters.get(w);
124     ai[0] = w1.count.toString();
125     ai[1] = w1.c;
126     ai[2] = subs.get(0).count.toString();
127     ai[3] = subs.get(0).c;
128     ai[4] = Double.toString(subs.get(0).levenshtein);
129     ai[5] = Double.toString(subs.get(0).jarowinkler);
130     w.writeText(a1);
131     for (int s = 1; s < subs.size(); s++) {
132         SubducedString w = subs.get(s);
133         ai[0] = "";
134         ai[1] = "";
135         ai[2] = w1.count.toString();
136         ai[3] = w1.c;
137         ai[4] = Double.toString(w.levenshtein);
138         ai[5] = Double.toString(w.jarowinkler);
139         w.writeText(a1);
140     }
141 }
142 w.close();
143 } catch (Exception e) {
144     System.err.println("Exception" + e + " at line " + linesRead);
145     e.printStackTrace();
146 }
```





Vertical Scaling

500+ Simulation Tools

6100+ Other Resources

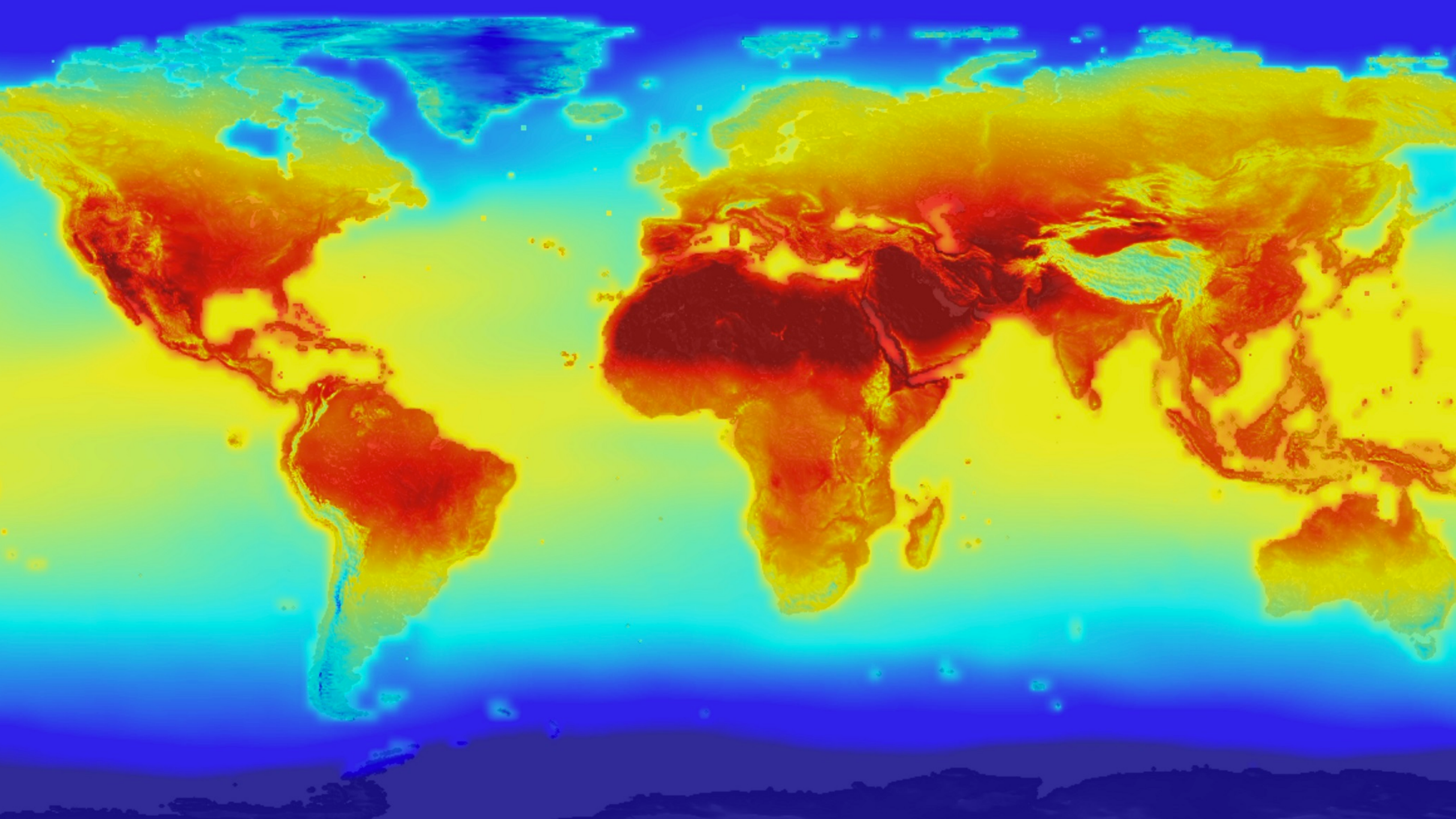
3900+ Online Presentations

700+ Teaching Materials

35,000+ Students Reached

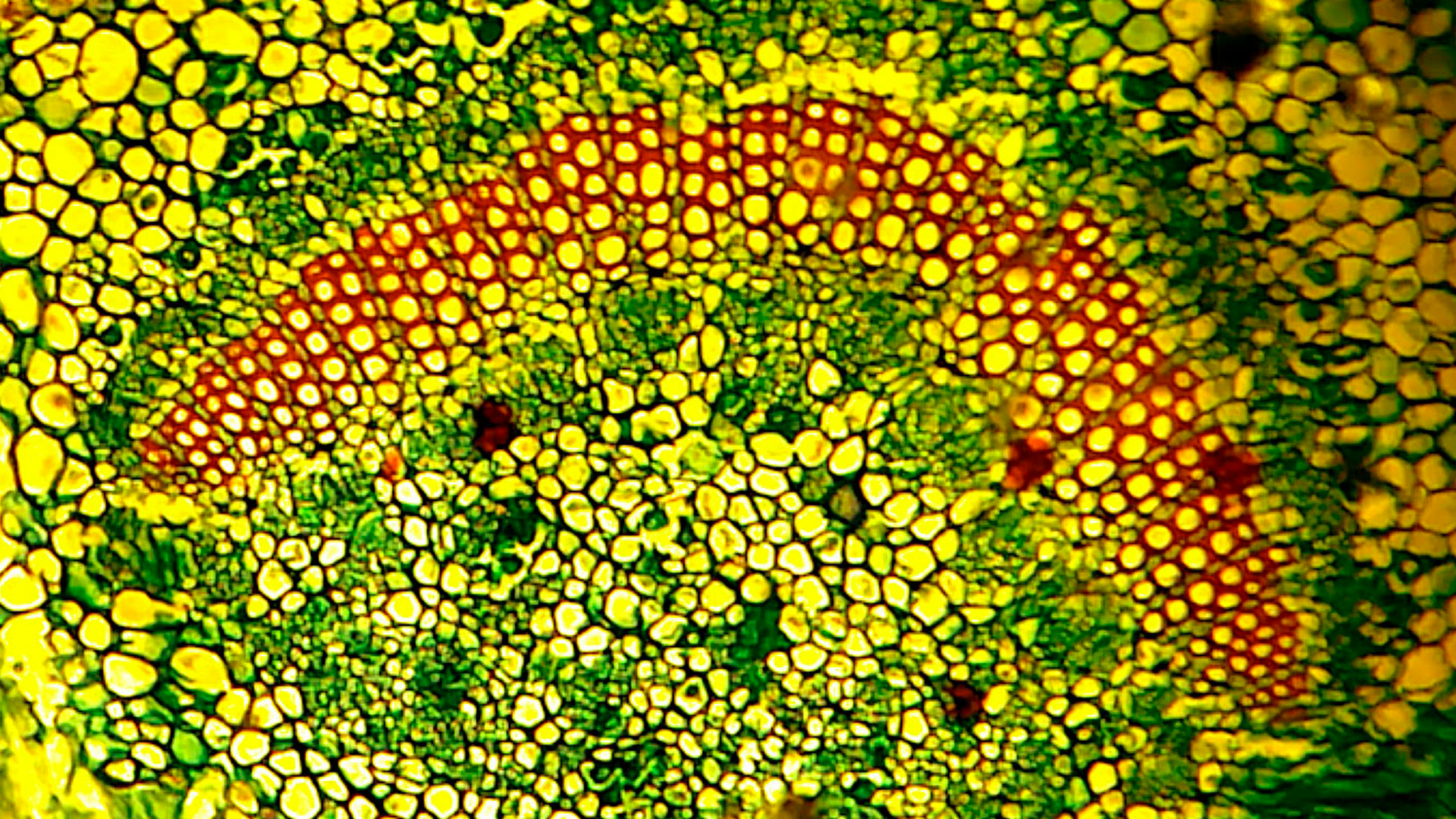






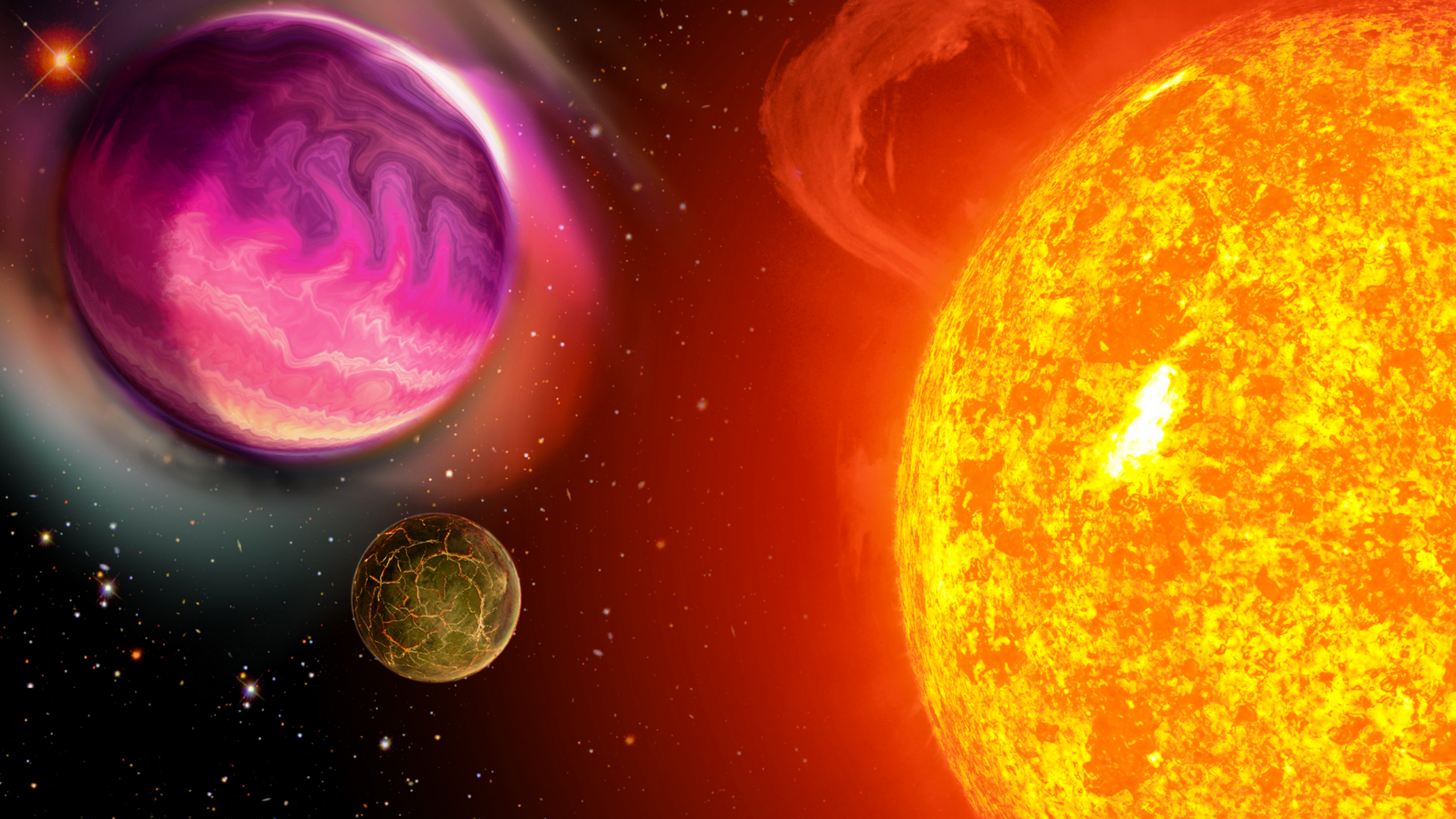




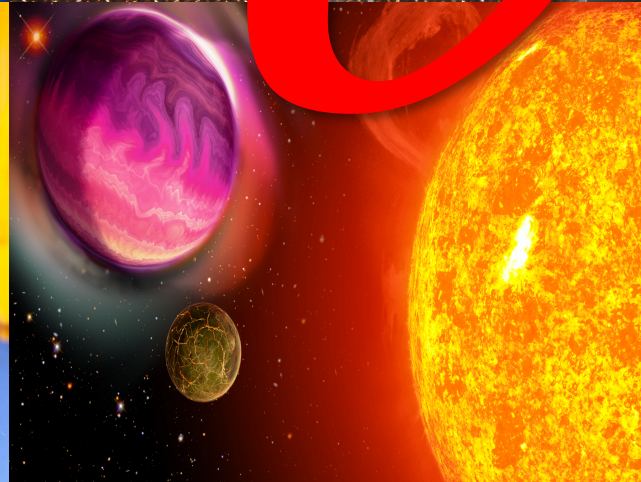
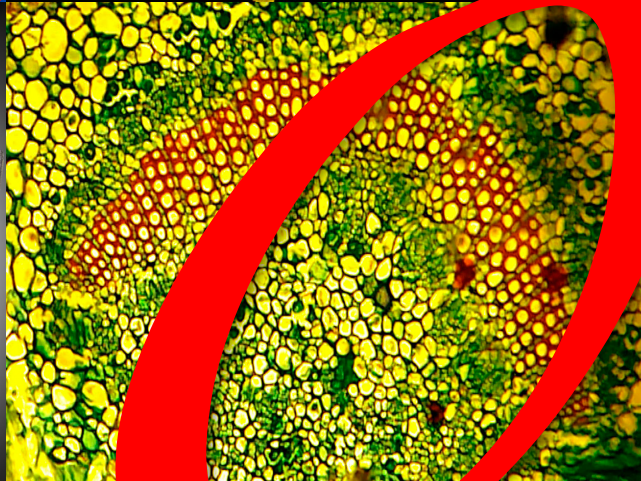
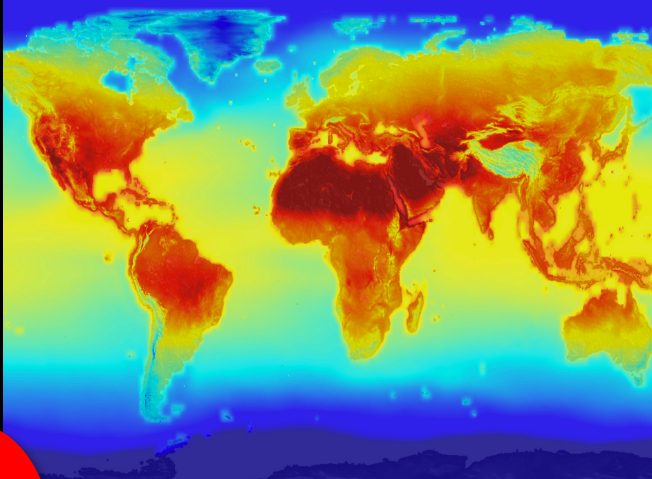
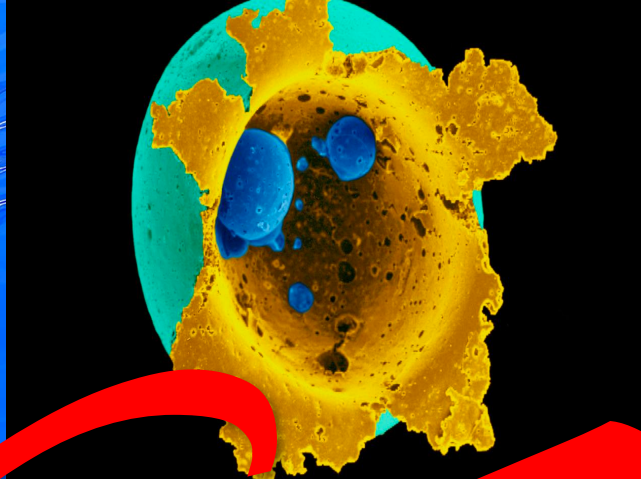










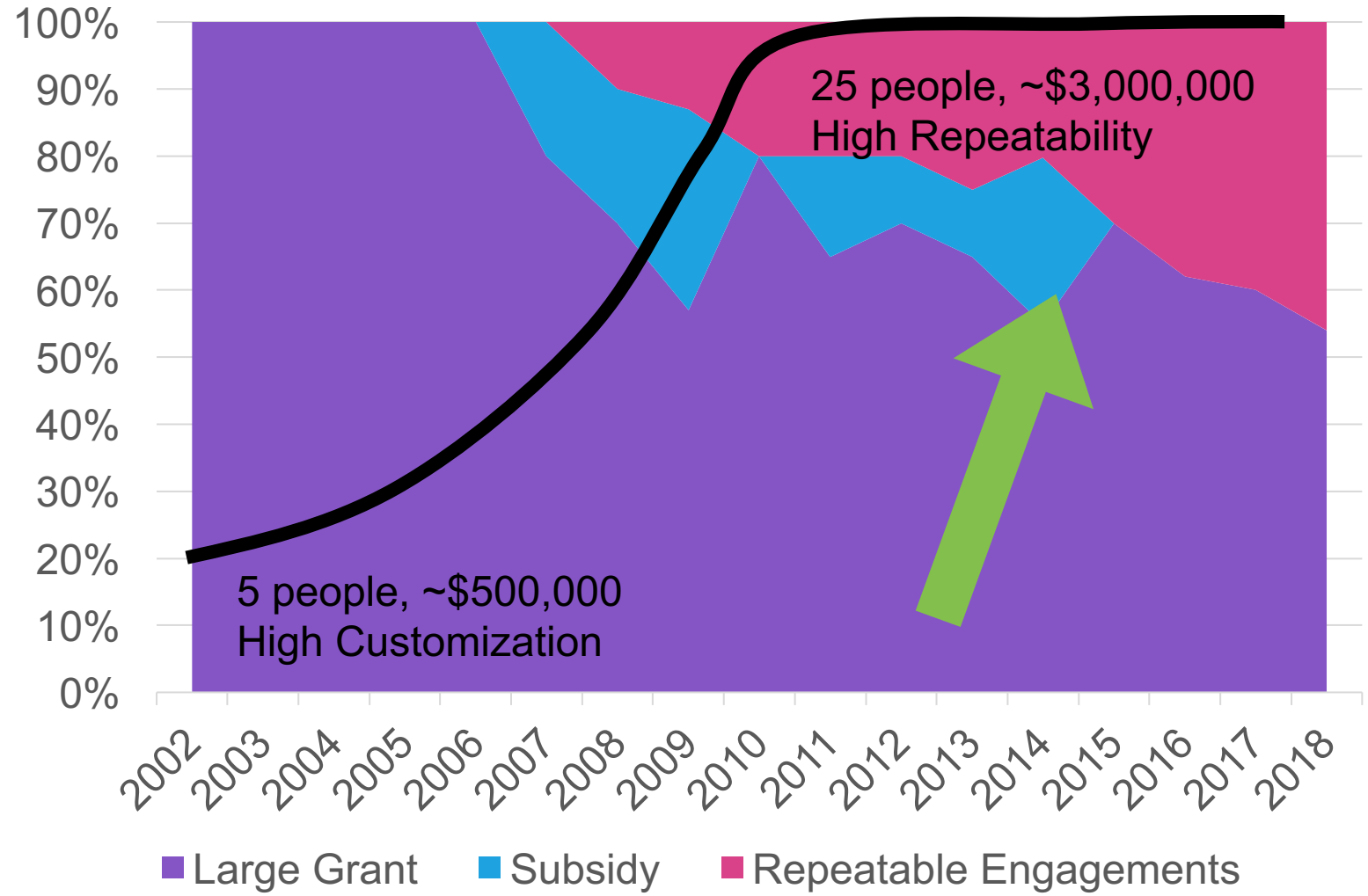


X

6

Evolving Cost Composition

Cost Composition + Team Size



The Math Does Not Work

High Customization

- \$500,000 Funding Requirement
 - 1/8 Proposal Hit Rate
 - \$500,000 Average Proposal Size
- == 8 Proposals Annually



Continue doing highly novel work

High Repeatability

- \$3,000,000 Funding Requirement
 - ?1/8? Proposal Hit Rate
 - \$500,000 Average Proposal Size
- == ~~48 Proposals Annually~~



Continue delivering value from
the work already done

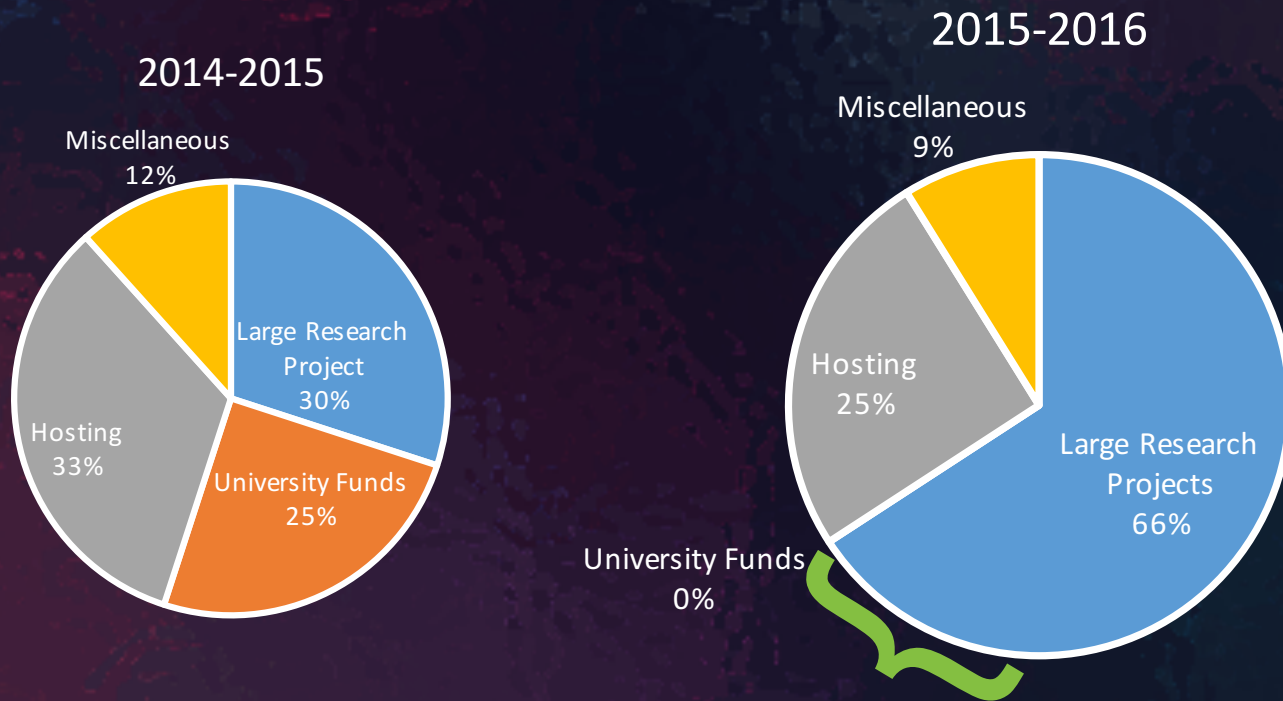
A surreal landscape featuring a starry night sky with a prominent green and blue nebula. In the foreground, a calm body of water reflects a vibrant, multi-colored horizon (yellow, orange, and red). A single tree stands on a small island in the water, with a wooden chair placed next to it. The overall scene is dreamlike and ethereal.

I Have A Dream...

...to never be obligated to write another unrelated research proposal

Evolving Revenue Stream Composition

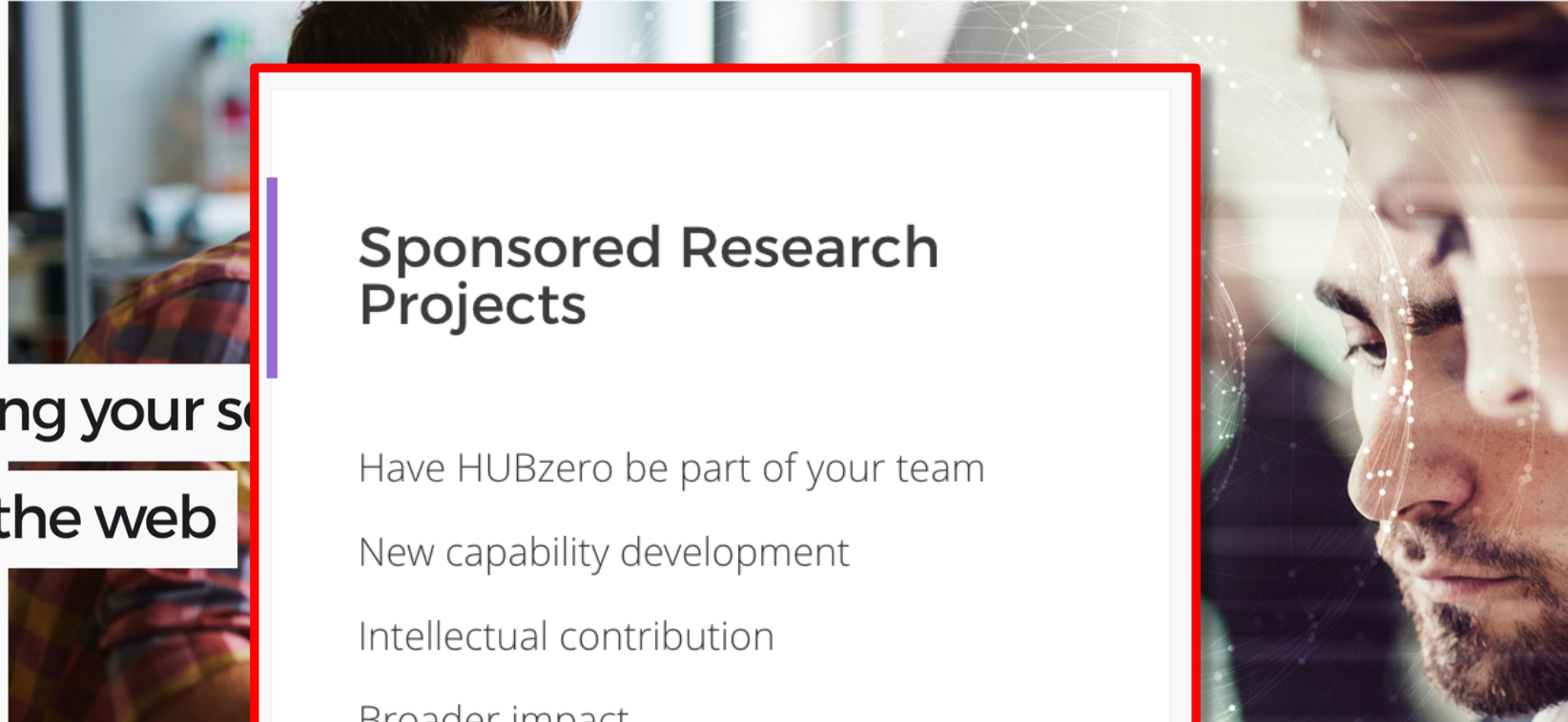
Phase I: Large Project Diversification



R&D based on what
can be borrowed from
these projects.



Business Model Components Customization



Bring your software
to the web

Sponsored Research Projects

- Have HUBzero be part of your team
- New capability development
- Intellectual contribution
- Broader impact

CHECK IT OUT

No Hassle Hub

- Cost effective
- Continuous upgrades
- Continuous security monitoring
- Continuous patching
- Dedicated community manager representative

CHECK IT OUT

Open Source

- No cost
- Modify the code yourselves
- Host on your machine

CHECK IT OUT

CHECK IT OUT

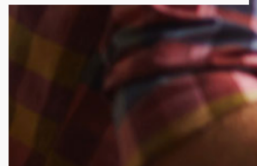
CHECK IT OUT

Business Model Components

Repeatability



Bring your software
to the web



No Hassle Hub

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Open Source

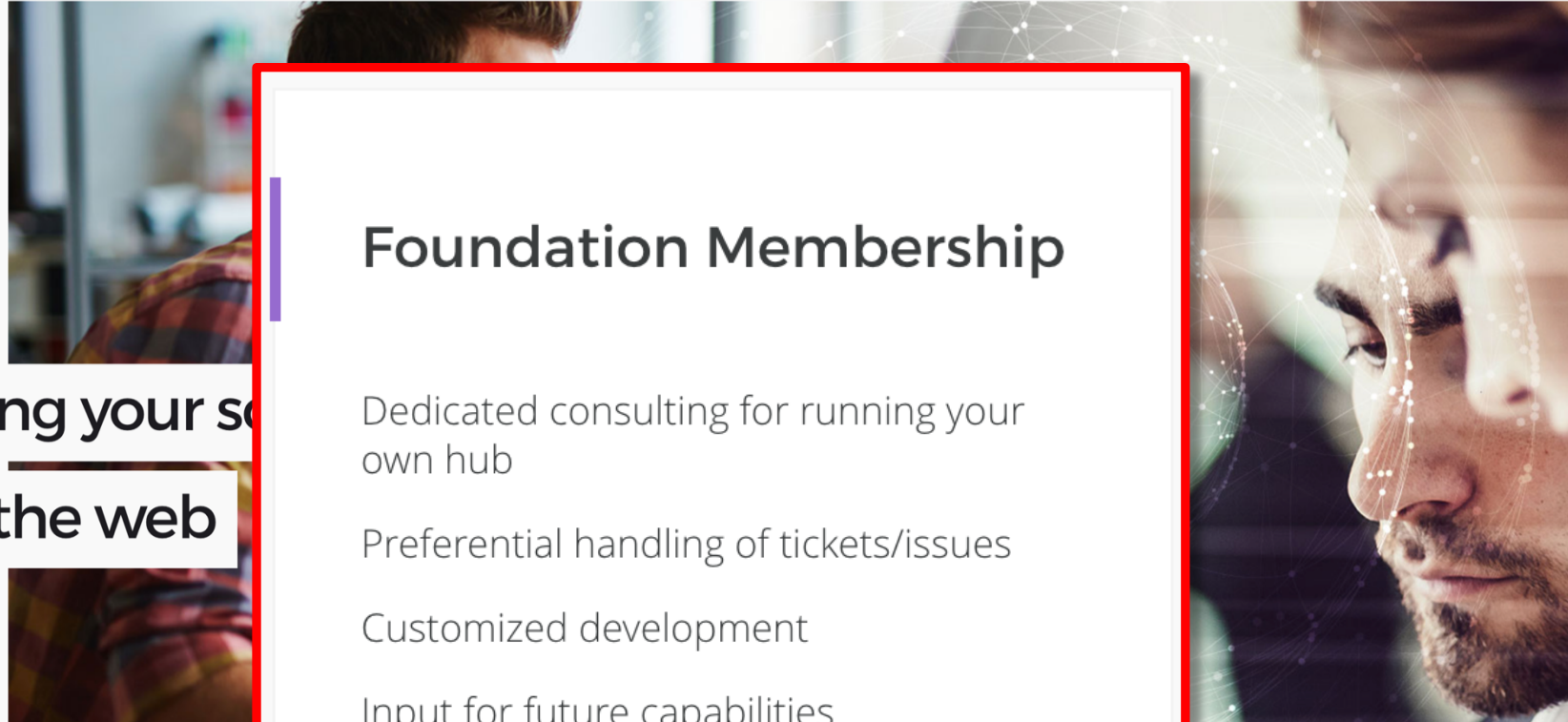
- No cost
- Modify the code yourselves
- Host on your machine

CHECK IT OUT

Less than 1/3 the cost of an FTE

Business Model Components

Repeatability



Bring your software
to the web

Foundation Membership

Dedicated consulting for running your own hub

Preferential handling of tickets/issues

Customized development

Input for future capabilities

CHECK IT OUT

No Hassle Hub

- Cost effective
- Continuous upgrades
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- Dedicated community manager representative

CHECK IT OUT

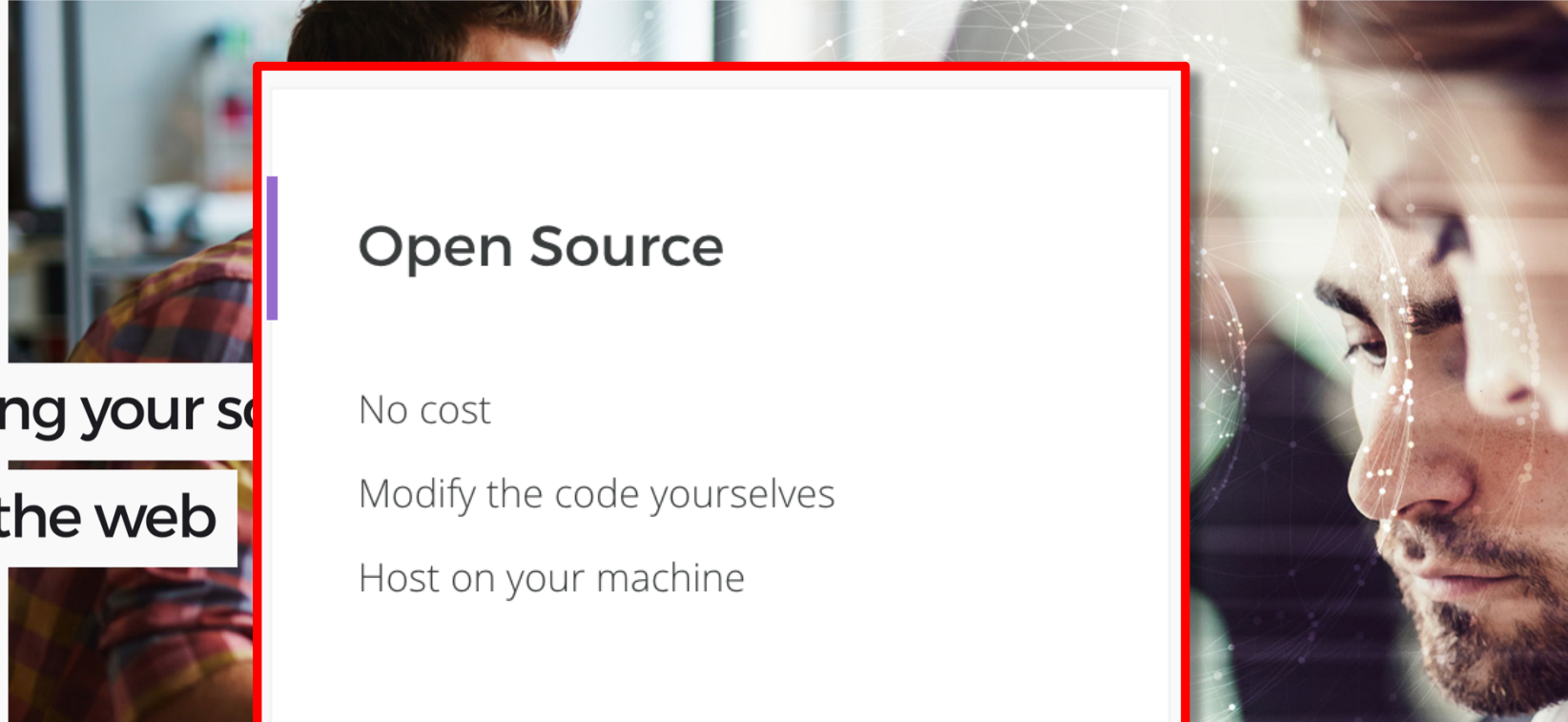
Open Source

- No cost
- Modify the code yourselves
- Host on your machine

CHECK IT OUT

On the spot help when you need it

Business
Model
Components
Repeatability
(sysadmin is
NOT free)



Bring your software
to the web

Open Source

No cost

Modify the code yourselves

Host on your machine

CHECK IT OUT

No Hassle Hub

Cost effective

Continuous upgrades

Continuous security monitoring

Continuous patching

Dedicated community manager representative

CHECK IT OUT

Open Source

No cost

Modify the code yourselves

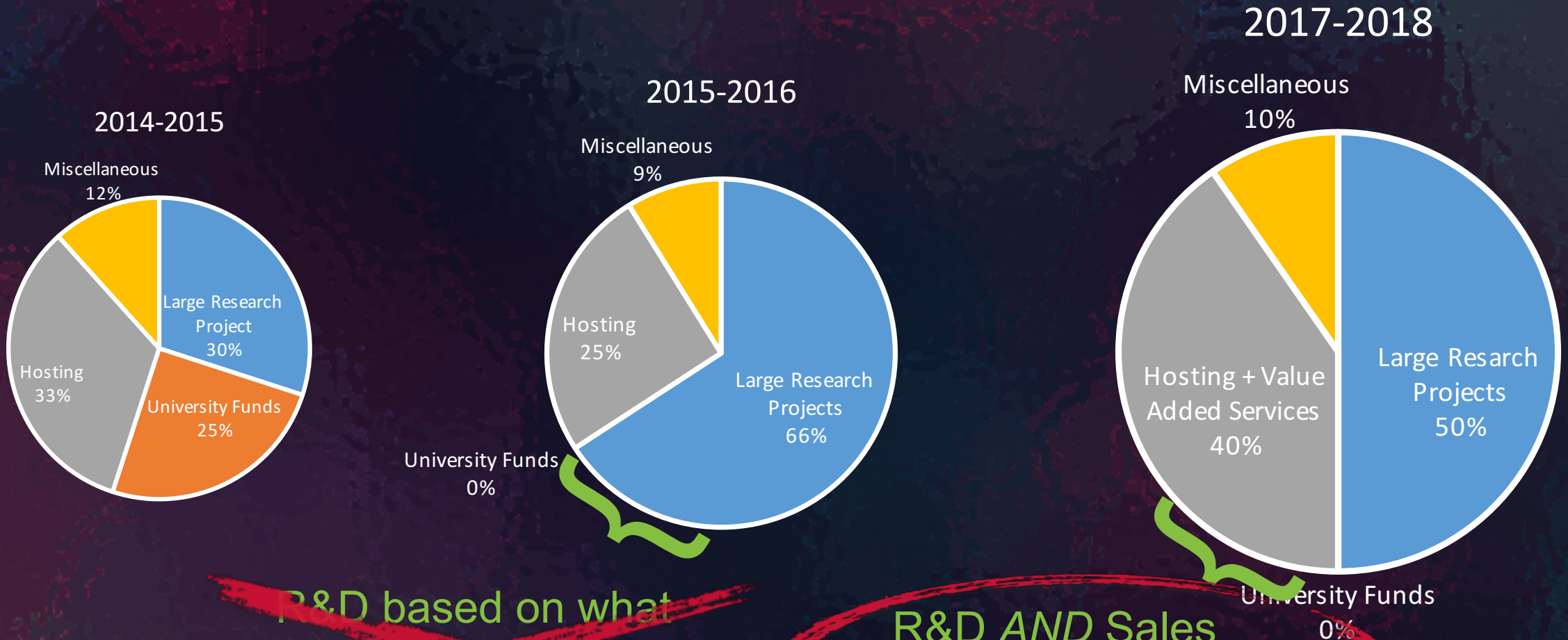
Host on your machine

CHECK IT OUT

Confidence your gateway can persist

Evolving Revenue Stream Composition

Phases II & III: Repeatability & Reinvestment



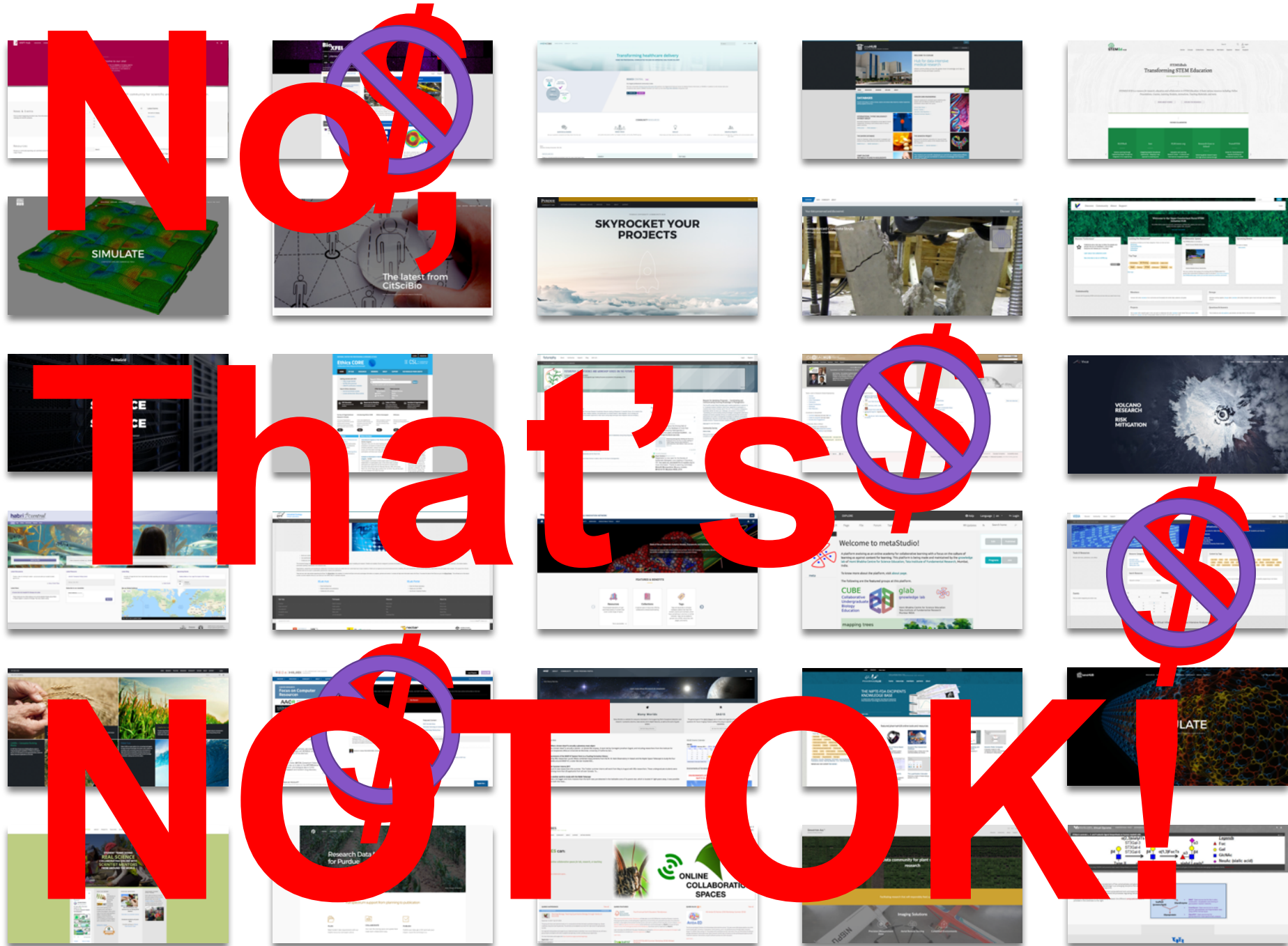
~~R&D based on what can be recovered from these projects.~~

R&D AND Sales based on true cost of operation.

Aligning with other organizations

End of Funding Should Not Mean End of Community

hubzero





This will not
stand, man

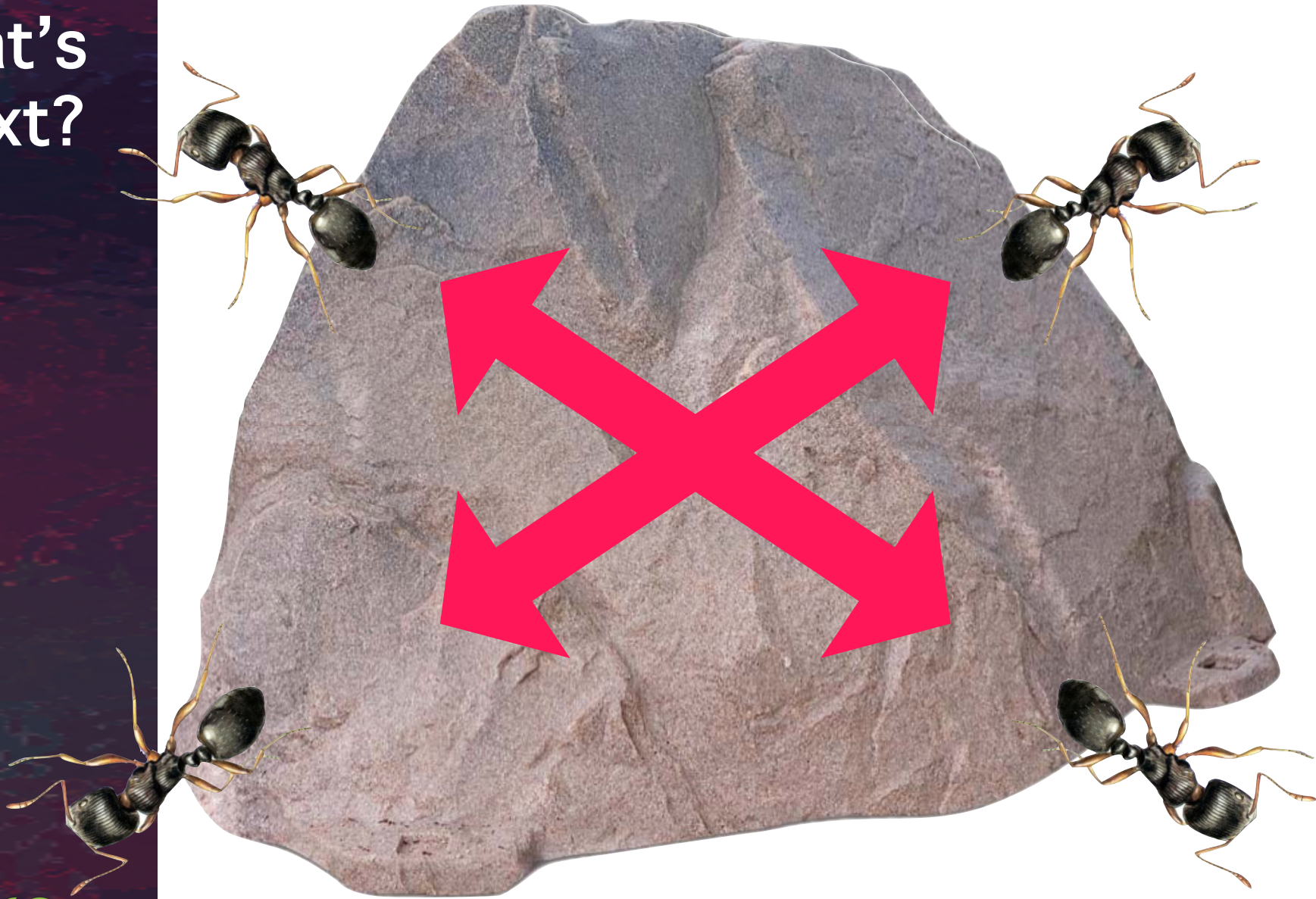
What's
Next?



hubzero

Drawing by Wright

What's
Next?



hubzero

Drawing by Wright

What's
Next?

hubzero

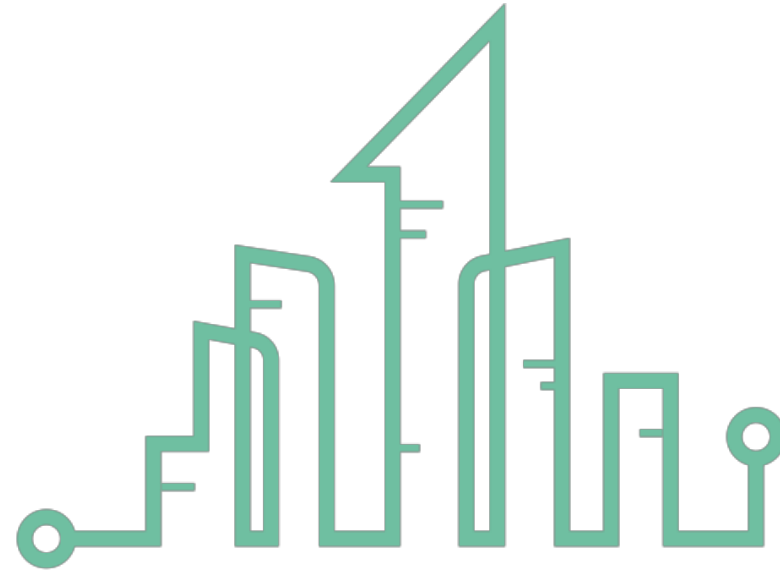




Aligning with
other
organizations

Solving
Sustainability
for our
Clients

hubzero



OneSciencePlace

A new address for sustainability
from the HUBzero Foundation

Aligning with
other
organizations

Solving
Sustainability
for our
Clients

hubzero

Foundation Membership

Dedicated consulting for running your own hub

Preferential handling of tickets/issues



No Hassle Hub

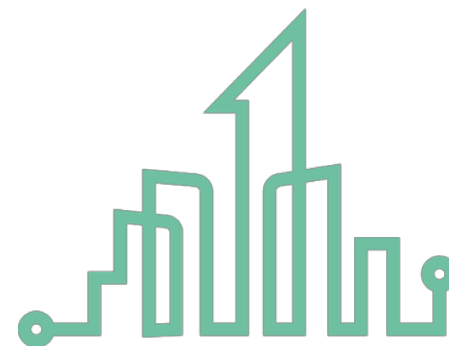
Cost effective

Continuous upgrades

Continuous security monitoring

Continuous patching

Dedicated community manager representative



One Science Place

A community of science gateways living in **one big community, solving sustainability together.**

Grant +7 years minimum for starter hubs.



Connecting people and resources
to accelerate discovery by empowering
the science gateway community



Science Gateways Community Institute

PI Nancy Wilkins-Diehr

San Diego Supercomputer Center

wilkinsn@sdsc.edu

co-PI Michael Zentner

Purdue University

mzentner@purdue.edu

sciencegateways.org

Award Number
ACI-1547611





A field of such platforms



hubzero



THE AGAVE PLATFORM
YOUR SCIENCE-AS-A-SERVICE API PLATFORM

Science Gateways Catalog

Save time – reuse gateway technologies or discover gateways and virtual research environments for research, teaching, and learning

Total Entries: 449



A field of such platforms

human science

```
[disassembly]
=> 0x40063f <main+114>: jle    0x400675 <main+168>
0x400641 <main+116>: mov    rax,QWORD PTR [rbp-0x30]
0x400645 <main+120>: add   rax,0x8
0x400649 <main+124>: mov   rax,QWORD PTR [rax]
0x40064c <main+127>: mov   esi,0x4007bd
0x400651 <main+132>: mov   rdi,rax
0x400654 <main+135>: call  0x4004a0 <strcmp@plt>
0x400659 <main+140>: test  eax,eax
0x40065b <main+142>: jne   0x400675 <main+168>
0x40065d <main+144>: mov   edi,0x4007c2
0x400662 <main+149>: call  0x400480 <puts@plt>
0x400667 <main+154>: add   DWORD PTR [rbp-0x18],0x1
0x40066b <main+158>: add   DWORD PTR [rbp-0x14],0x2
0x40066f <main+162>: add   DWORD PTR [rbp-0x10],0x3
0x400673 <main+166>: jmp   0x400667 <main+154>
0x400675 <main+168>: cmp   DWORD PTR [rbp-0x24],0x1
0x400679 <main+172>: jle   0x4006ad <main+224>
0x40067b <main+174>: mov   rax,QWORD PTR [rbp-0x30]
0x40067f <main+178>: add   rax,0x8
0x400683 <main+182>: mov   rax,QWORD PTR [rax]
0x400686 <main+185>: mov   esi,0x4007d8
```

```
0x00000000004005f9    14      int c=0,d=0,e=0;
(gdb)
16      if (argc > 1 && strcmp(argv[1], "sleep") == 0)
(gdb)
0x0000000000400604    15      if (argc > 1 && strcmp(argv[1], "sleep") == 0)
(gdb)
21      else if (argc > 1 && strcmp(argv[1], "loop") == 0)
(gdb) si
0x000000000040063f    21      else if (argc > 1 && strcmp(argv[1], "loop") == 0)
(gdb) █
```

```
0x7FFFFFFF628: 51 13 7A 38 14 DA B5 7B | 0.z8...{
0x7FFFFFFF620: 51 13 20 2F AD CA B5 7B | 0. /...{
0x7FFFFFFF618: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF610: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF608: A0 E6 FF FF FF 7F 00 00 | .....
0x7FFFFFFF600: D0 04 40 00 00 00 00 00 | ..@....
0x7FFFFFFF5F8: 51 13 80 F4 52 35 4A B4 | Q...R5J.
0x7FFFFFFF5F0: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF5E8: CD 05 40 00 00 00 00 00 | ..@....
0x7FFFFFFF5E0: 00 00 00 00 01 00 00 00 | .....
0x7FFFFFFF5D8: A8 E6 FF FF FF 7F 00 00 | .....
0x7FFFFFFF5D0: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF5C8: C5 6E A3 F7 FF 7F 00 00 | .n.....
0x7FFFFFFF5C0: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF5B8: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF5B0: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF5A8: 00 00 00 00 00 00 00 00 | .....
0x7FFFFFFF5A0: 00 07 40 00 00 00 00 00 | ..@....
0x7FFFFFFF598: 00 00 00 00 01 00 00 00 | .....
0x7FFFFFFF590: A8 E6 FF FF FF 7F 00 00 | .....
[stack]
```

```
[regs:general]
[odItsZaPc]
[Jump(z || s=0)]
RIP 000000000040063f Science Gateways
RAX 00000000004005c0 @
RBX 0000000000000000 Community Institute
RBP 00007FFFFFFF5c0 .....
RSP 00007FFFFFFF590 ..... => 0x7FFFFFFF6A8 => 0x7FFFFFFF8B6 => "/voltron/tests/inferior_lin
RDI 0000000000000001 .....
RSI 00007FFFFFFF6A8 ..... => 0x7FFFFFFF8B6 => "/voltron/tests/inferior_linux"
RDX 00007FFFFFFF6B8 ..... => 0x7FFFFFFF8D4 => "XDG_SESSION_ID=3"
RCX 0000000000000000 .....
R8 00007FFFF7DD4E80 .N..... => `initial in section .bss of /lib/x86_64-linux-gnu/libc.so.6`
R9 00007FFFF7DEA560 `..... => `_dl_fini in section .text of /lib64/ld-linux-x86-64.so.2`
R10 00007FFFFFFE450 P.....
R11 00007FFFF7A36DD0 .m..... => `__libc_start_main in section .text of /lib/x86_64-linux-gnu/lib
R12 00000000004004D0 ..@..... => `_start in section .text of /voltron/tests/inferior_linux`
R13 00007FFFFFFE6A0 ..... => ""
R14 0000000000000000 .....
R15 0000000000000000 .....
CS 0033 DS 0000
ES 0000 FS 0000
```

Science Gateways Catalog

save time — reuse gateway technologies or discover gateways and virtual research environments for research, teaching, and learning

Total Entries: 449

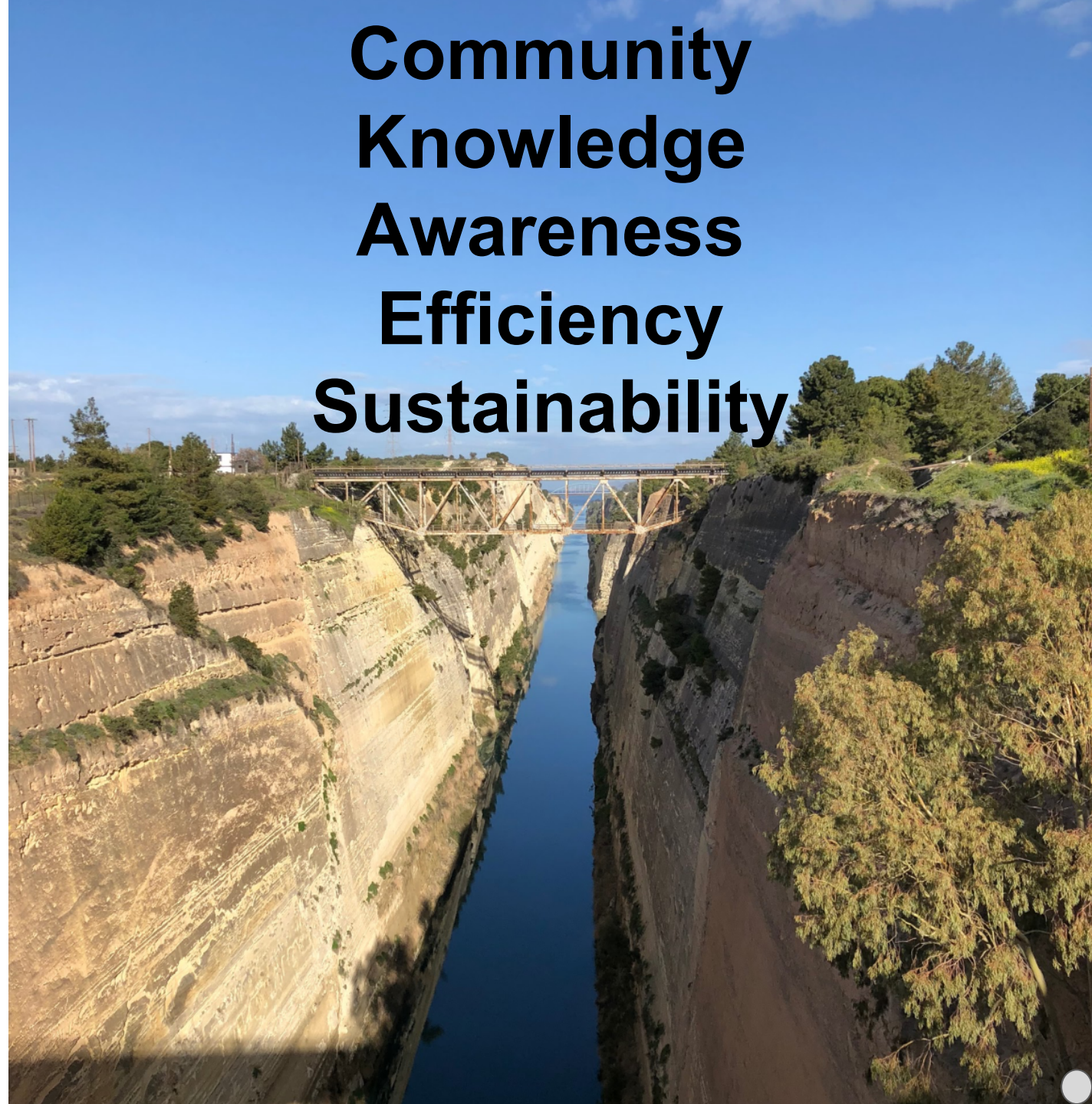
Search



[0x00a8:00007FFFFFFF590]



**NSF formation of
a \$15M institute...
to institutionalize
best practices**



**Community
Knowledge
Awareness
Efficiency
Sustainability**

Not
really...

...there is a
unifying
framework

But how
does a
project fill
it in?

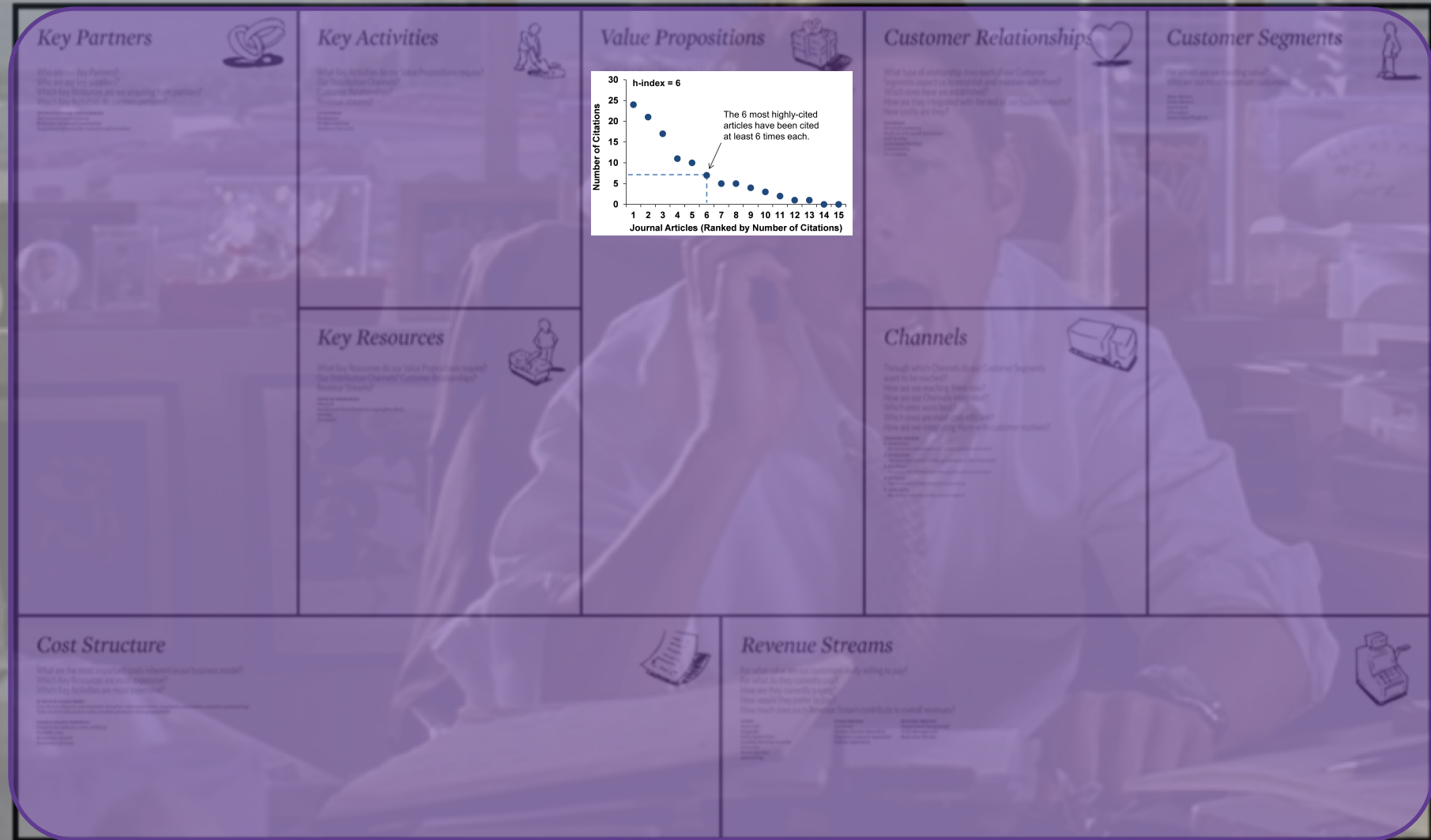
hubzero

The Business Model Canvas

Designed for:

Designed by:

On:
How/Out



But how
does a
project fill
it in?

- **Solicit business investment**
- Gradually build it from grant to grant
- **Align with another organization already doing it**

A surreal landscape featuring a tree and a chair on a horizon line. The scene is set against a vibrant, multi-colored sky with a prominent galaxy and a planet in the upper left. The lower half of the image shows a reflection of the sky and the tree/chair in a body of water, creating a dreamlike atmosphere.

Not yet...but maybe possible