Co-production in local public service delivery: a game analysis

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Abstract

Co-production consists in the involvement of citizens in projects for local public service delivery. Although this policy instrument is gaining momentum in a number of countries, its reach and design are still poorly understood, particularly as regards the incentive schemes to be used to boost citizens' effort. We study this issue considering a simple game in which the local government, acting on behalf of the entire community, decides what share of benefits from the project will accrue to co-producing citizens. Our results suggest that co-production is unlikely to fully elicit potential benefits from projects, and that actual net benefits will be allocated unevenly between involved and uninvolved citizens.

Keywords: co-production; incentives; local public services; administrative barter.

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1. Introduction

Co-production is to the forefront of the debate on local public policy reforms in a number of countries.[1] Although a univocal definition is missing, broadly speaking, co-production consists in citizens being involved in the design, management and/or delivery of public services, in addition to consuming or otherwise benefiting from them (see Howlett et al., 2017, who refer to Alford, 1998). These are services which neither the government nor citizens have sufficient overview to make socially valuable and/or effective, if acting alone. To illustrate, in the UK, under the Taff Housing scheme, tenants of disadvantaged housing estates in Cardiff help the housing association develop, improve and deliver its services (OECD, 2011). In Italy, under Law n.164/2014 introducing the *administrative barter*, associations of citizens contribute to the maintenance, improvement and embellishment of their territory. In Finland, the CADDIES project implemented in three neighbourhoods of Helsinki rests on the involvement of civil society organisations in education and urban planning. In Croatia co-production mostly deals with elderly and disability care. Further examples are the Local Area Coordination scheme in Australia, and the Nurse-Family Partnership scheme in the US (NESTA, 2011). These services are nearly all characterized by a certain degree of excludability, and generally funded according to the Benefit-Received Principle rather than to the Ability-to-Pay Principle. That is, they are not funded through the general taxation.

With user involvement in service delivery being as high as 56% in the UK, 53% in Germany, 52% in Czech Republic, 51% France and 48% in Denmark (Loeffler, 2010), co-production is already a widespread practice. Yet, it seems to be still poorly understood by local authority professionals. This is also because most of the existing studies on co-production belong to the field of public administration and management (Osborne et al. (2016), among others), whereas

[1] In the EU, it was introduced on the agenda of Ministries of Public Administration at the 2006 European Quality Conference for Public Agencies, and selected as the core theme of the 2008 European Quality Conference.

economists have been nearly silent on the subject so far.

One critical issue with co-production rests with the compensation to the involved citizens. Co-production is not volunteering, and civil society participation is not - and should not be - for free.[2] Under the Taff Housing co-production scheme, tenants' work is valued through the concession of credits for the use of local arts and leisure facilities. Italian citizens participating in the administrative barter receive reductions in service fees. However, the determination of a suitable compensation to citizens is proving problematic in several contexts. Whereas some local governments have already turned down co-production as the unpaid fees are deemed excessive to renounce, others are prone to adopt regulations to avoid professional status and rewards being undermined by a move to (low-paid) user- and citizen-centric services. There is thus a need to clarify, first, how much of the potential benefits from projects co-production permits to retain; second, how much of the actual benefits (and costs) should be shifted from the community as a whole to the co-producing citizens to make projects more valuable.

Our paper attempts to shed light on these issues from an economic perspective. In a simple co-production game, we study how a local government can incentivize citizens to exert effort in a project for local service delivery by offering them a properly chosen share of the resulting benefits, given the associated cost profile.

The remainder of the paper is organized as follows. In section 2 we describe the model. In section 3 we characterize the equilibrium of the game. Section 4 discusses results and concludes.

[2]Among others, Loeffler (2010) insists on the fact that co-production goes beyond the concept of volunteering, and refers to Loeffler and Watt (2009) to stress the importance of local governments better measuring the contributions made by users and community members.

2. The model

We consider a local government (G) who develops a project for the delivery of a public service in co-production with a partner (P). G acts on behalf of the entire community. P is a group of citizens within the community. The concerned service can be one, such as health care, for which the government aims at achieving a strong - though, possibly, little efficient - user and citizen engagement. Alternatively, it can be a service, such as monitoring the quality of a lake water, a park, or urban streets, the delivery of which is potentially more efficient with the involvement of the local community (see Cepiku, 2015, who draws on OECD, 2011).

The participation of G and P are complementary. The project would not be realized without any of the two parties, and has a higher social value the more effort either party exerts. Denoting e_G and e_P the respective efforts of G and P, the benefits from the project are given by

$$B\left(e_G, e_P\right) = \alpha\, e_G^{1/2}\, e_P^{1/2} + \varepsilon. \tag{1}$$

The parameter $\alpha > 0$ captures the intensity of complementarity between efforts, given the technology used to run the project. The parameter ε represents an external factor of uncertainty; it is a random variable following a Gaussian distribution with average value of 0 and variance of σ^2. Exerting effort occasions a cost of

$$C_G = \frac{\delta}{2}\, e_G^2 \tag{2}$$

$$C_P = \frac{1}{2}\, e_P^2 \tag{3}$$

respectively to G and P. The parameter $\delta > 0$ introduces an asymmetry between costs for equal levels of effort. Depending on whether δ is below or above 1, G is more or less efficient than P. The health-care example previously provided represents a case where $\delta < 1$, the monitoring example a case where $\delta > 1$.

P does not volunteer in the activity, and receives a compensation for participation. This can be a fee credit/exemption, as in the Italian administrative barter. Alternatively, it can consist in services being made more extensively accessible to co-producing citizens. Of course, the compensation to P reduces the amount of benefits available for the community as a whole. Formally, a share $\beta \in (0,1)$ of the total expected benefits remains with G, thus accruing to the community. The expected return to G, net of her[3] costs, is given by

$$\begin{aligned} R_G &= \beta\, \mathbb{E}_{\not\in} \left[B\left(e_G, e_P\right) \right] - C_G \\ &= \beta\, \alpha\, e_G^{1/2}\, e_P^{1/2} - \frac{\delta}{2}\, e_G^2. \end{aligned} \tag{4}$$

The compensation to P is the residual share $(1-\beta)$ of the total expected benefits. Of course, P also derives benefits from the project like any non-involved citizen. However, such benefits are a part of those G takes care of, and P can only focus on his direct expected reward, namely his the compensation net of costs:

$$\begin{aligned} R_P &= (1-\beta)\, \mathbb{E}_{\not\in} \left[B\left(e_G, e_P\right) \right] - C_P \\ &= (1-\beta)\, \alpha\, e_G^{1/2}\, e_P^{1/2} - \frac{1}{2} e_P^2. \end{aligned} \tag{5}$$

The choice of β is made by G before the project begins, anticipating what levels of effort will be exerted thereof.

Overall, the game unfolds as follows. In the first stage, G chooses a sharing rule of the project benefits and proposes it to P. If P rejects, then the game is over. If P accepts, then the parties undertake the project. In the second stage, G and P simultaneously choose their levels of effort and obtain their returns, given the established sharing rule.

[3]Whenever necessary, to avoid confusion, we refer to G with the *feminine* pronoun and to P with the *masculine* pronoun.

3. The equilibrium of the game

We solve the game by backward induction. We first characterize the levels of effort chosen by the two parties in the second stage. We next pin down the level of β set by G in the first stage. This is the main focus of our analysis. Actually, the sharing rule is what determines how much the two parties will want to contribute to the project and, hence, how beneficial it will be for the community.

In the second stage, P chooses the level of e_P which maximizes R_P, taking β and e_G as given. His reaction function is written as

$$e_P\left(e_G;\beta\right)=\frac{1}{4^{1/3}}\left(\alpha\left(1-\beta\right)e_G^{1/2}\right)^{2/3}. \tag{6}$$

First, and not surprisingly, e_P increases with e_G; this effect is more pronounced the more intense the complementarity between efforts (the higher α) is. Second, e_P is greater the more of the total benefits P will appropriate (the higher $(1-\beta)$ is). In turn, G chooses the level of e_G which maximizes R_G, taking β and e_P as given. Her reaction function is written as

$$e_G\left(e_P;\beta\right)=\frac{1}{4^{1/3}}\left(\frac{\alpha\,\beta e_P^{1/2}}{\delta}\right)^{2/3}. \tag{7}$$

As expected, e_G increases with the complementary effort (e_P), the technology parameter (α), and the benefit share (β). Besides, δ has a *negative* impact on e_G. The less efficient G is, the less effort she will be ready to exert in response to the effort of P.

Combining (6) and (7), and letting

$$\Gamma\left(\beta\right)\equiv\frac{\alpha}{2}\,\frac{\beta^{1/4}}{\delta^{1/4}}(1-\beta)^{1/4},$$

the levels of effort chosen by the parties, given β, are found to be

$$e_P^*(\beta) = (1-\beta)^{1/2}\,\Gamma(\beta) \tag{8}$$

$$e_G^*(\beta) = \frac{\beta^{1/2}}{\delta^{1/2}}\,\Gamma(\beta). \tag{9}$$

The two efforts include the common term $\Gamma(\beta)$ and a different scaling term, which is given by the (square root of the) respective benefit share, namely $(1-\beta)^{1/2}$ and $\beta^{1/2}$. In addition, the effort of G is inversely related to the (square root of the) efficiency parameter δ. One can tell that there is an "overall amount of effort" equal to $\Gamma(\beta)$, which is allocated between the two parties according to the sharing rule β. The effort quota of G is further inflated or deflated, depending on whether G enjoys an efficiency advantage ($\delta < 1$) or disadvantage ($\delta > 1$) relative to P.

In the first stage of the game, G sets β to maximize R_G, anticipating that the levels of effort will be those in (8) and (9). Replacing (8) and (9) in (4), the objective function of G is found to be

$$R_G\left(e_P^*(\beta), e_G^*(\beta)\right) = \frac{3}{2}\beta\,\Gamma^2(\beta), \tag{10}$$

and G sets

$$\beta^* = \frac{3}{4}. \tag{11}$$

First, although G appropriates most of the project benefits, it is *optimal* for G to let P enjoy some of those benefits. Thereby, P will be motivated to work hardly. Second, the optimal sharing rule depends neither on the technological characteristics of the project (α) nor on the asymmetry of the costs between the parties (δ). Indeed, once those factors are fully internalized in the choice of efforts, the decision on the sharing rule is no longer affected.

Using (11) to obtain

$$\Gamma^* = \frac{\alpha}{4}\left(\frac{3}{\delta}\right)^{1/4},$$

and replacing in (8) and (9), the equilibrium levels of effort are given by

$$e_P^* = \frac{1}{2}\Gamma^* = \frac{\alpha}{8}\left(\frac{3}{\delta}\right)^{1/4} \tag{12}$$

$$e_G^* = \frac{3^{1/2}}{\delta^{1/2}}\frac{1}{2}\Gamma^* = \frac{\alpha}{8}\left(\frac{3}{\delta}\right)^{3/4}. \tag{13}$$

It is apparent that the (in)efficiency of G affects the incentives of *both* P and G to contribute to the project. The less efficient G (the higher δ) is, the less benefit net of costs she can retain from the project and, hence, the less motivated G will be to work hardly. Moreover, the less effort G exerts, the less benefit the project generates for everybody and, hence, the less motivated P will be to work hardly, in turn.

Besides, since $(\partial e_G^*/\partial\alpha) < (\partial e_P^*/\partial\alpha)$ for $\delta > 3$, we deduce that, whereas the equilibrium levels of effort are both positively related to α, the effort choice of G is less sensitive to the level of technology as long as G is significantly less efficient than P. Actually, in that case, there is more value to co-producing with P, in that this permits to take better advantage of the technology in place. The value of δ determines the exact relationship between G's and P's effort, namely

$$\frac{e_G^*}{e_P^*} = \frac{3^{1/2}}{\delta}. \tag{14}$$

The less efficient G is relative to P, the more effort is shifted from G to P to make the project more valuable.

By contrast, the value of δ has no bite in the relationship between the equilibrium returns of the parties, which is constant. To see this, replace (12) and (13) in (4) and (5) to find

$$R_P^* = \frac{3}{8}(\Gamma^*)^2 = \frac{3}{128}\frac{3^{1/2}\alpha^2}{\delta^{1/2}} \tag{15}$$

$$R_G^* = 3\frac{3}{8}(\Gamma^*)^2 = \frac{9}{128}\frac{3^{1/2}\alpha^2}{\delta^{1/2}}, \tag{16}$$

hence $R_G^* = 3R_P^*$.

4. Discussion and conclusion

The levels of effort (12) and (13) are not those which maximize the total net benefits from the project, namely

$$NB\left(e_G, e_P\right) = B\left(e_G, e_P\right) - C_G - C_P. \tag{17}$$

Indeed, those levels of effort are given by

$$e_P^o = \frac{2}{3^{1/4}}\Gamma^* = \frac{\alpha}{2\delta^{1/4}} \tag{18}$$

$$e_G^o = \frac{1}{\delta^{1/2}}\frac{2}{3^{1/4}}\Gamma^* = \frac{\alpha}{2\delta^{3/4}}, \tag{19}$$

and are such that $e_P^* < e_P^o$ and $e_G^* < e_G^o$. The resulting total net benefits, which are found by replacing (18) and (19) in (17), amount to

$$NB^o = \frac{4}{3^{1/2}}(\Gamma^*)^2 = \frac{\alpha^2}{4\delta^{1/2}}, \tag{20}$$

and one can verify that $R_P^* + R_G^* < NB^o$.

In principle, there are two situations in which the outcome in (18) to (20) would be attained. The first is a situation in which all citizens share private and public costs and benefits, and are all prone to engage in co-production. However, since the case of perfect benefit sharing is that of pure public goods, which are generally funded according to the Ability-to-Pay Principle, the free-riding problem would emerge, and the involvement of the entire community in co-production would actually be infeasible. The second is a situation in which the local government concedes all project benefits to the involved citizens ($\beta = 0$) and funds her own effort e_G^o through the general budget. However, this is at odds with the Benefit-Received Principle, which applies to the local services more frequently co-produced.

In definitive, when incentivized by means of a scheme linked to the project, co-production is unlikely to elicit all potential benefits from projects. Furthermore, our results (β^*, R_P^*, and R_G^*) suggest that, in such a situation, a local

government will induce an uneven allocation of the associated net benefits between the involved citizens and the entire community.

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