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### **SNA, information control, organization theory**

### **Measuring strength of relationships**

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# **Gaining competitive advantage through the analysis of customers' social networks**

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## **Abstract**

Recently, companies have become interested in understanding customers' social networks — and gaining competitive advantage through this understanding. Analysis of social interactions *can potentially* provide great value! For example, Social Network Analysis (SNA) in the telecommunications industry provides insights into customers' relationships with each other, which can help drive customer retention, growth and acquisition activities, as well as giving operators significant competitive advantage. In this paper, the authors describe several ways in which SNA can provide competitive advantages to companies in different industries. We also describe the challenges to realizing this potential value and some ways in which technology can help overcome obstacles. We also provide case study examples describing the ways in which companies gain competitive advantage through SNA.

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## **Introduction to Social Network Analysis (SNA)**

### **Historical role of SNA**

SNA is the study of relationships and influence within a network of individuals. This is a very broad notion and, indeed, SNA has existed as a tool in the social sciences for more than a century. Historically, SNA focuses on identifying the critical individuals within some organizational structure, and identifying the various roles of these individuals in controlling the information flow and decision process within this organization.<sup>1</sup>

To perform SNA, one needs to identify the individuals and then define a measure of strength for the relationship between any two individuals. There is a very broad range of measures that have been used. Some of these are:

- financial transactions,
- messages,
- time spent on phone,
- time spent in live meetings,

- contact frequency,
- office proximity,
- authority.

### **SNA is not limited to social network sites**

#### **SNA is not just about Facebook**

Today, the term 'Social Network' is immediately associated with Facebook and Twitter. Indeed, they are instances of social networks, and surely SNA is performed extensively within these organizations. However, it is important to realize that social networks are not limited to these highly visible instances. Most social networks are implicitly, rather than explicitly, defined. For example, the set of individuals with whom you make regular money transactions (available to banks), the set of people with whom you are regularly on the phone (available to telephone operators), the set of people with whom you exchange gifts (online retailers) or even the set of people with whom you share media content (online news sites) are all social networks.

### **Traceability and processing power can now support SNA**

#### **Why is SNA such a hot topic?**

Traditionally, SNA was very labour intensive. It required having observers measure in the field how much interaction existed between individuals, and the number of individuals under study was always fairly small (a few hundreds at most).

SNA is top of mind because of the increasing importance of social networking sites. However, the reason SNA is now developing so rapidly as a competitive tool is largely technology based:

- the interactions between individuals are increasingly traceable,
- modern computing power allows the analysis of networks containing millions of individuals.

### **SNA in the telco industry**

This allows mobile operators to examine the way their customers call each other and determine who is likely to be more influential in terms of mobile phone habits, such as the adoption of a smart phone, the use of certain data-intensive applications or even switching to a different operator.

### **SNA in finance industry**

Banks, on the other hand, are interested in knowing who regularly transacts with whom to determine potential fraud rings, and the interconnectedness of credit risk. (For example, if Joe defaults on his loans, does this have an impact on Jane who regularly received alimony payments from Joe?)

### **SNA in retail industry**

A retailer is interested in knowing who is prepared to promote their brand to their friends and, ideally, to measure whether these recommendations have a positive effect.

### **Magnitude of SNA processing needs**

Until recently, the kind of exhaustive analysis, at the customer level, required for SNA was not conceivable for a corporation with tens of millions of customers. A large telco, for example, may have between 20 and 70 million customers. Even one month's call detail data would mean that there are between 1.0 and 3.5 billion call detail records. Using three months of data to build the network implies that 10 billion

**SNA creates business value**

records may need to be processed. This is non-trivial. However, modern data warehousing technology and some non-relational technology can readily handle this. Now that scale is no longer a barrier, corporations are working on this. Many are finding that SNA does create a competitive advantage.

Another key to why SNA is a hot topic now is that it works! That is, when used properly, it makes money for the companies investing in it. This money is incremental to classical predictive analytics, such as churn models and propensity models. The lift may be relatively small, but the benefit to large organizations, with millions of customers, is significant. The lift over classical churn models, for example, is typically between 4 per cent and 20 per cent. Churn is not a highly viral phenomenon. The better targeting achieved from this lift, coupled with relevant marketing actions, can pay for the investment in an SNA solution. The real benefits, however, come not just from doing one thing, but doing many things with SNA. Some of the SNA applications described in this paper are far more valuable than what is achieved by improving a churn model.

**Relationships over individual behavior**

**What does SNA consist of?**

Classical customer analysis examines the behaviour of an individual independently of what happens around him. For example, a mobile operator would look at the number of calls and total number of minutes on the phone, and determine whether this has changed significantly over the past month or week. The operator may even look at whether the number of different phone numbers called has changed significantly from one month to the next.

A bank considers a customer's cash flow, and whether his movements and spending pattern is consistent over time. The bank tries to react to any exceptional event such as a large withdrawal, or large deposit, to gauge which offers are most appropriate at any particular time, based on what appears to be the customer's needs.

For a mobile operator, SNA adds a new dimension to the analysis by examining relationships within a customer's calling circle, as shown in Figure 1. Within your calling circle, your spouse and children are not

**Nature of relationship**

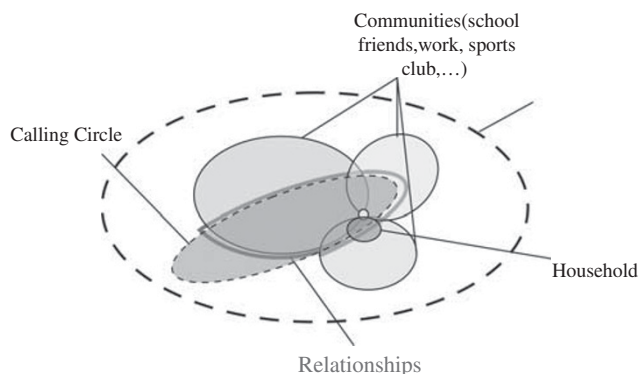


Figure 1: Communities and relationships

equivalent to your plumber, whom you may call very intensely for a short period of time but who is unlikely to have any influence over you regarding your mobile phone habits.

### Role in network

Moreover, SNA can measure the degree to which the people you have relationships with also have relationships with each other. In other words, do your friends also talk to each other, demonstrating a group of common friends? Or do your friends seem to have no contact among each other, demonstrating individual friendships with very little overlap? These insights can be invaluable in determining key aspects of a customer's lifestyle and whether he/she is likely to be receptive to new products adopted by their friends, or whether they are more likely to stay on the edge of innovation and show off new products themselves.

For a bank, these measures can be critical in gauging the impact when a customer becomes unemployed.

### Step 1: Build the network of relationships

### Identify significant links

The methodology of SNA involves isolating links between people that appear to be significant (as opposed to temporary, such as your plumber), and computing various measures of relevance on each link (such regularity, intensity and history). These links define a graph with nodes (people), links (relationship between two people) and link measures. Obtaining this network is the fundamental first step of SNA, and is very processor intensive. Everything else that is done with SNA is based on this network.

The Link Analytic Record may contain hundreds of variables describing the relationship between each relevant pair of people. These are used as predictors in models. A few examples of variables include:

### LAR to describe links

- the number of weeks within a three-month period in which there was at least one communication (regularity),
- the number of communications, in total, that happen during a one-month period (intensity),
- the number of long calls that happen during the late-night period,
- the ratio of inbound to total calls between the pair of people, and
- changes in regularity patterns that occur during a three-month period.

Note several important aspects of the SNA network that are constructed:

### Network contains information about non-customers

- The network includes more than just the company's own customers. It also has information about all the people with whom your customers meaningfully interact. This means it includes information about phone numbers for your competitors, but which appear in Call Detail Records (CDRs) of your customers. For a bank, the network includes information about customers of other banks when customers make regular transactions. For retailers, this includes information about prospects who are friends of customers.

**Link measures must be flexible**

- The network, just like behaviour, has a dynamic nature. The set of people with whom I am having a regular interaction (spouse, children, extended family, colleagues, friends and so on) is bound to evolve over time, and any particular role or influence I have in the network is equally bound to evolve over time.
- This effort corresponds to building a Link Analytic Record, or LAR. As much as ‘classical’ customer analytics start by building a Customer Analytic Record (CAR), SNA starts off by building LARs so as to enrich insights into customers.
- Just like for the CAR, the LAR is never going to be a stable set of measures. It is bound to evolve and be enriched with new measures over time, depending on the business problems at hand, and the sophistication of analysis that is considered.
- The network, for telecommunication operators, is an aggregation of CDRs, and as such many parameters must be set, and questionable choices must be made, in order to be able to produce it.

**Step 2: Compute the SNA metrics**

After building this network, SNA is used to compute special metrics about each entity (ie network node, person in the network), giving insight into the individual’s position in the network. Some of these measures are:

**Measures to describe role in network**

- degree (how many individuals do you have significant relationships with?),
- second degree (friends of your friends),
- betweenness (do your friends know each other?),
- centrality (if you disappear from the network, does this have a significant impact on the network dynamics?),
- triangles (how many pairs of your friends are also friends?).

These metrics are then integrated into the CAR and used with the classic analytic tools to develop behavioural segmentations, affinity models, churn models, value segments and other types of predictive models. Figure 2 shows the CDRs and the final CARs.

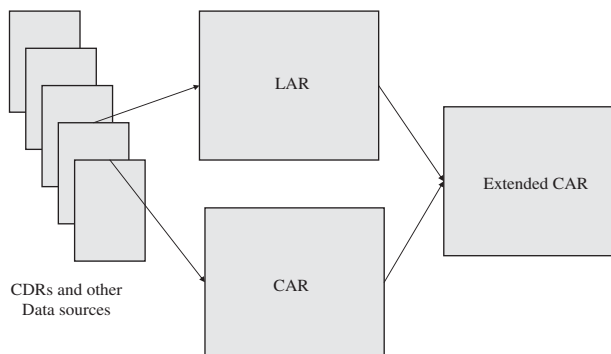


Figure 2: From CDRs to the extended CAR

**Churn, Affinity,  
Householding,  
Lifestage, Full Market  
Analysis**

**What are some of the business applications of SNA?**

Businesses are now interested in the SNA for the same reason they have been interested in customer analytics in general: being more competitive by providing new insights and extra predictability into customer behaviour. This translates into marketing actions that are better targeted, more relevant and more timely, which in turn results in better marketing ROI. In the paper, the authors will discuss the following applications of SNA:

- customer retention,
- product adoption — Cross-sell/up-sell,
- householding, identifying that customers belong to the same household,
- lifestage events, such as moving home,
- customer life cycle management, such as identifying how a person's community changes over time,
- full market view — such as gaining insights into consequences of competitor actions,
- special community identification, such as seasonal workers,
- identifying individuals behind account numbers when the user of the service is different than the bill payer,
- detection of fraud rings, and
- customer profiling.

**Customer retention**

The first application for which SNA was considered was customer retention. If your friends defect from a particular brand, how will this influence your decision process on whether to defect as well? And indeed banks and mobile operators have done numerous tests with SNA to improve churn scores and retention campaigns.

There is very little lingering doubt at this point that taking into account the activity among the close contacts of a customer provides value in predicting churn, even though churn is not a highly viral behaviour. In other words, if I churn, a *few* of my circle *may* churn with me. It is an important aspect to take into account because churn is expensive and it remains true in all industries that it is significantly more expensive to acquire a new customer than to maintain an existing customer. However, on average any particular churner takes only half of a customer with him in his trail.

This number is small if considering the overall viral impact of churn. However, the number is the average of a very fat-tailed distribution, and some customers seem to provoke a very heavy amount of churn. This means it is possible to isolate a segment of customers with enough influence to provoke heavy damage should they churn. It may also be possible to use SNA to predict which competitors would be the beneficiaries of this viral churn, allowing a deeper understanding of competitive weaknesses.

It is important to note that these customers are active and well connected, and good customers in many ways, but may not be

**Viral churn – reactive  
campaign**

**Viral churn – preventive  
campaigns**



## Network profitability vs individual profitability

necessarily very 'profitable' customers. Thus, companies who are too focused on managing profitable customers and organized to purposely ignore unprofitable customers are probably unaware of the damage caused by these angry and influential customers.

There are two ways to integrate SNA into churn management. The first is reactive: examine the churn-driving patterns in the network of your customer, and re-evaluate his likelihood to churn as a result, and then make an offer to secure his loyalty. This is a way to contain the damage of existing churn by attempting to mitigate the viral influence of churners.

The second way is preventive in nature: identify your customers who are likely to take many customers with them if they churned, and be particularly attentive to them to secure their loyalty. The latter approach means estimating for each customer his 'network value'. This is the value of all customers who would leave you if this customer churns. By having this measure of network value, it becomes possible to orient retention efforts without overly focusing on individual customer value.

### Product adoption — Cross-sell/up-sell

Similar to churn, SNA is used to understand the viral adoption of new products and technology. This is really the same concept as customer retention, but instead of applying it to a negative event (churn) it is applied to a positive event (product adoption). In this case, the two approaches mentioned for retention also apply, reactive and proactive (prospective).

## Viral cross-sell – influential adopters

Suppose that we are considering the adoption of a new consumer investment product among a bank's customer base. The reactive approach is to examine how many of a customer's contacts have adopted the investment product and integrate this knowledge to compute a likelihood of adopting the product. The prospective approach is to identify, *a priori*, the customers who would be most likely to recommend the investment product, *should they adopt it themselves*. If you can convince these customers to purchase the investment product, they will help you spread its adoption faster.

The evidence so far is that some products can be extremely viral (think iPhone), but many are not. Some characteristics of viral products are quite obvious:

## Viral products and offers

- it must be desirable to talk about these products,
- there must be something inherently new,
- adopting the product/behaviour creates pressure for others to do the same.

If any one of these conditions is not met, then the viral effect is likely to be disappointing, and any attempt to build a campaign to leverage the viral nature even more so.

### Householding

The convergence of mobile and fixed line operators is now forcing operators to do their marketing efforts to households as opposed to

individuals only. In addition, from a retention perspective, operators have noticed that customer loyalty is stronger when the household is serviced by a single operator.

For banks, understanding how their customers live is critical to make offers that are more appropriate to their needs, and to understand their true position within the household finances.

### **Identifying links from a household**

SNA provides critical insights into householding. As it turns out, a large share of customer interactions are with the individuals they are closest to: spouses, children and parents. As a result, relationships in the same household appear almost systematically in social networks, whether based on telephone calls or financial transactions.

The key step is to isolate these relationships from other 'important' relationships such as close friends, colleagues and extended family (living apart from the core household). The call pattern with someone in your household is quite distinctive: frequent and short calls, including very busy times (eg morning and evening rush hours).

### **Household links are distinctive**

The important aspect of householding based on SNA is that it provides a view on the household even when other members of the household are customers of your competition. Indeed, one of the valuable insights is to estimate what is your wallet share as a service provider within this household, and which brand serves the decision maker of the household. It allows you to answer questions such as:

- Who provides service for the fixed line for ADSL?
- Who is my customer within the household (decision maker, dependants)?
- Am I already serving most customers within this household?
- What is my share of budget within this household?

### **Relative position within household**

Analysing the household quickly leads to questions regarding the current needs of the household. Marketers who have to design offers for the households need to know more than just how many members it contains. They want to know what this household is planning, how they live and whether a major event is already in sight (eg moving, new child, new job, going to university).

This leads naturally to the next application: predicting lifestage events.

#### **Lifestage events**

### **Life events deduced from social links**

Whether for banks, retailers, or telephone operators, the key to effective marketing is to properly identify what is currently happening in the life of the customer and her household. Some lifestage events that can often be identified by analysing detailed transaction relationships include:

- moving as a family,
- moving in as a couple,
- changing job,
- marrying,



- divorcing,
- having a child,
- child moving away,
- retirement,
- major illness,
- buying a home, and
- starting a business.

### **Early warning on major live events**

In particular, marketers find it very valuable to know about lifestage events *in advance* whenever possible, or at least as close as possible to the event. For example, if an ADSL provider wants a chance to effectively sell his offer, his chances are much higher a few weeks before the prospect moves to a new home, as opposed to once the move has happened. Similarly, a bank has a much better chance of influencing the financial choices of a new family if the conversation can start during pregnancy, as opposed to the harrowing months following a birth.

SNA is very helpful in identifying and predicting lifestage events. A change in lifestage provokes noticeable changes in your social circle and the way you interact with them. For example, any plan to move provokes numerous calls to real estate agencies, utility providers and moving companies. When combining a calling circle with a phone book, a flurry of new contacts can shed light on a customer's intentions for the new future, and thus create an opportunity for a marketer to make relevant offers.

### **Customer lifecycle, engagement revealed by social links**

#### **Life cycle management**

Many companies have well-defined customer life cycle management programmes. Different marketing actions are taken at different stages in the life cycle: new customer, growth stage, maturity and decline. Depending on how customers are developing, different products are offered to them, different levels of risk are assigned. However, customers do not just develop individually. There is evidence that their social networks also evolve over time. Communities grow or shrink. A person's role within his community may change over time. Using these patterns, it may be possible to extend customers' growth stages, and stimulate new growth stages. New customer actions may also vary using SNA analytics. Even a new customer may be an influencer in his network. A welcome message to this customer may include a special member-gets-member offer. Thus, SNA begins before the customer life cycle starts. It can, and should, be used to drive more successful and profitable customer acquisition.

### **Customers linked to non-customers**

#### **Full market view — Competitor insight**

An unexpected benefit of doing SNA, as was noted before, is that it provides a much wider view of the market than just looking at existing customers. Any interaction between two individuals is visible as long as at least one of the individuals is a customer. For a large player in a consolidated market, this usually means the company is able to get

some information about almost everyone in the market. Granted, the view available for non-customers is only partial and limited to interactions with customers, but that is already very rich information compared to nothing, which would be the alternative.

### **Tracking market dynamics**

This market view can be used to track major reactions to novelties in the market. If a competitor introduces a new offer, it allows you to watch how the market reacts by watching how many subscribers it attracts, what type of subscriber it attracts (their roles in the network) and even whose subscribers it attracts (your competitor's or yours?). Moreover, it becomes possible to build a user segmentation (as opposed to a customer segmentation) to classify all the individuals in the market.

### **Full market segmentation**

This segmentation can then be used to get a sharper view of market dynamics. Following a big above-the-line promotion in the market, which customers belonging to what competitor does it attract? Are they the customers which were targeted? Does this damage you or does it help you?

### **Fast insight into market changes**

Of course, since this is dependent on your own data with which you build your social network, nothing stops you from tracking key market dynamics on a daily basis. It also allows you to analyse, with great reliability, the customer mix within each competitor in the market, and thus gauge the potential for your own product introductions and campaigns.

### **Special community identification**

In the telecommunications industry, in addition to identifying households, SNA is useful for recognizing other types of communities. These include:

### **Communities with homogeneous behavior**

- seasonal workers,
- small and medium-sized enterprises,
- students, and
- schoolchildren.

For example, people who work together usually have calls during the work days, and not on weekends. There are many calls, both in-bound and out-bound, and a lot of the calls are short. Seasonal workers are seen on the network only at certain times of the year. It does not make sense to spend marketing money on them at other times of the year. Students and schoolchildren have long calls outside of school hours, and short calls, coming from the same location, during school hours.

These insights can be used both to better inform your marketing messaging, and, in some cases, to better understand to whom you might not want to send messages.

### **Matching individuals and users**

#### **Identifying individuals behind account numbers**

For telephone operators, a significant issue is that no matter how much detail is known about the subscriber, or even the account payer, you may not know who the actual user of the telephone line is.

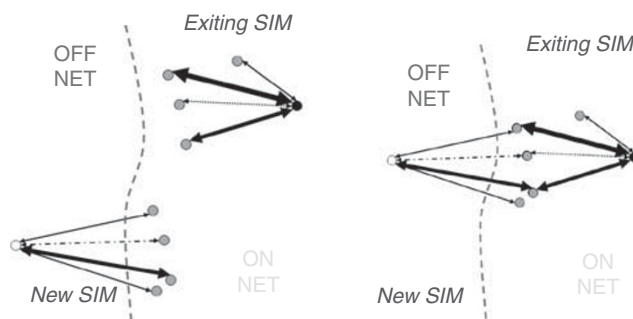


Figure 3: Identifying that two SIMs are of the same customer

**Multi-SIM behavior,  
internal churn, dealer  
fraud**

In prepaid markets, many individuals regularly use two or even three SIM cards because each line provides different benefits at different times. In postpaid markets, many individuals choose to separate their private and business lives. In addition, as operators often make more generous offers to new subscribers, it is desirable to appear as a new subscriber. This creates the problem known as ‘internal churn’: customers who give up their lines only to re-subscribe with the same operator, to benefit from the generous new subscriber offers. The issue of internal churn is sometimes stimulated by the dealer, and is a form of dealer fraud that can only be tackled if properly measured.

SNA is able to help operators with this issue. It may be easy to subscribe to a line using a different name, but it is not so easy to change the patterns of your social relationships. Indeed, if two individuals are calling the same set of people with a comparable call pattern, then they are most likely to be the same individual using two SIM cards. Figure 3 shows this analysis.

**Fast matching, securing  
share of wallet**

One operator in a mostly prepaid market wanted to identify the customers who were trying out a competitor SIM and thus beginning to churn away, or at least ready to give a significant share of their communication budget to another operator. If they were able to identify the behaviour ‘in the bud’, then they could make an offer to win back the customer and keep a larger share of wallet. By observing all new off-net numbers within a week, they were able to match them to existing customers by comparing their on-net calling circle. Subscribers who were matched this way were made a generous offer, which proved very effective in bringing customers back.

**Fraud rings**

Although the topic of this article is about using SNA to be more competitive, no paper on SNA would be complete without mentioning fraud and anti-terrorism. SNA acquired its recent glory through the successes of anti-terrorist efforts that have strived to find links between alleged terrorists and thus identify efforts to organize attacks.

**Fraud, anti-terrorism,  
eBay**

Banks, and eBay, attempt to do a very similar thing to identify fraud rings attempting what is known as ‘bust out fraud’. The idea is that seemingly unrelated people acquire credit lines, and make transactions among each other using very little real cash (because it is always the

### Discreet commonalities between fraudsters

same money going around the ring of people). Through these transactions, the bank builds trust with these individuals and extends their credit lines. Once all their credit lines are long, all the individuals cash out the maximum possible amount in the same day and disappear completely.

The trick for this to work is to be able to open many new accounts with identities that appear totally unrelated. After the fact, however, the bank often realizes that these identities invariably had a few things in common: an old phone number, a shared address, a last name and transfers of money between the accounts. To become more proactive in their efforts to counter this, banks are building SNA networks based on very discreet links such as 'A had the same phone number as B's number 6 months ago', or 'share the same last name'. This network based on identity overlap is then integrated with the network based on transactions between accounts. This can reveal to the fraud detection department *before* the fact that a fraud ring is in the making.

In the case of eBay, the equivalent of building a credit line is to build a seller profile with impeccable credentials and stellar past transactions. Once the profile is trustworthy, the seller proceeds to sell expensive and fraudulent items.

eBay's ability to root out such fraudsters through SNA, among other analytics, has allowed them recently to vouch for every transaction.

### User and payer are distinct individuals

#### Customer profiling

One of the complexities of managing customers as a mobile operator is that you are never sure of who is using the line. This is a real impediment to understanding the appropriate customer needs. In particular, something as elementary as the age of the user is difficult to obtain reliably. You can only ask the payer of the line, or the original subscriber, but he could be paying for his child's line.

### Age profile

As an extension to the identification of lifestage events, SNA is also helpful in establishing basic demographic profiles, such as estimating the user's age. This is based on a simple insight: if you are 17, you are more likely to be talking to other 17-year-olds than if you are 40. And a group of teenagers tends to behave like a group of teenagers.

### Reinforcing profile confidence with network

Thus customer profiling consists of accumulating evidence and rating its reliability. Starting with the profile of the subscriber, basic checks are performed to determine whether the general behaviour is consistent with this profile. Then the social network is examined to determine whether the main connections are in a similar profile or not, which feeds further updates to the probable customer profile. Consider, for example, the customer's age. A mobile line has been acquired by an alleged 40-year-old man. However, the line is mostly used around a university campus, with a very large number of text messages and weekend activity that is comparable to business day activity. Then most contacts seem to be in the 18–25 range. This is good evidence of a university student with a line paid for by parent.

This example shows how profiling efforts reinforce each other. The more you have established about customers, the more it will help you establish useful facts about the surrounding customers.

## Conclusions

### **Business value areas**

SNA has become a powerful competitive tool for companies in multiple industries. SNA is used to track the impact of above-the-line marketing activities on customers' and competitor customers' circles. It is used to segment your own and competitors' customers to understand who to try to acquire and which customers may be most likely to influence acquisition. SNA can support customer retention and growth activities, at the expense of your competitors. In addition, it can be a powerful tool for identifying lifestage events.

### **Hot topic in many industries**

In this paper, we provided an introduction to SNA, and discussed why it is now a hot topic with companies in several industries. We reviewed the steps in doing SNA, from building the network through solving the business problem. Ten applications of SNA were also described.

### **Maturing solutions, new business uses discovered, necessity of flexibility**

Commercial solutions for SNA are available. However, new applications based on SNA are continually being discovered. Thus, it is important to select a solution that is highly flexible and extensible to the needs of the organization. There is a world of untapped opportunity, which we have only begun to realize.

### **Proven business value, insights into people and relationships vs people in isolation**

We mentioned that, for large companies, the benefits of using SNA may be massive. In this context, we talked about lift over classical predictive models. However, a real benefit is that this analytical methodology provides us with a new viewpoint on the customer. It should not be seen as just an optimization on an existing approach. We can now solve new problems, and see customers in new ways — and make significant ROI doing this. We can now look at people in terms of their relationships with each other, and study what that means in terms of their interactions with our companies. This is a paradigm shift from looking at people in isolation.

### **Any industry where links can be defined can leverage SNA**

In this paper, we focused on applications of SNA in telecommunications and banking. However, it is useful in all industries — whenever the data required to identify relationships between people are available. We mentioned identifying social networks from social media data, such as Facebook. Companies are just beginning to leverage this information to help their businesses. There are now emerging techniques to 'follow-the-breadcrumbs' and identify what your customers are saying about you in the social world. But that would be the subject of another paper. For now, take advantage of SNA to be more competitive. You will do this by better serving your customers through an improved understanding of who they are and their needs.

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