ters to move through several stages in order to reach a similar level of understanding as sponsors.

Both differences in characteristics and differences in stage of the diffusion process explain the existence of a sponsor-adopter gap. Sponsors tend to be innovators who, in addition, are at an advanced stage in their understanding of the systems; adopters can be anything from innovators to laggards and, at the same time, are at the first stage of the diffusion process. Once it is clear what are the differences between sponsors and adopters and why those differences are there, it is possible to identify ways to overcome the sponsor-adopter gap.

What Can be Done About the Gap?

The gap between sponsor and adopter can be overcome by efforts from the sponsor and the adopter (Figure 2). The sponsor can actively address the differences and help the adopter understand and learn [3]. Adopter learning is speeded up by contact with other adopters [4].

Sponsors: The sponsor has to be sensitive to the characteristics of adopters and be responsive to the stage in the diffusion process in which adopters find themselves. Through careful marketing the sponsor can address the adopters' lack of technological awareness and lack of understanding of the business impact of the IOS. This type of marketing is much more sophisticated than mere 'selling' of the system. Superior marketing includes establishing a dedicated, well-trained sales force, providing continuing support for the IOS, offering help with integration into the adopters' business processes, establishing user groups, responding to requests for modifications of the system.

Adopters: Adopters tend to learn from each other. Peers have similar problems and run similar operations and thus contact among peers is a powerful means of organisational learning. Organisations are more easily convinced by recommendations from peers than by sales talks from sponsors. Communication among potential adopters in Chambers of Commerce, in industry groups and in user groups enables exchange of information, promotes understanding of the system and encourages uptake of the IOS. In this way, learning by potential adopters from others is a way of bridging the sponsor-adopter gap and speeds up diffusion of IOS.

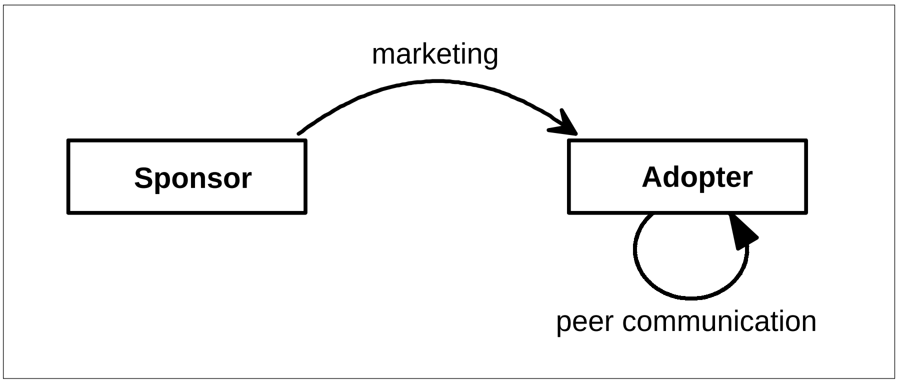

Figure 2: Addressing the Sponsor-Adopter Gap

The sponsor-adopter gap exists and can not really be prevented. When not understood, the sponsor-adopter gap can contribute to difficult and delayed implementation of IOS. It is therefore important not only to be aware of the differences between sponsors and adopters, but also to try and overcome them. Sponsors can actively bridge the sponsor-adopter gap by using superior marketing when introducing the IOS to potential adopters. As for adopters, understanding of the IOS and trust of the sponsor is enhanced by interaction among adopters themselves. ■

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Marketing EDI

Once the critical mass of EDI users is reached, the rate of EDI adoption will speed up. Therefore, the question is how to induce implementations in excess of the critical level. The strategy of cascading critical masses presented here may serve to promote the diffusion of EDI.

The diffusion of EDI, especially in Switzerland and Germany, seems to be nowhere near the predictions. Why is the diffusion of EDI so poor? Is it possible to speed up the diffusion process? In response to these questions, we will first characterize a certain class of goods called network externalities goods (NEGs), under which EDI can be subsumed. NEGs have interesting features relevant to their patterns of diffusion. In a second step, we will present the strategy of *cascading critical masses*.

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EDI is a NEG

EDI standards, subsets, and procedures, along with the corresponding hardware, can be classified as network externalities goods. Table 1 shows the important differences between singularity goods and NEGs.The important features of NEGs are the following:

- ❐ *Product utility* and *network externalities:* The utility of an NEG is constituted by the level of diffusion of complementary goods (indirect network externalities). The utility rises in accordance with the number of users connected to the same network and in accordance with the degree of shared standards and components (direct network externalities).
- ❐ *Feedback processes:* A special form of feedback is present when individuals

base their adoption decision on the decisions of other adopters and non-adopters ('watching the group while being watched' [1]). In this case, it is assumed that a non-adopter adopts the standard he or she believes to be the most well-diffused standard. The probability of any given standard being adopted is therefore correlative to the relative market share of that standard. Feedback processes have tremendous impact on patterns of diffusion.

Characteristics		Categories of Goods		
		Singularity goods	Network externality goods (NEG)	
			Network externality goods (close meaning)	System goods
Product utility	singular	●	●	○
	derivative	○	●	●
Network effects	no	●	○	○
	indirect	○	●	●
	direct	○	○	●
Important phenomena		'take-off' / 'critical size'	critical mass, feedback processes, path dependency, lock-in, inefficiency	
Examples		most convenience goods such as toothpaste, pencils	VCR: complimentary of tapes and recorders; computer: complimentary of software and hardware; periphery	telephone, fax, terminals, communication standards as EDIFACT
Legend: ● true ○ not true				

Table 1: Categorization of Goods

❒ *Critical mass:* Of great relevance to the empirically observed diffusion patterns of NEGs is the phenomenon of critical mass. Until a critical mass occurs in the diffusion process, the rate of adoption is relatively low; after the critical mass has occurred, the rate of adoption will speed up. However, since the attractiveness of a given network is dependent upon the number of its users, it may happen that at an early stage in the diffusion process, too few users adopt the new standard. Potential users either delay their adoption decision or decide not to adopt at all. If this occurs, some of the early adopters who were counting on the increase of utility that would have occurred through the joining of new users may withdraw from the network. This decrease in the number of users would then lead to a further reduction in utility, which in turn would influence the remaining users. Clearly, if a sufficiently large network base is to be realized, this vicious circle of negative feedback has to be prevented.

Cascading Critical Masses

Usually we speak of 'the' critical mass or 'the' critical level of users at which EDI can be called successful. However, this macroscopic point of view appears less and less adequate. The central underlying assumption is that all present users gain an equal degree of utility once a new user gets connected to the network. This would mean that network externalities are independent of the particular identity and quality of any new member, and, furthermore, that each network member experiences the same rise in utility. As far as EDI is concerned, however, this assumption does not hold. The more realistic assumption seems to be that certain clusters of users in which the majority of transactions are processed (e.g. trade groups, communities of interest) are more affected than other clusters by the addition of a new adopter. As the development of industry-specific standards as well as of company-cluster-specific standards suggests, most EDI interactions still concern only a small set of business partners. The diffusion within certain communities of interest (microscopic view) plays an important role in the overall diffusion (macroscopic view). We can conclude, therefore, that each trade group has its own critical mass and that there is no single critical mass.

The relevant question is thus no longer one of attaining the critical mass in a general sense, but rather one of attaining the critical mass within specific trade groups. We can derive the first hints of an answer from the logic of growth of NEGs, as described by Rohlfs [3]. Starting with several communities of interest acting according to different functions of utility, Rohlfs shows how the diffusion process of a new telematic service can be sustained. In the first version of his model, only one specific innovative service is provided for a relatively small group which is satisfied with the service. Through the constitution of this 'first' group of users, the critical mass for members of a second group may be reached. In this case, the members of this second group become users as well. An illustrative example is the case of EDITEC which originated in the sanitation branch of industry in Germany. Similar structure of business processes have allowed for the diffusion of EDITEC into other branches of industry (heating facilities and technical supply for houses) in several other countries.

After the second group has been connected, the overall sum of adopters may constitute the critical mass for a third group, and so forth. This pattern of growth shows how the diffusion may occur through different categories of adopters. For a sustaining process of diffusion to occur, the critical mass for the 'next' group must be reached when a new group becomes an adopter.

Synergetics may offer a complementary way of explaining these diffusion processes. The basic idea of synergetics is that in complex systems (such as the economy) structures of order emerge in time in a self-organized way. Crucial for this emergence is the existence of slow or 'order' variables. In the context of telematic innovations, order variables may be seen in slow changing prevailing conditions such as the telecommunication infrastructure or strong market players such as national PTTs.

The result is that less powerful but flexible market players are forced to adapt to the order variables. They are, so to speak, 'slaved' [2]. An emerging 'order' can be seen in the spread and diffusion of (used) standards over time. Though Rohlfs himself does not distinguish between his *communities of interest*, synergetics allows for the specification of his general illustration in the case of EDI.

Accordingly, any means aimed at stimulating self-organizational effects should first identify those organizations which have the best leverage or the greatest power of order. For example, banks and authorities which communicate with firms from all branches of industry may be classified as orders. Banks and (customs) authorities that are in close contact with EDI-pioneering companies can transfer experience and know-how to other competing organizations. In this way, companies that have not yet adopted the network system can get information regarding the advantages and disadvantages of EDI-related technology and therefore can better judge the potential of EDI. This might weaken the risk-averse attitude towards investment in complex and expensive innovation.

By analogy, we can sketch the same picture with powerful and innovative market players. The automobile manufacturing industry serves as a good example. There, a small number of manufacturers adopted EDI procedures and set de-facto-standards and so forced ('slaved') their suppliers to implement EDI as well. Not only did the suppliers have to adopt the latest state-of-the-art systems, but the still non-adopting suppliers had to act according to the increased pressure of competition. Consequently, later adopters were inclined to take over already established EDI standards. The utility of those standards increased and so did the attractiveness of adopting them.

Thus, applying resources to a small set of firms with order of power may be more effective than distributing a flat rate subvention to a large number of firms. The promotion of additional organizations with power of order is likely to break the negative feedback cycle because it limits the ability of single firms to refuse the given standard. In fact, it is realistic to assume that by targeting interest-specific communities, critical masses may be permanently exceeded. An extension of this procedure in several branches of industry may do the most to spur the cascading of critical masses and, in turn, to promote the diffusion of EDI. A formal model can be found in [4]. ■

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The Distribution of the Benefits and Drawbacks of EDI Use in the European Automotive Industry

The automotive industry has seen a steady movement towards more complex inter-organisational structures and co-ordination mechanisms between car manufacturers and their suppliers. Increasingly, manufacturers are engaging in long-term stable relationships with their suppliers as opposed to the traditional arm's length arrangements, characterised by conflicting interests. Changes in the competitive environment drove car manufacturers to restructure their supply chains and rely increasingly on effective co-ordination of their logistical activities.

EDI can be seen as a prerequisite for these externally focused systems with its ability to provide fast, frequent and reliable information exchange [9]. But EDI does not only affect the efficiency of co-ordination, its impact may be even more fundamental on the power-dependency relationship. EDI can shift the balance of power and control between the supplier and the manufacturer, making for a possibly unhealthy dependence on either side. As EDI can increase the efficiency of an entire network of organisations, conflicting interests between organisations will often need to be resolved [3]. Organisational literature suggests that inter-organisational networks are likely to experience more conflict when organisations with different perspectives work together [1]. The objective of this study is to assess the distribution of benefits and drawbacks of EDI use between car manufacturers and their suppliers in two particularly advanced EDI user communities in Europe. German and British based car manufacturers were selected as focal firms together with a number of their suppliers for extensive interviews. The interview data were supplemented with information gleaned from annual reports and internal documentation.

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Theoretical Foundations

Three theoretical perspectives were used to help guide this research: transaction cost analysis [2,6], resource dependence theory [5] and the network perspective [6]. Each of these perspectives has a unique emphasis that contributes to a broad understanding of the benefits and drawbacks of EDI use for inter-organisational co-ordination. Transaction cost analysis emphasises the organisational concerns with efficiency, resource dependence theory highlights the degree to which an organisation is dependent on other organisations for important, and the network approach makes the web of relationships more explicit. Drawing on the three theoretical perspectives, we extracted three key concepts in order to produce a multi-perspective framework to capture key elements of inter-organisational co-ordination. These are frequency, dependence and structure.

Trends in the Automotive Industry

The European automotive industry is an excellent example for interorganisational co-ordination. Rather than manufacture the whole car themselves and practise extensive verticalintegration, car manufacturers purchase many parts from suppliers [9]. Some of the most complex and sophisticated supply arrangements can be observed in the automotive industry where strategic alliances and outsourcing are used as a means to spread the risks.

Manufacturers pursue co-operative agreements to reduce uncertainty, get fast access to information, technologies and know how, achieve reliability and responsiveness, share the risks, achieve economies of scale in joint research and development or production [7]. As manufacturers move towards more timecritical supply chain operations and real-time planningsystems, more co-ordination and information exchange is needed within a production network.

Developments in the automotive industry to call-off materials at short notice and to reduce purchasing lead-times start with improvements of information and communication links between manufacturers and suppliers. EDI links between suppliers and manufacturers become more and more important because of EDI's ability to transmit faster and error-free information. Daily or even hourly delivery frequencies of parts that are ordered at short notice require a rationalisation of data exchange. Thus, European car manufacturers increasingly rely on integrated EDI systems to co-ordinate sub-assembly production, final assembly and parts supply.