Outsourcing of R&D versus operational outsourcing and its effects on flexibility and time to market

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Abstract

In this work strategic and operational outsourcing is analysed in terms of three theoretical lens, dominantly used for explaining outsourcing phenomena and its impact on volume flexibility and time to market. Theoretical lenses are Resource based view, Transaction cost theory and Contingency theory. It is hypothesized that strategic outsourcing is performed due to lack of skills in accordance with Resource based view. That is, if the company does not possess necessary knowledge it is better to outsource. Indeed our results confirm this hypothesis. Operational outsourcing (outsourcing of manufacturing and assembly) would according to Transaction cost theory be performed if it is less costly to outsource and indeed our OLS regression analysis shows positive signs. That is, operational outsourcing raises Return on sales but the coefficients are not significant. Non significance of operational outsourcing is attributed to the fact that overall capacity utilisation in the two researched countries (Croatia and Slovenia) is still low. Contingency theory lens was introduced through control variables (batch size, complexity of the product, capacity utilisation and size of the company in terms of number of employees) and if those situational factors would become significant in the analysis the contingency view would be more appropriate. However, the analysis did not show that these contingency factors affected outsourcing.

Keywords: Outsourcing, R&D, Manufacturing

Topic(s): 15. Managing Inter-firm Relationships in Supply Chains, 25. Operations Strategy

Introduction

Today's companies face extreme pressures from global competition and in order to survive one of the most important aspects of being global is to be flexible. Manufacturing flexibility is an important source of competitive advantage because of ever changing customer needs (Boyer and Lewis, 2002; Rosenzweig and Roth, 2004; Ward et al., 2007; Hallgren et al., 2011). According to Scherrer-Rathje et al. (2014), flexibility is achieved through advanced technology and outsourcing. Scherrer-Rathje et al. (2014) on base of literature categorization define flexibility as operating flexibilities in terms of product mix flexibility and volume flexibility. However they also mention

strategic flexibilities that rely on R&D and design flexibility. Flexibility through outsourcing has gained momentum almost exclusively because of advances in information systems and information technology. However, Scherrer-Rathje et al. (2014) based their work only on operating flexibilities. In this work we are trying to give a complete picture, which is looking at operational and strategic flexibilities achieved through outsourcing.

Research shows that outsourcing produces mixed results (Verwaal, 2017). Ettlie and Sethuraman (2002) and Kremic et al. (2006) show negative effects of outsourcing while Lau and Zhang (2006), Kamien and Li (1990), Bresnen and Fowler (1994), Embleton and Wright (1998), and Beaumont and Sohal (2004) show positive relation of outsourcing on flexibility. Looking at this list there is a clear gap in recent research on outsourcing effects as well as a concise evaluation of these effects, either positive or negative.

Additional reason for this investigation is the Größler et al. (2013) paper that argues that there is not enough survey based empirical investigation on outsourcing, and that dominant work is conducted in developed countries through case study research. They mention the work of Kakabadse and Kakabadse (2002), where the authors show that US is more open to outsourcing while Europe is less open and more focused on gaining economies of scope, while Japan is totally conservative in terms of outsourcing. Größler et al. (2013) proposes that emerging markets dominantly outsource due to skill shortage, while developed countries to cut costs. Both, emerging and developed countries outsource locally to increase production capacity.

Outsourcing is defined as contracting with an outside partner in contracted activities. It originated by Porter's (Porter, 1998) advice to outsource all non-core activities, but recently outsourcing has increased momentum even in core activities (Sinnett, 2006). Not only non-core activities are outsourced but also research and development, engineering, marketing, quality control, human resource management, logistics, maintenance of equipment and IT. According to Hätonen and Eriksson (2009) the dominant reasons for outsourcing are cost reduction, competence seeking or increasing flexibility.

Dominant lenses for exploring outsourcing in literature are Transaction cost economics and Resource Based View. Those theoretical lenses are very efficient in explaining most of the phenomenon but not all. While transaction cost economics suggests that it is better to outsource if it is cheaper than having the job done in-house, the reality shows that that is not always the case. Same is with Resource based view, if a company possesses valuable, rare, non-imitable resources, the company should keep the resources in house and therefore not outsource. However, Hitt (2011) finds relationships in which both normative advices do not stand. We investigate is the Contingency theory lens more appropriate to explain the phenomenon of outsourcing on flexibility. According to contingency theory two companies with identical investments or characteristics might obtain quite different results dependent on the contingencies in which they operate. Sousa and Voss (2008) define contingencies as resources or situational factors that cannot be changed in short time. Usually those are type of production process, number of employees, type of product produced in terms of its complexity. Also situational factors usually found in the literature is environment in which firm operates, usually defined in terms of development of the country.

Manufacturing and assembly flexibility

Manufacturing and assembly flexibility in essence relates to volume flexibilities, that is, increase production volumes in terms of increased demand or cancelation of outsourcing contracts in times of low demand. Outsourcing has a positive effect in those times of increased demand because the company does not need to invest into additional capacities. However, in times of low demand when the company is not able to use all of its existing capacity it will not engage in outsourcing. Therefore we propose that outsourcing of manufacturing and assembly and this volume flexibility highly depends on economic conditions as a contingency.

However, if we suppose that economic conditions are favourable, and capacity utilisation is high, logically a company would outsource gaining flexibility in delivery and meeting delivery targets. Therefore, we propose that manufacturing and assembly outsourcing will rise measured with on time delivery if environmental contingencies are favourable and capacity utilisation is high. In other words, if capacity utilisation is high, instead of long term investments into new capacities, companies will prefer to outsource manufacturing and assembly. That would be in line with Transaction cost theory that outsourcing will be performed if it is cheaper than obtaining own new capacities. However, since Slovenia and Croatia just exited a long-term recession, capacity utilisation is still low and it is not expected that there will be a raise in outsourcing of manufacturing and assembly in these two countries.

R&D and design/engineering flexibility

Strategic flexibility is routed in flexibility of R&D and design/engineering flexibility. It means fast recombination of existing knowledge into new or modified products that meet some customers need. Since today it is expensive to do the entire R&D and design in house, there is a raise in outsourcing of R&D and design/engineering. At one side, keeping the R&D in house is less risky but more expensive and may need longer times to give the final result – innovation. On the other hand outsourcing of R&D might speed up the process and bringing new products in a more timely matter to the market. Based on this analysis there are both pros and cons for outsourcing of these strategic activities.

Slovenia and Croatia are small countries that cannot survive selling only on local market. Therefore, they have to export, and that means that they have to be globally competitive. One of issues of being globally competitive is to be able to innovate. Apart from that, Slovenia's and Croatian companies are not large companies that could invest into its own R&D so it is hypothesized that there will be more outsourcing in these two countries. However, to measure strategic flexibility we used time to market or average period to launch a new product in months. So, we hypothesize, the more important is the speed of introduction of new products, the more will the companies outsource R&D and Engineering.

Strategic outsourcing will speed up time of introduction of new products on the market, that is, strategic outsourcing will decrease time needed for development of new products. Strategic outsourcing will negatively impact return on sales because the outsourcing partner has to be paid for the contract, therefore a negative relationship is hypothesized. On the other hand, operational outsourcing would increase delivery on time, because the company does not wait to build its own capacity, rather outsources production in order to deliver on time.

Control variables represent contingencies. If contingencies have a significant impact on outsourcing, than control variables would be significant predictor of outsourcing.

Summation of our hypotheses is given in Figure 1.

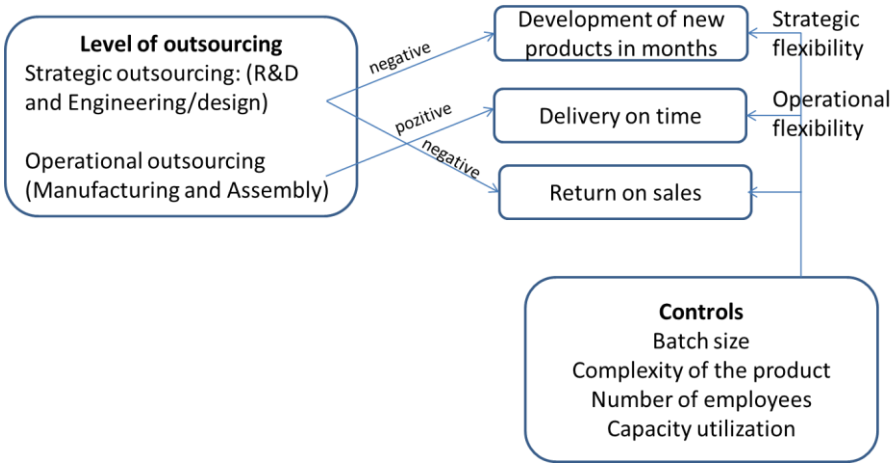

Figure 1. Proposed model

Design/methodology/approach

The research data was collected using the European Manufacturing Survey (EMS), coordinated by the Fraunhofer Institute for Systems and Innovation Research – ISI, the largest European survey of manufacturing activities (ISI, 2015). The survey's questions deal with manufacturing strategies, application of innovative organizational and technological concepts in production, cooperation issues, production off-shoring, servitisation, and questions of personnel deployment and qualification. In addition, data on performance indicators such as productivity, flexibility, quality and returns is collected. The survey is conducted among manufacturing companies (NACE Revision 2 codes from 10 to 32) having at least 20 employees. The main objectives of the EMS project are to find out more about the use of production and information technologies, new organizational approaches in manufacturing and the implementation of best management practices (Palcic et al. 2015). Our sample was collected in 2015, and all together consists of 196 companies, 106 companies from Croatia and 90 companies from Slovenia.

The questionnaire has a question that measures level of outsourcing (low, medium, high) in four different areas: R&D, Engineering, Manufacturing and Assembly outsourcing. With OLS regression we first entered the control variables (batch size, complexity of the product, capacity utilisation and number of employees). In the next phase we entered independent variables (level of R&D outsourcing, level of Engineering/Design, Manufacturing and Assembly outsourcing). The three dependent variable (forming 3 models) are: length of development of new products in months, percentage of delivery on time and return on sales.

Results

Descriptive results show that more outsourcing is happening in R&D outsourcing, and Engineering/Design outsourcing, while assembly and manufacturing is more done internally in house. This can be seen on Figure 2.

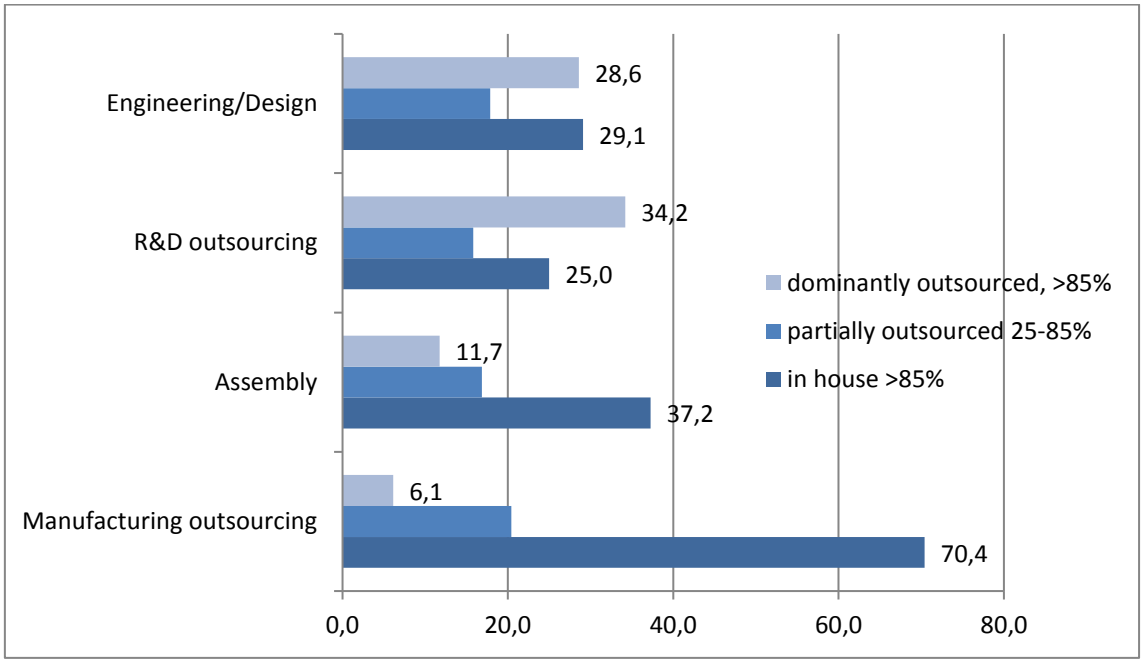

Figure 2. Percentage of companies outsourcing (N=196)

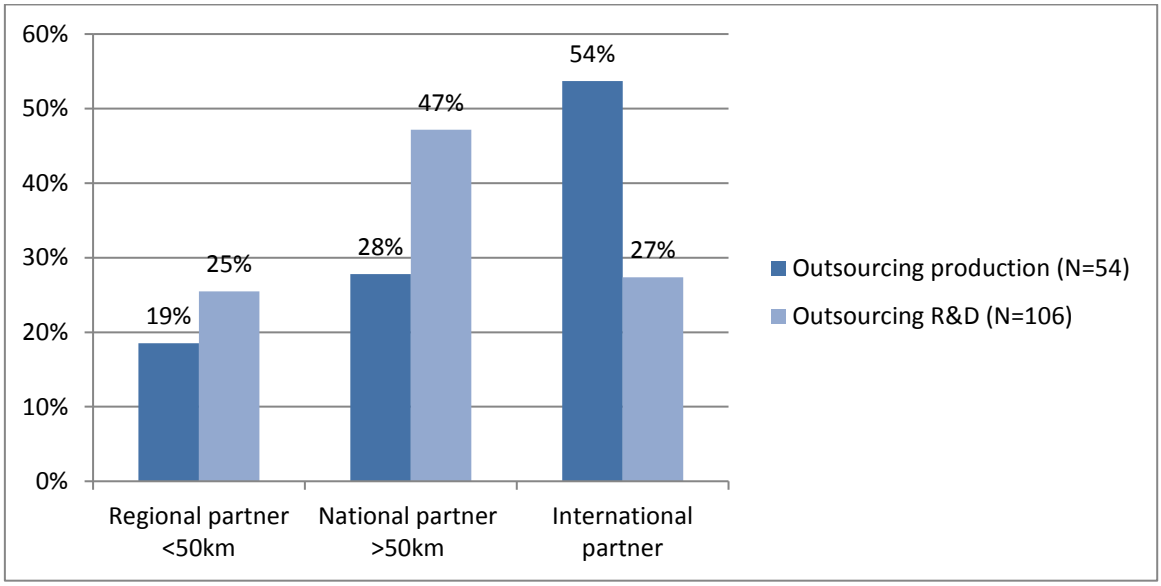

Figure 3. Percentage of companies to whom and with whom they outsource

Because of Größler et al. (2013) conclusion that emerging markets dominantly outsource due to skill shortage, while developed countries to cut costs and both, emerging and developed countries, outsource locally to increase production capacity, we wanted to see with whom the companies cooperate in production and R&D. Only a small percentage of companies (28%) have manufacturing cooperation, but interestingly

it is more with international partners (54%) than national (28%) and regional (19%). It either means that this outsourcing is not because of capacity constraints, otherwise according to Größler et al. (2013) they would outsource locally. R&D outsourcing cooperation is dominantly national (47%), followed by international (27%) and regional (25%).

The questionnaire has a question that measures level of outsourcing (low, medium, high) in four different areas: R&D, Engineering, Manufacturing and Assembly outsourcing. Since we wanted to explore will the contingencies play an important role OLS regression was performed. We first entered the control variables batch size, complexity of the product, capacity utilisation and number of employees). In the next phase we entered independent variables (level of R&D outsourcing, level of Engineering/Design, Manufacturing and Assembly outsourcing). The three dependent variable (forming 3 models) are: length of development of new products in months, percentage of delivery on time and return on sales.

Strategic outsourcing is defined as outsourcing of R&D and outsourcing of Engineering/Design. These two types of outsourcing will shorten length of new product development, as can be seen in Table 1.

Table 1: Regression results for test of hypotheses

Variable	**Model 1 Months for product development**	**Model 2 Return on sales before tax**	**Model 3 Delivery on time**
Step 1. Control variables			
Batch size	-0,149 *(0,254)**	-0,059 (0,344)	0,159 (0,141)
Complexity	0,002 (0,405)	-0,047 (0,365)	-0,103 (0,162)
Capacity utilisation	0,017 (0,309)	0,237 (0,027)	-0,176 (0,107)
No of employees	0,139 (0,490)	0,061 (0,292)	0,020 (0,406)
Step 2. Independent variables			
Level of R&D outsourcing	-0,335 (0,002)	-0,078 (0,060)	0,378 (0,049)
Level of eng./design outsourcing	-0,013 (0,026)	-0,257 (0,012)	-0,059 (0,056)
Level of assembly outsourcing	-0,196 (0,048)	0,199 (0,109)	0,342 (0,157)
Level of manufacturing outsourcing	0,145 (0,241)	0,031 (0,412)	0,276 (0,122)
Step 1 Rsquare Change/Sig.	0,017 (0,917)	0,064 (0,422)	0,058 (0,508)
Step 2 Rsquare Change/Sig.	0,191 (0,029)	0,0124 (0,099)	0,165) (0,043)
Max VIF	2,505	2,754	2,585
R	0,456	0,433	0,473
Adjusted R2	0,079	0,067	0,100
Sig	0,029	0,099	0,043
Outcome	Supp1,2,3	Partially supported	Not supported

* are standardised Beta coefficients
** are significances

Indeed, higher is the level of outsourcing, shorter is time needed for new product development. The model is significant. However, interesting findings come from analysis of control variables. None of them affect relationship between time of development and level of outsourcing. So the results suggest that these results are valid for any type of manufacturing defined, any size of company and any size of capacity utilisation, and level of outsourcing does not depend on contingencies (in terms of our control variables). If, emerging markets as a contingency is not taken into consideration, than contingency theory here is not appropriate.

Model 2, presents Return on sales before tax as a dependent variable. From control variables significant effect has capacity utilisation. It would mean higher capacity utilisation higher profits, but since R Square Change Significance is not significant we cannot generalise this result. However in this model 2, only level of engineering/design outsourcing is significant, in line with our hypothesis that both R&D and outsourcing of Engineering/Design would decrease Return on sales. In fact we see that level of these strategic outsourcing decrease return on sales even though the whole model is not significant. This means that those strategic outsourcing is not performed for profits rather for strategic reasons. It means that this strategic outsourcing is costly and it negatively (but not significantly) affects return on sales before tax. The fact that capacity utilisation as a control variable turned out significant might be a contingency effect because in 2015 both Slovenia and Croatia exited recession and probable the utilisation rates of machinery rose, but the overall capacity utilisation is low (37,41%). It means that probably those companies that managed to acquire additional revenues and better capacity utilisation generated belter returns on sales.

Model 3, reflects outsourcing on delivery on time. Specifically we hypothesized that Operational outsourcing (manufacturing and assembly outsourcing) will augment delivery on time. Operational outsourcing has a positive influence on delivery on time, but those effects are not significant even though the whole model 3 is significant. We find positive relationships, but the significances are above cut of level of $p<0,05$ therefore we cannot confirm the hypotheses even though the whole model 3 is significant.

Graphical representation of results is given in Figure 4.

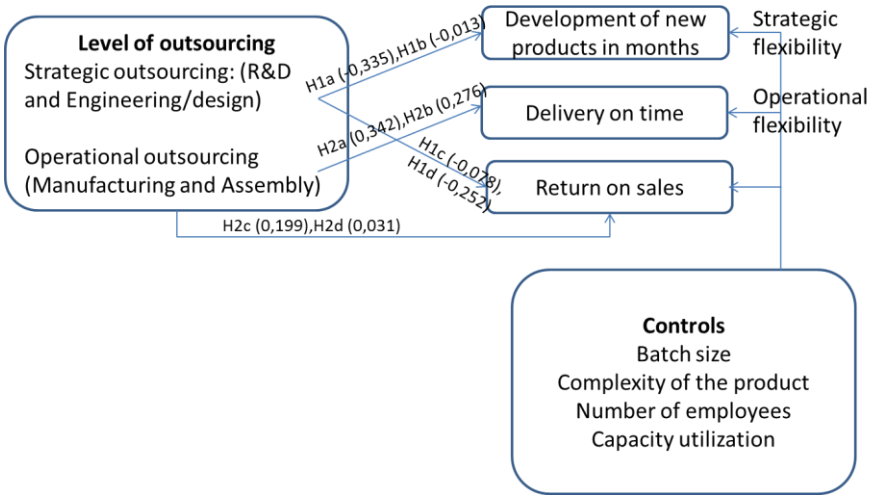

Figure 4. Results

Discussion

We posed hypotheses according to Transaction cost theory (TC) and Resource based View (RBV) and defined the relationships. However, we explored will these relationships be under the influence of contingencies or control variables. That is, we wanted to test is Contingency theory more suitable for explaining outsourcing.

Our analysis show that strategic outsourcing of R&D and Engineering/Design does really reduce time needed for development of new products and the result is valid in any circumstances (control variables). We can therefore say that strategic outsourcing raises strategic flexibility measured in new product development time. Therefore, for strategic outsourcing the appropriate lens is Resource Based View. That is, since companies do not possess adequate resources it is better to outsource. That is in line with Größler et al. (2013) finding that skill shortage is dominant reason for outsourcing in emerging economies.

In order to see is Transaction Cost Economics valid for strategic outsourcing we performed analysis with return on sales before tax (ROS) as dependent variable and strategic outsourcing as independent variables. Again, contingencies did not play any role in the model. But, our finding, although not significant, shows that ROS diminishes as the level of outsourcing raises. This is explainable with the fact that a contracting party has to be paid for its services (R&D and Engineering/Design). But this in contradiction with Transaction Cost Theory (TE) that states that if outsourcing is less expensive than done in house, the work should be outsourced. We actually see a raise in strategic outsourcing even though it negatively affects ROS. Therefore again, RBV is more appropriate than TE or Contingency theory.

Delivery on time is a pure operational measure, and literature suggests it should be used when the company has higher capacity utilization and cannot perform all the work by themselves. However, even though Operational outsourcing positively affects delivery on time it is not significant.

Overall, capacity utilization in Slovenia and Croatia is still low (37,41%). Therefore there is according to theory no need for outsourcing of manufacturing and assembly. If it is done (outsourcing of manufacturing and assembly) it would probably be because of skill shortage rather than costs or lack of capacity.

It remains unexplained why R&D outsourcing as a strategic outsourcing positively and significantly affects delivery on time. One possible explanation is that R&D outsourcing partners adhere to agreed upon delivery times, so the whole manufacturing of the end product is performed on time.

Conclusion

We proved that strategic outsourcing raises strategic flexibility and that this is in line with RBV of the firm. It also contributes to Größler et al. (2013) finding that skill shortage is dominant reason for outsourcing in emerging economies. That actually means that Slovenia and Croatia as transition countries follow the findings found in the research under emerging rather than developed countries.

Transaction cost economics is not appropriate for strategic outsourcing because strategic outsourcing actually decreases profits and this type of outsourcing is done for

strategic and not tactical reasons. Transaction cost theory might be applied to operational outsourcing (manufacturing and assembly) because those outsourcing levels increase return on sales (albeit not significantly). This non significance is probably because the overall capacity utilisation in Slovenian and Croatian manufacturing is low (37,41%).

As for Contingency theory, since none of the control variables were significant in our three models we can conclude that the results are generalizable and do not depend on selected contingencies of batch size, complexity, capacity utilisation and size of the company in terms of number of employees. The only exception was model 2 with return on sales as the dependent variable where higher capacity utilisation led to higher return on sales. Another contingency is that the analysis is performed on two emerging countries and therefore results are more in line with Größler et al. (2013) findings for emerging economies.

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